Photobiomodulation in the Brain

Low-Level Laser (Light) Therapy in Neurology and Neuroscience

Edited by
Michael R. Hamblin and Ying-Ying Huang
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Michael R. Hamblin
Wellman Center for Photomedicine, Massachusetts General Hospital, Boston, MA, United States
Department of Dermatology, Harvard Medical School, Boston, MA, United States

Ying-Ying Huang
Wellman Center for Photomedicine, Massachusetts General Hospital, Boston, MA, United States
Department of Dermatology, Harvard Medical School, Boston, MA, United States
Dedication

To the love of my life, my beautiful wife, Angela
Michael R. Hamblin

To Sophie and Ryan, you have always been great sources of inspiration, joy, and pride
Ying-Ying Huang
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*Ivan V. Maksimovich*

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### 40. Russian low level laser therapy techniques for brain disorders

*Sergey V. Moskvin and Andrey V. Kochetkov*

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*L. Longo*

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*Randy Lamartiniere, Rhett Bergeron, Ronald Aung-Din, Matthew Bennett, William Stephan and Louis Banas*

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List of Contributors

Praveen R. Arany Department of Oral Biology and Biomedical Engineering, School of Dental Medicine, University at Buffalo, Buffalo, NY, United States

Jorge L. Arias INEUROPA (Instituto de Neurociencias del Principado de Asturias), Oviedo, Spain; Laboratory of Neuroscience, Department of Psychology, University of Oviedo, Asturias, Spain

Natalia Arias Department of Basic and Clinical Neuroscience, Institute of Psychiatry, Psychology and Neuroscience, King’s College London, London, United Kingdom; INEUROPA (Instituto de Neurociencias del Principado de Asturias), Oviedo, Spain

Ronald Aung-Din Sarasota, FL, United States

Evan Austin Department of Dermatology, University of California at Davis, Sacramento, CA, United States; Dermatology Service, Sacramento VA Medical Center, Mather, CA, United States

Louis Banas Laser Innovations, Amherst, New York, United States

Matthew Bennett Patterson, CA, United States

Patrick Benson Bosch Institute, University of Sydney, Sydney, NSW, Australia; Discipline of Physiology, University of Sydney, Sydney, NSW, Australia

Rhett Bergeron Real Health Medical, Roswell, GA, United States

Marvin H. Berman Quietmind Foundation, Elkins Park, PA, United States

Yelena Bogdanova VA Boston Healthcare System, Boston, MA, United States; Department of Psychiatry, Boston University School of Medicine, Boston, MA, United States

Marco Antonio Caldieraro Universidade Federal do Rio Grande do Sul, Department of Psychiatry and Forensic Medicine, Porto Alegre, RS, Brazil; Hospital de Clínicas de Porto Alegre, Department of Psychiatry, Porto Alegre, RS, Brazil


James D. Carroll Thor Photomedicine Ltd., Chesham, United Kingdom

Paolo Cassano Depression Clinical and Research Program, Department of Psychiatry, Massachusetts General Hospital, Boston, MA, United States; Center for Anxiety and Traumatic Stress Disorders, Department of Psychiatry, Massachusetts General Hospital, Boston, MA, United States; Department of Psychiatry, Harvard Medical School, Boston, MA, United States

Marucia Chacur Laboratory of Functional Neuroanatomy of Pain, Department of Anatomy—ICB, University of São Paulo, São Paulo, Brazil

Agnes S. Chan Department of Psychology, The Chinese University of Hong Kong, Hong Kong, China; Chanwuyi Research Center for Neuropsychological Well-Being, The Chinese University of Hong Kong, Hong Kong, China

Suk-tak Chan Harvard Medical School, Massachusetts General Hospital, Boston, MA, United States; Department of Radiology, Athinoula A. Martinos Center for Biomedical Imaging, Massachusetts General Hospital, Boston, MA, United States
Linda Chao Departments of Radiology & Biomedical Imaging and Psychiatry, University of California, San Francisco, CA, United States

Francisco José Cidral-Filho Experimental Neuroscience Laboratory (LaNEx), University of Southern Santa Catarina, Palhoça, Santa Catarina, Brazil; Postgraduate Program in Health Sciences, University of Southern Santa Catarina, Santa Catarina, Brazil

Thomas J. Covey Division of Cognitive and Behavioral Neurosciences, Department of Neurology, Jacobs School of Medicine and Biomedical Sciences, University at Buffalo, Buffalo, NY, United States

Luís De Taboada Chief Technology Officer, LiteCure LLC, New Castle, DE, United States

Janis T. Eells Department of Biomedical Sciences, University of Wisconsin-Milwaukee, Milwaukee, WI, United States

Nabil El Massri Department of Anatomy, University of Sydney, Sydney, NSW, Australia

Andrea Fedoruk VA Boston Healthcare System, Boston, MA, United States

Manuel Fierro Department of Dermatology, University of California at Davis, Sacramento, CA, United States; Dermatology Service, Sacramento VA Medical Center, Mather, CA, United States

Saša R. Filipović Institute for Medical Research, University of Belgrade, Belgrade, Serbia

Sherry Fox BioCare Systems, Inc., Parker, CO, United States, Colorado BioScience Association, Denver, CO, United States, National Association of Laser Therapy, Baltimore, MD, United States, LumiWave NIR Therapy Device, Operation Stand Tall Against TBI — A Non-Profit Organization, Calhan, CO, United States

Juan Díaz González Área de Tecnología Electrónica de la Universidad de Oviedo, Gijón, Spain; Grupo de Electrónica para la Innovación Industrial, Gijón, Spain

Luke Gordon Bosch Institute, University of Sydney, Sydney, NSW, Australia; Discipline of Physiology, University of Sydney, Sydney, NSW, Australia

Rajiv Gupta Harvard Medical School, Massachusetts General Hospital, Boston, MA, United States; Department of Radiology, Neuroradiology Division, Massachusetts General Hospital, Boston, MA, United States

Michael R. Hamblin Wellman Center for Photomedicine, Massachusetts General Hospital, Boston, MA, United States; Department of Dermatology, Harvard Medical School, Boston, MA, United States; Harvard-MIT Division of Health Sciences and Technology, Cambridge, MA, United States

Catherine Hamilton Department of Anatomy, University of Sydney, Sydney, NSW, Australia

David Hamilton Department of Anatomy, University of Sydney, Sydney, NSW, Australia

Theodore A. Henderson Neuro-Laser Foundation, Centennial, CO, United States; The Synaptic Space, Centennial, CO, United States

Michael D. Ho VA Boston Healthcare System, Boston, MA, United States

Jason Huang Department of Neurosurgery, Baylor Scott & White Health, Dallas, TX, United States

Ying-Ying Huang Wellman Center for Photomedicine, Massachusetts General Hospital, Boston, MA, United States; Department of Dermatology, Harvard Medical School, Boston, MA, United States

Jared Jagdeo Department of Dermatology, University of California at Davis, Sacramento, CA, United States; Dermatology Service, Sacramento VA Medical Center, Mather, CA, United States; Department of Dermatology, State University of New York, Downstate Medical Center, Brooklyn, NY, United States

Daniel M. Johnstone Bosch Institute, University of Sydney, Sydney, NSW, Australia; Discipline of Physiology, University of Sydney, Sydney, NSW, Australia

Linda Ramball Jones Department of Physics and Astronomy, College of Charleston, Charleston, SC, United States

Ramanjot Kaur Department of Dermatology, University of California at Davis, Sacramento, CA, United States

Ivo I. Kerppers Laboratory of Neuroanatomy and Neurophysiology, University of Centro-Oeste, Guarapuava, Brazil

Boaz Kim Bosch Institute, University of Sydney, Sydney, NSW, Australia; Discipline of Physiology, University of Sydney, Sydney, NSW, Australia
Sergey V. Moskvin The Federal State-Financed Institution “O.K. Skobelkin State Scientific Center of Laser Medicine under the Federal Medical Biological Agency” of Russia, Moscow, Russia

Margaret A. Naeser VA Boston Healthcare System, Boston, MA, United States; Department of Neurology, Boston University School of Medicine, Boston, MA, United States

Trent Nichols Quietmind Foundation, Elkins Park, PA, United States

Frank Nicklason Department of Anatomy, University of Sydney, Sydney, NSW, Australia; Geriatric Medicine, Royal Hobart Hospital, Hobart, TAS, Australia

Damir Nizamutdinov Department of Neurosurgery, Baylor Scott & White Health, Dallas, TX, United States

Amir Oron Department of Orthopedic Surgery, Kaplan Medical Center, Rehovot, Israel

Uri Oron Department of Zoology, George S. Wise Faculty of Life Sciences and Sagol School of Neuroscience, Tel Aviv University, Tel Aviv, Israel

Rodolfo Borges Parreira Salgado Institute of Integrative Health, Londrina, Brazil; Residency Program in Integrative Physical Therapy at UNIFIL University, Londrina, Brazil

Alberto Martín Pernía Área de Tecnología Electrónica de la Universidad de Oviedo, Gijon, Spain; Grupo de Electrónica para la Innovación Industrial, Gijon, Spain

Claudia Petrucco Bosch Institute, University of Sydney, Sydney, NSW, Australia; Discipline of Physiology, University of Sydney, Sydney, NSW, Australia

Nathali Cordeiro Pinto Physiotherapy, Bright Photomedicine Ltd., São Paulo, Brazil

Marcelo Victor Pires de Sousa Bright Photomedicine Ltd., São Paulo, Brazil

Eva-Maria Ratai Harvard Medical School, Massachusetts General Hospital, Boston, MA, United States; Department of Radiology, Athinoula A. Martinos Center for Biomedical Imaging, Massachusetts General Hospital, Boston, MA, United States; Department of Radiology, Neuroradiology Division, Massachusetts General Hospital, Boston, MA, United States

Carlo Rondinoni Institute of Radiology (INRAD), Universidade de São Paulo, São Paulo, Brazil

George Rozelle MindSpa Integrative Wellness Center, Sarasota, FL, United States

Saeed Sadigh-Eteghad Neurosciences Research Center, Tabriz University of Medical Sciences, Tabriz, Iran

Farzad Salehpour Neurosciences Research Center, Tabriz University of Medical Sciences, Tabriz, Iran; ProNeuroLIGHT LLC, Phoenix, AZ, United States

Afonso Shiguemi Inoue Salgado Salgado Institute of Integrative Health, Londrina, Brazil; Residency Program in Integrative Physical Therapy at UNIFIL University, Londrina, Brazil

Anita Saltmarche Saltmarche Health & Associates Inc., Orangeville, ON, Canada

David W. Shucard Division of Cognitive and Behavioral Neurosciences, Department of Neurology, Jacobs School of Medicine and Biomedical Sciences, University at Buffalo, Buffalo, NY, United States

William Stephan Buffalo, New York, United States

Jonathan Stone Bosch Institute, University of Sydney, Sydney, NSW, Australia; Discipline of Physiology, University of Sydney, Sydney, NSW, Australia

Luis De Taboada Chief Technology Officer, LiteCure LLC, New Castle, DE, United States

M.A. Tolentino College of Health Sciences, University of Wisconsin-Milwaukee, Milwaukee, WI, United States

Lorelei Tucker Department of Neuroscience and Regenerative Medicine, Medical College of Georgia, Augusta University, Augusta, GA, United States

Erica B. Wang Department of Dermatology, University of California at Davis, Sacramento, CA, United States; Dermatology Service, Sacramento VA Medical Center, Mather, CA, United States

Nicholas Alexander Wise Department of Physical Medicine and Rehabilitation, UNC Chapel Hill School of Medicine, Chapel Hill, NC, United States
Margaret Wong-Riley Department of Cell Biology, Neurobiology and Anatomy, Medical College of Wisconsin, Milwaukee, WI, United States

Mei X. Wu Wellman Center for Photomedicine, Massachusetts General Hospital, Boston, MA, United States; Department of Dermatology, Harvard Medical School, Boston, MA, United States; Harvard-MIT Division of Health Sciences and Technology, Cambridge, MA, United States

Luodan Yang Department of Neuroscience and Regenerative Medicine, Medical College of Georgia, Augusta University, Augusta, GA, United States

Michael K. Yeung Department of Psychology, The Chinese University of Hong Kong, Hong Kong, China; Department of Neurology and Neurosurgery, Montreal Neurological Institute, McGill University, Montreal, QC, Canada

Elisabeth Mateus Yoshimura Institute of Physics, Laboratory of Radiation Dosimetry and Medical Physics, University of São Paulo, São Paulo, Brazil

Quanguang Zhang Department of Neuroscience and Regenerative Medicine, Medical College of Georgia, Augusta University, Augusta, GA, United States

Reza Zomorrodi Temerty Centre for Therapeutic Brain Intervention, Centre for Addiction and Mental Health, Toronto, ON, Canada
Photobiomodulation (PBM) also known as low-level laser (or light) therapy has been known for over 50 years (since 1967), but it is only relatively recently that it has begun to make the transition into the mainstream. PBM describes the use of red or near-infrared light at levels that do not produce undue heating of the tissue to produce beneficial effects on the human body. The introduction of light-emitting diodes (LEDs) has made this approach more accessible than the previously used laser sources, as LEDs are safer, cheaper, and can easily be used at home. Another factor that has led to PBM becoming more widely accepted is the growing understanding of the mechanisms of action at a molecular and cellular level. The lack of a clear mechanism of action was a deterrent to many biomedical scientists who maintained a healthy level of skepticism.

Among the wide range of tissues, organs, diseases, and conditions that can be beneficially affected by PBM, the subject of this book is the brain. The brain is probably the single human organ that engenders the most concern, interest, and expenditure in the 21st century. Brain disorders that cause widespread morbidity, mortality, and loss of quality of life can be divided into four broad categories. Traumatic brain disorders include stroke, traumatic brain injury (TBI), global ischemia, and perinatal difficulties. Neurodegenerative diseases include Alzheimer’s disease, Parkinson’s disease, and a range of dementias. Psychiatric disorders include major depression, anxiety, addiction, and insomnia, among many others. Finally there are neurodevelopmental disorders (autism and ADHD) and the possibility of cognitive enhancement in healthy individuals. Many of these brain disorders are specifically addressed in the present volume.

The book is divided into three parts. The first part covers some basic considerations, dosimetry, and devices, and discusses the mechanisms of action at a cellular level and on the brain as a whole organ. The second part includes contributions from researchers who have carried out studies on a variety of animal models in their investigations of brain disorders, stroke, TBI, and Alzheimer’s and Parkinson’s diseases, to name a few. The third part concentrates on human studies, including controlled clinical trials, pilot trials, case series, and clinical experience. Disorders treated include TBI, stroke, Alzheimer’s and Parkinson’s diseases, depression, and others.

The book is expected to play a role in stimulating the further increase and acceptance of PBM for brain disorders, which has really started to take off in recent years. It will also act as a resource for researchers and physicians wishing to get a broad overview of the field and who are contemplating entering it themselves. The number of individuals considering obtaining a home-use PBM device is also steadily increasing and this book will act as an authoritative source of unbiased, well-researched, information, which is all the more necessary in the Internet age.