Handbook of the Cerebellum and Cerebellar Disorders

Mario Manto • Donna L. Gruol
Jeremy D. Schmahmann
Noriyuki Koibuchi • Ferdinando Rossi
Editors

Handbook of the Cerebellum and Cerebellar Disorders

With 545 Figures and 69 Tables

Springer

Editors
Mario Manto
Unité d'Etude du Mouvement (UEM)
FNRS, Neurologie ULB Erasme
Bruxelles, Belgium

Jeremy D. Schmahmann
Ataxia Unit, Cognitive and
Behavioral Neurology Unit
Department of Neurology
Massachusetts General Hospital
Harvard Medical School
Boston, MA, USA

Ferdinando Rossi
Neuroscience Institute of the
Cavalieri-Ottolenghi
Foundation (NICO)
University of Turin
Orbassano, Turin, Italy

Donna L. Gruol
Molecular and Integrative Neuroscience
Department (MIND)
The Scripps Research Institute
California, CA, USA

Noriyuki Koibuchi
Department of Integrative Physiolgy
Gunma University Graduate School of
Medicine
Maebashi, Gunma, Japan

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Foreword

Although research on the cerebellum has a long history of over two centuries, its advancement during the past five decades has been particularly rapid. An enormous amount of knowledge has been accumulated, forming a rich wealth of technological innovations, diverse refined data, novel concepts, and challenging hypotheses. Clearly, it is a timely endeavor to broadly review and reorganize the accumulated knowledge on a commonly understandable basis. This should be a very necessary step toward the full utilization of available outcomes of rigorous research thus far performed on the cerebellum and toward the effective focusing of our future research. It is my pleasure to welcome this great *Handbook of the Cerebellum and Cerebellar Disorders* as a compilation with such an overall aim. I am certain that it will play a pivotal role in promoting the entire research fields on the cerebellum.

This handbook provides an authoritative survey of the experimental and theoretical studies performed in two core areas of cerebellar research. One core covers fundamental knowledge of the cerebellum at the molecular, cellular, neuronal circuit, developmental, and behavioral levels. It includes not only biological and experimental approaches but also modeling and computational approaches to the study of the cerebellum. The other core covers knowledge of disorders involving the cerebellum. This area will be applied in the near future to the development of breakthroughs in the so-far-difficult medical treatment of cerebellar diseases. The handbook embodies the current situation in which significant disparities between these two core areas of research on the cerebellum, which hampered their merging, have been diminished considerably. This handbook will no doubt facilitate the further merging of fundamental and medical knowledge of the cerebellum.

The five editors (Mario Manto, Donna L. Gruol, Jeremy D. Schmahmann, Ferdinando Rossi, and Noriyuki Koibuchi) have masterly identified major phenomena, issues, and concepts of central importance in normal and diseased cerebella. They have chosen 106 topics to fill four volumes. Two thirds of these topics are on the fundamental knowledge and the other one third on knowledge of cerebellar disorders. Each of these topics is assigned to a qualified author(s) and is explained in terms of basic components such as genes, messengers, electrical/chemical signals, cellular processes, neuronal circuits, systems functions, theoretical models, mutations, animal models, and evolution.

Among such diverse topics, the degree of establishment and the depth of refinement of concepts could vary, and some might be debated among contemporaries. I take such a variety as a feature of a rapidly expanding research field, in which new research technologies are developed to enable novel observations and in which hypothesis-guided approaches play leading roles. Hence, in this handbook, the readers will find not only an impressive array of new knowledge but also dynamic perspectives of ever-advancing research fields on the cerebellum.

Masao Ito
Riken Institute
Japan

Preface

The cerebellum has long attracted a core group of scientists intrigued by the sophistication of its circuitry, its unique geometric arrangement and developmental biology, and its characteristic clinical manifestations. With the advances in genetic studies, the rising awareness of the roles of the cerebellum in the nonmotor domain, and the profusion of brain imaging techniques that have generated a vast amount of new knowledge revealing novel aspects of cerebellar function, the field of cerebellar neurobiology has expanded rapidly. Large communities of scholars now setting out on their own paths of scientific enquiry are keenly interested in the cerebellum and its multiple roles in nervous system function. The evolution, and in some instances revolution, in knowledge of the cerebellum has sparked new fields of enquiry and attracted new schools of thought and legions of new investigators. The motivating goal of this comprehensive text therefore was to assemble an international panel of experts who could summarize the state of the art of the many facets of cerebellar clinical and basic neuroscience, and incorporate the most recent developments in the field. There are several excellent books on the neurobiology and clinical neurology of the cerebellum, but until the present volume there has been no single comprehensive work that can serve as an in-depth authoritative resource for the international community of scientists, clinicians, and other professionals interested in the science of the cerebellum.

The *Handbook of the Cerebellum and Cerebellar Disorders* has been in preparation for over 2 years. This detailed work required the contributions of an international panel of renowned scientists and clinicians with experience in a diverse array of fields of neuroscience who were invited to write chapters that provide synthesis, analysis, and interpretation of both the historical and contemporary literature. This handbook could not have been completed without their considerable efforts, and we gratefully acknowledge their commitment to the project.

We would like to recognize the staff at Springer who provided excellent service throughout this project. We particularly wish to acknowledge Ann Avouris, Martijn Roelandse, Somodatta Roy, Namita Mathur, Mansi Seth, and Vasuki Ravichandran for their input, assistance, constant support, and high degree of professionalism. They have been invaluable in helping to bring this work to completion. In addition to the printed version, we have arranged with Springer that the handbook be made available electronically on the Springer website. The reader may find that the ebook format is more accessible and that it facilitates searches more readily.

The editors have attempted to cover what we regard as essential material, while striving to avoid redundancy. In the belief that this volume may be useful to the scientific and clinical communities, we plan to produce future editions of this work, and we therefore invite suggestions and critique in order to further strengthen this compilation, and perhaps include other authors and material that could serve to enhance the handbook and draw attention to the increasingly vibrant field of the basic science and clinical neurology of the cerebellum.

Mario Manto, Brussels, Belgium
Donna L. Gruol, La Jolla, USA
Jeremy D. Schmahmann, Boston, USA
Noriyuki Koibuchi, Gunma, Japan
Ferdinando Rossi, Turin, Italy

Biographical Sketch of the Editors

Mario Manto, M.D. (1992), Ph.D. (1996), is a neurologist. He is Researcher at the FNRS (ULB)-Belgium. He is the founding and current Editor of the international journal *The Cerebellum* (Springer). He has also founded the Society for Research on the Cerebellum (www.socrecer.org). His research studies are focused on the pathogenesis of cerebellar disorders and have been funded by national and international research organizations: FNRS (Belgium), European Commission (FP5, FP6), NIH (USA). Works carried out by him have been published in peer-reviewed journals. He serves as reviewer for more than 30 international journals.

Donna L. Gruol, Ph.D., is Associate Professor in the Department of Molecular and Integrative Neuroscience at the Scripps Research Institute and adjunct Associate Professor of the Neuroscience Department at the University of California at San Diego. She obtained a Ph.D. from the Illinois Institute of Technology and did postdoctoral training at the University of Maryland Medical School, The National Institutes of Health, and The Salk Institute. She has been a member of several NIH grant review panels and has served on journal editorial boards and advisory committees. Her current research focuses on neuroadaptive changes in CNS neurophysiology produced by neuroinflammation.

Jeremy D. Schmahmann is Professor of Neurology at Harvard Medical School and Massachusetts General Hospital. He is Director of the Ataxia Unit and the Laboratory for Neuroanatomy and Cerebellar Neurobiology, and a member of the Cognitive and Behavioral Neurology Unit at Massachusetts General Hospital. He trained at the University of Cape Town Medical School, the Neurological Unit of Boston City Hospital, and the Department of Anatomy and Neurobiology at Boston University. He received the Norman Geschwind Prize from the American Academy of Neurology and the Behavioral Neurology Society, and the Distinguished Neurology Teacher Award from the American Neurological Association. He is a Fellow of the American Academy of Neurology and the American Neuropsychiatric Association, on the scientific advisory board of the National Ataxia Foundation, and is cited in The Best Doctors in America since 1996. His research and clinical efforts are focused on the neuroanatomical substrates of cognition, and the role of

the cerebellum in intellect and emotion. His other books include *The Cerebellum and Cognition* (Academic Press), *MRI Atlas of the Human Cerebellum* (Academic Press), *Fiber Pathways of the Brain* (Oxford University Press), and *Cerebellar Disorders in Children* (MacKeith Press).

Noriyuki Koibuchi, M.D., Ph.D., obtained an M.D. degree from Gunma University School of Medicine in 1985 and a Ph.D. degree from Institute of Endocrinology, Gunma University, in 1989. Then he had a postdoctoral training at the Rockefeller University, New York. After serving as an Assistant Professor of Physiology at Dokkyo University School of Medicine and a Visiting Assistant Professor of Medicine at Harvard Medical School, he became a Professor of Integrative Physiology, Gunma University Graduate School of Medicine, Japan, in 2001. His major research interest is hormonal regulation of cerebellar development and plasticity.

Ferdinando Rossi obtained M.D. (1985) and Ph.D. degrees in Neuroscience (1990) at the University of Turin, Italy. He has been Assistant Professor of Human Physiology (1990–1998), Associate Professor of Neurobiology (1998–1998), and Full Professor of Neuroscience (1999-today) at the Department of Neuroscience, University of Turin. He spent 2 years on sabbatical at the INSERM U-106 (Paris). He is now Director of the Neuroscience Institute of Turin and Dean of the Faculty of Psychology. He is Associate Editor of the *European Journal of Neuroscience*; member of the editorial board of *Neuroscience*, *The Cerebellum, Neurobiology of Disease*, and *Frontiers in Neurosciences*. His main research interests are focused on the mechanisms of cerebellar development, axonal regeneration, and cell replacement following CNS injury, activity/experience-dependent plasticity, and repair in the CNS.

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List of Contributors

Kenji Akita Biomedical Institute, Research Center, Hayashibara Biochemical Laboratories, Inc., Naka-ku, Okayama, Japan

George A. Alexiou Department of Neurosurgery, Children's Hospital "Agia Sofia", Holargos, Athens, Greece

Ozlem Alkan Department of Radiology, Baskent University Medical School, Adana, Turkey

Matthew Allin Department of Psychosis Studies, Biomedical Research Centre for Mental Health, Institute of Psychiatry and King's College London, London, United Kingdom

Ramiro Alvarez Neurodegeneration Unit, Neurology Service, University Hospital Germans Trias i Pujol (HUGTP), Badalona (Barcelona), Spain

Richard Apps School of Physiology and Pharmacology, University of Bristol, Bristol, UK

Neal H. Barmack Department of Physiology & Pharmacology, Oregon Health & Science University, Portland, OR, USA

Curtis C. Bell Neurological Sciences Institute, Oregon Health and Science University, Beaverton, OR, USA

Fredrik Bengtsson Department of Experimental Medical Science, Division for Neuroscience, University of Lund, Lund, Sweden

Georgia A. Bishop Department of Neuroscience, The Ohio State University, Columbus, OH, USA

Emmanuelle Bitoun Department of Physiology, Anatomy and Genetics, MRC Functional Genomics Unit, University of Oxford, Oxford, UK

Gene J. Blatt Anatomy and Neurobiology, Boston University School of Medicine, Boston, MA, USA

Pablo M. Blázquez Department of Otolaryngology, School of Medicine, Washington University, St. Louis, MO, USA

Renato Borgatti Department of Child Neuropsychiatry and Neurorehabilitation, Scientific Institute "Eugenio Medea", Bosisio Parini (LC), Italy

L. W. J. Bosman Netherlands Institute for Neuroscience, Royal Dutch Academy of Arts & Sciences (KNAW), Amsterdam, The Netherlands

Department of Neuroscience, Erasmus Medical Center, Rotterdam, The Netherlands

Andreea C. Bostan Center for the Neural Basis of Cognition, Systems Neuroscience Institute and Department of Neurobiology, School of Medicine, University of Pittsburgh, Pittsburgh, PA, USA

Jean-Pierre Bouchard Department of Neurological Sciences, Laval University CHAUQ (Enfant-Jésus), Québec, Québec, Canada

James M. Bower Barshop Institute to Longevity and Aging Studies, Department of Radiology, University of Texas Health Science Center, San Antonio, TX, USA

Department of Biology, Neuroscience Institute, University of Texas, San Antonio, TX, USA

Michael Brand Developmental Genetics, Biotechnology Center and Center for Regenerative Therapies Dresden, Dresden University of Technology, Dresden, Germany

Katrin Bürk Department of Neurology, Philipps University of Marburg, Marburg, Germany

Thomas Butts MRC Centre for Developmental Neurobiology, King's College, London, UK

Daniel E. Callan Department of Computational Brain Imaging, Neural Information Analysis Laboratories ATR, Soraku-gun, Kyoto, Japan

Louis Caplan Department of Neurology, Beth Israel Deaconess Medical Center, Boston, MA, USA

Jan Cendelín Department of Pathophysiology, Faculty of Medicine in Pilsen, Charles University, Pilsen, Czech Republic

Daniel J. Chandler Department of Neurobiology and Anatomy, Drexel University College of Medicine, Philadelphia, PA, USA

Ronil V. Chandra Department of Interventional Neuroradiology and Endovascular Neurosurgery, Massachusetts General Hospital, Harvard Medical School, Boston, MA, USA

Zeshan A. Chaudhry Department of Diagnostic Neuroradiology, Massachusetts General Hospital, Harvard Medical School, Boston, MA, USA

Gang Chen Department of Neuroscience, University of Minnesota, Minneapolis, MN, USA

Robert Chen Emergency Imaging Division, Department of Radiology, Massachusetts General Hospital, Boston, MA, USA

Luisa Chiapparini Unit of Neuroradiology, Fondazione IRCCS Istituto Neurologico "Carlo Besta", Milan, Italy

Victor V. Chizhikov Center for Integrative Brain Research, Seattle Children's Hospital Research Institute, Seattle, WA, USA

Herweh Christian Department of Neuroradiology, University of Heidelberg, Medical Center, Heidelberg, Germany

Beverley A. Clark Wolfson Institute for Biomedical Research, University College London, London, UK

G. Giacomo Consalez Division of Neuroscience, San Raffaele Scientific Institute, Milan, Italy

Ian D. Coombs Department of Neuroscience, Physiology and Pharmacology, University College London, London, UK

F. Crepel Laboratoire de Pharmacologie et Biochimie de la synapse, CNRS UMR 8619, Institut de Biochimie et de Biophysique Moléculaire et Cellulaire, Université Paris-Sud 12, Orsay Cedex, France

Laura Croci Division of Neuroscience, San Raffaele Scientific Institute, Milan, Italy

Stuart G. Cull-Candy Department of Neuroscience, Physiology and Pharmacology, University College London, London, UK

Maria Dagioglou Behavioural Brain Sciences, School of Psychology, University of Birmingham, Edgbaston, Birmingham, UK

Egidio D'Angelo Department of Neuroscience, University of Pavia, Brain Connectivity Center, IRCCS C. Mondino, Pavia, Italy

Hervé Daniel Laboratoire de Pharmacologie et Biochimie de la synapse, CNRS UMR 8619, Institut de Biochimie et de Biophysique Moléculaire et Cellulaire, Université Paris-Sud 12, Orsay Cedex, France

Kay E. Davies Department of Physiology, Anatomy and Genetics, MRC Functional Genomics Unit, University of Oxford, Oxford, UK

Ray A. M. Daza Department of Neurological Surgery, Seattle Children's Research Institute, Center for Integrative Brain Research, M/S C9S-10, Seattle, WA, USA

Peter P. De Deyn Department of Neurology, ZNA Middelheim Hospital, Antwerp, Belgium

Hyo Jung De Smet Department of Experimental Psychology, University of Ghent, Ghent, Belgium

Paul Dean Department of Psychology, University of Sheffield, Sheffield, UK

Geneviève Demarquay Centre de Référence, de Diagnostic et de Traitement des Syndromes Neurologiques Paranéoplasiques, Hospices Civils de Lyon, Lyon, France

John E. Desmond Department of Neurology, Johns Hopkins Medical School, Baltimore, MD, USA

Stefano Di Donato Fondazione IRCCS Istituto Neurologico C., Milano, Italy

Uwe Dietrich Department of Neuroradiology, Evangelisches Krankenhaus Bielefeld, Bielefeld, Germany

Stéphane Dieudonné Laboratoire de Neurobiologie, Inhibitory Transmission Team, IBENS, Ecole Normale Supérieure (CNRS UMR 8197; INSERM U 1024), Paris, France

Patrick A. Dion Centre of Excellence in Neuroscience of Université de Montréal (CENUM), Centre de Recherche du Centre Hospitalier de l'Université de Montréal (CRCHUM), Montréal, Québec, Canada

Department of Pathology and cellular biology, Université de Montréal, Montréal, Québec, Canada

Opher Donchin Department of Biomedical Engineering and Zlotowski Center for Neuroscience, Ben-Gurion University of the Negev, Be'er Sheva, Israel

Nicolas Dupré Department of Neurological Sciences, Laval University CHAUQ (Enfant-Jésus), Québec, Québec, Canada

Timothy J. Ebner Department of Neuroscience, University of Minnesota, Minneapolis, MN, USA

Gina E. Elsen Department of Neurological Surgery, Seattle Children's Research Institute, Center for Integrative Brain Research, M/S C9S-10, Seattle, WA, USA

Carmen Espinós Laboratory of Genetics and Molecular Medicine, Instituto de Biomedicina de Valencia, Consejo Superior de Investigaciones Científicas (CSIC), and CIBER de Enfermedades Raras (CIBERER), Valencia, Spain

Jennifer K. Fahrion Department of Neurosciences, NC30, Lerner Research Institute, Cleveland Clinic Foundation, Cleveland, OH, USA

S. Hossein Fatemi Department of Psychiatry, Division of Neuroscience Research, University of Minnesota, Minneapolis, MN, USA

Departments of Pharmacology & Neuroscience, University of Minnesota, Minneapolis, MN, USA

Kathleen B. Fenner Department of Neurosciences, NC30, Lerner Research Institute, Cleveland Clinic Foundation, Cleveland, OH, USA

Josef Finsterer Danube University Krems, Vienna, Austria

Marta Florio Division of Neuroscience, San Raffaele Scientific Institute, Milan, Italy

Timothy D. Folsom Department of Psychiatry, Division of Neuroscience Research, University of Minnesota, Minneapolis, MN, USA

Kathryn D. Foote Department of Neurosciences, NC30, Lerner Research Institute, Cleveland Clinic Foundation, Cleveland, OH, USA

David Genís Neurodegenerative Diseases Unit, University Hospital of Girona Dr. Josep Trueta, Girona, Spain

Sid Gilman Department of Neurology, University of Michigan, Ann Arbor, MI, USA

Elke R. Gizewski Departments of Neuroradiology, University of Duisburg-Essen and Justus-Liebig-Universität Gießen, Gießen, Germany

Mitchell Glickstein Cell and Developmental Biology, University College London, London, UK

Daniel Goldowitz Department of Medical Genetics, Child and Family Research Institute, Centre for Molecular Medicine and Therapeutics, University of British Columbia, Vancouver, BC, Canada

R. Gilberto González Department of Diagnostic Neuroradiology, Massachusetts General Hospital, Harvard Medical School, Boston, MA, USA

Roy Graham DRC Computer, Sunnyvale, CA, USA

Michael D. Greicius Department of Neurology and Neurological Sciences, Functional Imaging in Neuropsychiatric Disorders (FIND) Lab, Stanford University School of Medicine, Stanford, CA, USA

Giuliana Grimaldi Unité d′Etude du Mouvement (UEM), Neurologie - ULB Erasme, Bruxelles, Belgium

J. R. De Gruijl Netherlands Institute for Neuroscience, Royal Dutch Academy of Arts & Sciences (KNAW), Amsterdam, The Netherlands

Christophe Habas Service de NeuroImagerie, CHNO des XV-XX, Université Pierre et Marie Curie Paris 6, Paris, France

Marios Hadjivassiliou Department of Neurology, Royal Hallamshire Hospital, Sheffield, UK

Robert M. Hardwick Behavioural Brain Sciences, School of Psychology, University of Birmingham, Edgbaston, Birmingham, UK

Richard Hawkes Department of Cell Biology and Anatomy Genes and Development Research Group, and Hotchkiss Brain Institute, The University of Calgary, Calgary, AB, Canada

Joachim Hermsdörfer Lehrstuhl für Bewegungswissenschaft, Fakultät für Sport- und Gesundheitswissenschaft, Technische Universität München, Munich, Germany

Germund Hesslow Department of Experimental Medical Science, Section for Neuroscience, University of Lund, Lund, Sweden

Robert F. Hevner Department of Neurological Surgery, Seattle Children's Research Institute, Center for Integrative Brain Research, M/S C9S-10, Seattle, WA, USA

Akiyuki Hiraga Department of Neurology, Chiba Rosai Hospital, Ichihara-shi, Chiba, Japan

Tomoo Hirano Department of Biophysics, Graduate School of Science, Kyoto University, Kyoto, Sakyo-ku, Japan

Moritoshi Hirono Laboratory for Motor Learning Control, RIKEN Brain Science Institute, Saitama, Japan

Jérôme Honnorat Centre de Référence, de Diagnostic et de Traitement des Syndromes Neurologiques Paranéoplasiques, Hospices Civils de Lyon, Lyon, France

Université Claude Bernard Lyon 1, Lyon, France

Neuro–Oncologie, Hôpital Neurologique, BRON Cedex, France

Mikio Hoshino Department of Biochemistry and Cellular Biology, National Institute of Neuroscience, National Center of Neurology and Psychiatry, Kodaira, Tokyo, Japan

C. Huang School of Biological Sciences, University of Missouri-Kansas City, Kansas City, MO, USA

Yayoi Ikeda Department of Histology and Cell Biology, Yokohama City University School of Medicine, Yokohama, Japan

Takanori Ikenaga Graduate School of Life Science, University of Hyogo, Ako-gun, Hyogo, Japan

Winfried Ilg Section Computational Sensomotorics, Department of Cognitive Neurology, Hertie Institute for Clinical Brain Research, Centre for Integrative Neuroscience, University of Tübingen, Tübingen, Germany

M. E. Ioffe Institute of Higher Nervous Activity and Neurophysiology, Russian Academy of Science, Moscow, Russia

Yerko Ivánovic Monte Alto Rehabilitation Medical Center, (Madrid), Private Practice, Madrid, Spain

National Reference Care Centre for People with Rare Diseases and Their Families–CREER–(Burgos), IMSERSO, Burgos, Spain

Richard B. Ivry Department of Psychology, University of California, Berkeley, CA, USA

Dieter Jaeger Department of Biology, Emory University, Atlanta, GA, USA

M. T. G. De Jeu Department of Neuroscience, Erasmus Medical Center, Rotterdam, The Netherlands

Patrice Jissendi Service de Neuroradiologie, ULB Erasme, Bruxelles, Belgium

Henrik Jörntell Section for Neurophysiology, Department of Experimental Medical Sciences, Lund University, Lund, Sweden

Keun-Hwa Jung Department of Neurology, Seoul National University, Medical College, Seoul National University Hospital, Seoul, South Korea

Gordana Juric-Sekhar Department of Pathology, Harborview Medical Center, Seattle, WA, USA

Masanobu Kano Department of Neurophysiology, Graduate School of Medicine, The University of Tokyo, Bunkyo-ku, Tokyo, Japan

Jan Kaslin Developmental Genetics, Biotechnology Center and Center for Regenerative Therapies Dresden, Dresden University of Technology, Dresden, Germany

Australian Regenerative Medicine Institute (ARMI), Monash University, Melbourne, Australia

James S. King Department of Neuroscience, The Ohio State University, Columbus, OH, USA

Osman Kizilkilic Department of Radiology, Istanbul University Cerrahpasa Medical School, Istanbul, Turkey

Boris P. Klyuch School of Life Sciences, University of Warwick, Coventry, UK

Thomas Knöpfel Laboratory for Neuronal Circuit Dynamics, RIKEN Brain Science Institute, Saitama, Japan

Noriyuki Koibuchi Department of Integrative Physiology, Gunma University Graduate School of Medicine, Maebashi, Gunma, Japan

Hitoshi Komuro Department of Neurosciences, NC30, Lerner Research Institute, Cleveland Clinic Foundation, Cleveland, OH, USA

Yutaro Komuro Department of Neurosciences, NC30, Lerner Research Institute, Cleveland Clinic Foundation, Cleveland, OH, USA

Florian Krismer Division of Clinical Neurobiology, Department of Neurology, Medical University, Innsbruck, Austria

Michael Küper Department of Neurology, University of Duisburg-Essen, Essen, Germany

Tatsuro Kumada Department of Neurosciences, NC30, Lerner Research Institute, Cleveland Clinic Foundation, Cleveland, OH, USA

Matt Larouche Department of Medical Genetics, Child and Family Research Institute, Centre for Molecular Medicine and Therapeutics, University of British Columbia, Vancouver, BC, Canada

Pilar Latorre Neurodegeneration Unit, Neurology Service, University Hospital Germans Trias i Pujol (HUGTP), Badalona (Barcelona), Spain

Maria G. Leggio Neurorehabilitation Unit A – Ataxia Laboratory, I.R.C.C.S. Santa Lucia Foundation, Rome, Italy

Department of Psychology, University of Rome La Sapienza, Rome, Italy

Benjamin Legros Department of Neurology; Reference Center for the Treatment of Refractory Epilepsy, Université Libre de Bruxelles- Hôpital Erasme, Brussels, Belgium

Mathieu Letellier Centre National de la Recherche Scientifique, Université Pierre et Marie Curie–Paris6, Paris, France

MRC Laboratory for Molecular Cell Biology and Cell Biology Unit and Department of Neuroscience, Physiology and Pharmacology, University College London, London, United Kingdom

Derick H. Lindquist Department of Psychology, The Ohio State University, Columbus, OH, USA

Siqiong June Liu Department of Cell Biology and Anatomy, LSU Health Sciences Center Medical Education Building LSUHSC, New Orleans, LA, USA

Ann M. Lohof Centre National de la Recherche Scientifique, Université Pierre et Marie Curie-Paris6, Paris, France

Elan D. Louis GH Sergievsky Center, College of Physicians and Surgeons, Columbia University, New York, NY, USA

Department of Neurology, College of Physicians and Surgeons, Columbia University, New York, NY, USA

Taub Institute for Research on Alzheimer's Disease and the Aging Brain, College of Physicians and Surgeons, Columbia University, New York, NY, USA

Department of Epidemiology, Mailman School of Public Health, Columbia University, New York, NY, USA

Unit 198, Neurological Institute, New York, NY, USA

Arn M. J. M. van den Maagdenberg Departments of Neurology and Human Genetics, Leiden University Medical Centre, Leiden, The Netherlands

Mario Manto Unité d'Etude du Mouvement (UEM), FNRS, Neurologie ULB Erasme, Bruxelles, Belgium

Jean Mariani Centre National de la Recherche Scientifique, Université Pierre et Marie Curie–Paris6, Paris, France

Assistance Publique–Hôpitaux de Paris, Hôpital Charles Foix, Unité d'Exploration Fonctionnelles, Ivry–sur–Seine, France

Peter Mariën Department of Neurology, ZNA Middelheim Hospital, Antwerp, Belgium

Department of Clinical Neurolinguistics, Vrije Universiteit Brussel, Brussels, Belgium

Caterina Mariotti Department of Diagnostics and Applied Technology, Unit of Genetics of Neurodegenerative and Metabolic Disease, Fondazione IRCCS Istituto Neurologico "Carlo Besta", Milan, Italy

Daniele Marmolino Laboratoire de Neurologie expérimentale, Université Libre de Bruxeles (ULB), Bruxelles, Belgium

Matthias Maschke Department of Neurology, Krankenhaus der Barmherzigen Brüder, Trier, Germany

Luca Massimino Division of Neuroscience, San Raffaele Scientific Institute, Milan, Italy

Alexandre Mathy Wolfson Institute for Biomedical Research, University College London, London, UK

Antoni Matilla-Dueñas Department of Neurosciences, Basic, Translational and Molecular Neurogenetics Research Unit, Health Sciences Research Institute Germans Trias I Pujol (IGTP), Universitat Autònoma de Barcelona, Badalona (Barcelona), Spain

R. Chris Miall Behavioural Brain Sciences, School of Psychology, University of Birmingham, Edgbaston, Birmingham, UK

Marco Molinari Laboratory of Experimental Neurorehabilitation Unit A – Ataxia Laboratory, I.R.C.C.S. Santa Lucia Foundation, Rome, Italy

Maria Mörsdorf Department of Neuroradiology, Bruederkrankenhaus Trier, Trier, Germany

Michael H. Myoga Department of Neurobiology, Harvard Medical School, Boston, MA, USA

Shevon E. Nicholson Department of Neurobiology and Anatomy, Drexel University College of Medicine, Philadelphia, PA, USA

Anne Noreau Centre of Excellence in Neuroscience of Université de Montréal (CENUM), Centre de Recherche du Centre Hospitalier de l'Université de Montréal (CRCHUM), Montréal, Québec, Canada

Dennis A. Nowak Klinik Kipfenberg, Neurologische Fachklinik, Kipfenberg, Germany

Neurologische Universitätsklinik, der Philipps–Universität, Marburg

John Oberdick Department of Neuroscience & Center for Molecular Neurobiology, The Ohio State University, Columbus, OH, USA

Adrian L. Oblak Anatomy and Neurobiology, Boston University School of Medicine, Boston, MA, USA

Nobuhiko Ohno Department of Neurosciences, NC30, Lerner Research Institute, Cleveland Clinic Foundation, Cleveland, OH, USA

Gaku Okugawa Department of Neuropsychiatry, Kansai Medical University, Hirakata, Osaka, Japan

Peter L. Oliver Department of Physiology, Anatomy and Genetics, MRC Functional Genomics Unit, University of Oxford, Oxford, UK

Gülin Öz Center for Magnetic Resonance Research, Department of Radiology, Medical School, University of Minnesota, Minneapolis, MN, USA

Francesc Palau Laboratory of Genetics and Molecular Medicine, Instituto de Biomedicina de Valencia, Consejo Superior de Investigaciones Científicas (CSIC), and CIBER de Enfermedades Raras (CIBERER), Valencia, Spain

Philippe Paquier Department of Clinical Neurolinguistics, Vrije Universiteit Brussel, Brussels, Belgium

Department of Neurology and Neuropsychology, University Hospital Erasme, ULB, Brussels, Belgium

Unit of Neurosciences, School of Medicine, Antwerp University, Antwerp, Belgium

Angel M. Pastor Departamento de Fisiología, Universidad de Sevilla, Sevilla, Spain

Annarita Patrizi Department of Anatomy, Pharmacology, and Forensic Medicine, National Institute of Neuroscience–Italy, Turin, Italy

F.M. Kirby Neurobiology Center, Children's Hospital, Harvard Medical School, Boston, MA, USA

Peter A. Pellionisz UCLA, Westwood, CA, USA

Andras J. Pellionisz HolGenTech, Sunnyvale, CA, USA

Jean-Claude Perez IBM Emeritus, Martignas, France

Katarzyna Pietrajtis Laboratoire de Neurobiologie, Inhibitory Transmission Team, IBENS, Ecole Normale Supérieure (CNRS UMR 8197; INSERM U 1024), Paris, France

Jaap J. Plomp Departments of Neurology and Molecular Cell Biology – Group Neurophysiology, Leiden University Medical Centre, Leiden, The Netherlands

John Porrill Department of Psychology, University of Sheffield, Sheffield, UK

Neofytos Prodromou Department of Neurosurgery, Children's Hospital "Agia Sofia", Holargos, Athens, Greece

O. Rapalino Neuroradiology Division, Department of Radiology, Massachusetts General Hospital, Boston, MA, USA

Wade G. Regehr Department of Neurobiology, Harvard Medical School, Boston, MA, USA

Robert E. Ricklefs University of Missouri-St. Louis, St. Louis, MO, USA

Jae-Kyu Roh Department of Neurology, Seoul National University, Medical College, Seoul National University Hospital, Seoul, South Korea

Romina Romaniello Department of Child Neuropsychiatry and Neurorehabilitation, Scientific Institute "Eugenio Medea", Bosisio Parini (LC), Italy

Ferdinando Rossi Neuroscience Institute of Turin (NIT), Department of Neuroscience, University of Turin, Turin, Italy

Neuroscience Institute of the Cavalieri–Ottolenghi Foundation (NICO), University of Turin, Orbassano, Turin, Italy

Guy A. Rouleau Centre of Excellence in Neuroscience of Université de Montréal (CENUM), Centre de Recherche du Centre Hospitalier de l'Université de Montréal (CRCHUM), Montréal, Québec, Canada

Research Center CHU Ste–Justine, and Department of Pediatrics and Biochemistry, University of Montreal, Montréal, Québec, Canada

Research Center CHU Ste–Justine, and Department of Pediatrics and Biochemistry, CHUM Research Centre, Montréal, Québec, Canada

Tom J. H. Ruigrok Department of Neuroscience, Erasmus Medical Center Rotterdam, Rotterdam, The Netherlands

Fumihito Saitow Department of Pharmacology, Nippon Medical School, Tokyo, Japan

Japan Science and Technology Agency, CREST, Tokyo, Japan

Elizabeth M. Sajdel-Sulkowska Department of Psychiatry, Harvard Medical School and Brigham and Women's Hospital, Harvard Institute of Medicine, Rm. 921, Boston, MA, USA

Sharleen T. Sakai Department of Psychology and Neuroscience Program, Michigan State University, East Lansing, MI, USA

Marco Sassoè-Pognetto Department of Anatomy, Pharmacology, and Forensic Medicine, National Institute of Neuroscience-Italy, Turin, Italy

Nathaniel B. Sawtell Department of Neuroscience and Kavli Institute for Brain Science, Hammer Health Sciences Center, Room 510C Columbia University Medical Center, New York, NY, USA

Karl Schilling Anatomisches Institut – Anatomie und Zellbiologie, Rheinische Friedrich-Wilhelms-Universität, Bonn, Germany

Jeremy D. Schmahmann Ataxia Unit, Cognitive and Behavioral Neurology Unit, Department of Neurology, Massachusetts General Hospital, Harvard Medical School, Boston, MA, USA

Beate Schoch Departments of Neurosurgery, University of Duisburg-Essen and Stiftungsklinikum Mittelrhein GmbH, Koblenz, Germany

Dennis J. L. G. Schutter Department of Experimental Psychology, Faculty of Social Sciences, Utrecht University, Utrecht, The Netherlands

Carme Serrano Neurology Service, Hospital de Martorell, Barcelona, Spain

Yusuke Seto Integrative Bioscience and Biomedical Engineering, Graduate School of Science and Engineering, Waseda University, Shinjuku-ku, Tokyo, Japan

Rachel M. Sherrard Centre National de la Recherche Scientifique, Université Pierre et Marie Curie-Paris6, Paris, France

Yoshikazu Shinoda Department of Systems Neurophysiology, Graduate School of Medicine, Tokyo Medical and Dental University, Bunkyo-ku, Tokyo, Japan

William R. Shirer Department of Neurology and Neurological Sciences, Functional Imaging in Neuropsychiatric Disorders (FIND) Lab, Stanford University School of Medicine, Stanford, CA, USA

Roy V. Sillitoe Dominick P. Purpura Department of Neuroscience, Albert Einstein College of Medicine 812 Kennedy Center, Bronx, NY, USA

Constantino Sotelo Neurociences Institute, Miguel Hernandez University and CSIC, Alicante, Sant Joand'Alacant, Spain

INSERM, U968, Paris, France

UPMC Univ Paris 06, UMR_S 968, Institut de la Vision, Paris, France

CNRS, UMR_7210, Paris, France

Rebecca M. C. Spencer Department of Psychology, University of Massachusetts, Amherst, MA, USA

Maja Steinlin Neuropaediatrics, University Children's Hospital Inselspital, Bern, Switzerland

Joseph E. Steinmetz Department of Psychology, The Ohio State University, Columbus, OH, USA

Catherine J. Stoodley Department of Psychology, College of Arts and Sciences, American University, Washington, DC, USA

Peter L. Strick Pittsburgh Veterans Affairs Medical Center, Pittsburgh, PA, USA

Center for the Neural Basis of Cognition, Systems Neuroscience Institute and Department of Neurobiology, School of Medicine, University of Pittsburgh, Pittsburgh, PA, USA

Izumi Sugihara Department of Systems Neurophysiology, Graduate School of Medicine, Tokyo Medical and Dental University, Bunkyo-ku, Tokyo, Japan

Hidenori Suzuki Department of Pharmacology, Nippon Medical School, Tokyo, Japan

Japan Science and Technology Agency, CREST, Tokyo, Japan

Franco Taroni Fondazione IRCCS Istituto Neurologico C., Milano, Italy

Department of Diagnostics and Applied Technology, Unit of Genetics of Neurodegenerative and Metabolic Diseases Istituto Neurologico "Carlo Besta", Milan, Italy

Richard F. Thompson Department of Psychology, University of Southern California, Los Angeles, CA, USA

Dagmar Timmann Department of Neurology, University of Duisburg-Essen, Essen, Germany

Shoji Tsuji Department of Neurology, Graduate School of Medicine, The University of Tokyo, Tokyo, Japan

Kazuyoshi Tsutsui Laboratory of Integrative Brain Sciences, Department of Biology, Waseda University, and Center for Medical Life Science of Waseda University, Shinjuku-ku, Tokyo, Japan

Marylka Yoe Uusisaari Laboratory for Neuronal Circuit Dynamics, RIKEN Brain Science Institute, Saitama, Japan

Theoretical and Experimental Neurobiology Unit, Okinawa Institute of Science and Technology (OIST), Onna–Son, Okinawa, Japan

Jo Verhoeven Department of Language and Communication Science, City University London, London, UK

Maria Teresa Viscomi Laboratory of Experimental Neurorehabilitation, I.R.C.C.S. Santa Lucia Foundation, Rome, Italy

Jan Voogd Department of Neuroscience, Erasmus Medical Center Rotterdam, Rotterdam, The Netherlands

Oegstgeest, The Netherlands

František Vožeh Department of Pathophysiology, Faculty of Medicine in Pilsen, Charles University, Pilsen, Czech Republic

Mark J. Wall School of Life Sciences, University of Warwick, Coventry, UK

Marion Wassef Institut de Biologie de l'Ecole Normale Supérieure (IBENS), Paris, France

CNRS UMR 8197, Paris, France

INSERM U1024, Paris, France

Masahiko Watanabe Department of Anatomy, Hokkaido University Graduate School of Medicine, Sapporo, Japan

Barry D. Waterhouse Department of Neurobiology and Anatomy, Drexel University College of Medicine, Philadelphia, PA, USA

Thomas C. Watson Department of Pharmacology, University of Cambridge, Cambridge, UK

Gregor K. Wenning Division of Clinical Neurobiology, Department of Neurology, Medical University, Innsbruck, Austria

Leigh Wilson MRC Centre for Developmental Neurobiology, King's College, London, UK

Richard J. T. Wingate MRC Centre for Developmental Neurobiology, King's College, London, UK

Kevin Wingeier Neuropaediatrics, University Children's Hospital Inselspital, Bern, Switzerland

Vadim Yakhnitsa Department of Physiology & Pharmacology, Oregon Health & Science University, Portland, OR, USA

Mitsunori Yamada Department of Clinical Research, National Hospital Organization, Saigata National Hospital, Ohgata-ku Johetsu-city, Niigata, Japan

Mayumi Yamada Department of Biochemistry and Cellular Biology, National Institute of Neuroscience, National Center of Neurology and Psychiatry, Kodaira, Tokyo, Japan

Tulin Yildirim Department of Radiology, Baskent University Medical School, Adana, Turkey

Albert J. Yoo Department of Interventional Neuroradiology and Endovascular Neurosurgery, Massachusetts General Hospital, Harvard Medical School, Boston, MA, USA

Chris I. De Zeeuw Netherlands Institute for Neuroscience, Royal Dutch Academy of Arts & Sciences (KNAW), Amsterdam, The Netherlands

Department of Neuroscience, Erasmus Medical Center, Rotterdam, The Netherlands

Gerard Zitnik Department of Neurobiology and Anatomy, Drexel University College of Medicine, Philadelphia, PA, USA

Mary L. Zupanc Children Hospital of Orange County, Orange County, CA, USA