Mechanisms of Photobiomodulation Therapy XII

Michael R. Hamblin James D. Carroll Praveen Arany Editors

28 January 2017 San Francisco, California, United States

Sponsored and Published by SPIE

Volume 10048

Proceedings of SPIE, 1605-7422, V. 10048

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

Mechanisms of Photobiomodulation Therapy XII, edited by Michael R. Hamblin, James D. Carroll, Praveen Arany, Proc. of SPIE Vol. 10048, 1004801 · © 2017 SPIE · CCC code: 1605-7422/17/\$18 · doi: 10.1117/12.2269861 The papers included in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. The papers published in these proceedings reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from these proceedings:

Author(s), "Title of Paper," in Mechanisms of Photobiomodulation Therapy XII, edited by Michael R. Hamblin, James D. Carroll, Praveen Arany, Proceedings of SPIE Vol. 10048 (SPIE, Bellingham, WA, 2017) Seven-digit Article CID Number.

ISSN: 1605-7422 ISSN: 2410-9045 (electronic)

ISBN: 9781510605374 ISBN: 9781510605381 (electronic)

Published by **SPIE** P.O. Box 10, Bellingham, Washington 98227-0010 USA Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445 SPIE.org

Copyright © 2017, Society of Photo-Optical Instrumentation Engineers.

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is \$18.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 1605 7422/17/\$18.00.

Printed in the United States of America.

Publication of record for individual papers is online in the SPIE Digital Library.



Paper Numbering: Proceedings of SPIE follow an e-First publication model, with papers published first online and then in print. Papers are published as they are submitted and meet publication criteria. A unique citation identifier (CID) number is assigned to each article at the time of the first publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online, print, and electronic versions of the publication. SPIE uses a seven-digit CID article numbering system in which:

- The first five digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering
- system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc.

The CID Number appears on each page of the manuscript. The complete citation is used on the first page, and an abbreviated version on subsequent pages.

Contents

- v Authors
- vii Conference Committee

MECHANISMS OF PHOTOBIOMODULATION THERAPY I

10048 06 Diffuse correlation spectroscopy (DCS) study of blood flow changes during low level laser therapy (LLLT): a preliminary report [10048-5]

MECHANISMS OF PHOTOBIOMODULATION THERAPY II

- 10048 07 Extraorally delivered photobiomodulation therapy for prevention of oropharyngeal mucositis in pediatric patients undergoing hematopoietic cell transplantation (Invited Paper) [10048-6]
- 10048 08 The use of laser phototherapy in the management of trigeminal neuralgia pain: two decades of clinical experience [10048-7]
- 10048 09 Biomedical, translational and clinical research on PDT of TMJ [10048-8]

MECHANISMS OF PHOTOBIOMODULATION THERAPY IV

- 10048 OE Low-level light treatment ameliorates immune thrombocytopenia (Invited Paper) [10048-13]
- 10048 0H **3D Monte Carlo simulation of light propagation for laser acupuncture and optimization of illumination parameters** [10048-16]
- 10048 0I Effect of LED phototherapy on blood lactate level in Taekwondo contest [10048-17]
- 10048 0J Effects of photobiomodulation therapy (pulsed LASER 904 nm) on muscle oxygenation and performance in exercise-induced skeletal muscle fatigue in young women: a pilot study [10048-18]
- 10048 OK Photobiomodulation (PBM) with 20 W at 640 nm: pre-clinical results and propagation model [10048-26]

POSTER SESSION

10048 0M Challenges of transcutaneous laser application for the potential of photobiomodulation of the spinal cord at the scale of a large companion animal [10048-19]

- 10048 0N The use of phototherapy in the management of TMJ pain: clinical evidence of benefits and limitations [10048-20]
- 10048 00 Evaluation of the efficacy of AmPDT of oral microorganisms with Photogem associated to red LED (λ640ηm±5ηm): in vitro [10048-21]
- 10048 OP Investigation on physiological and clinical effects of different light sources in TMJ photobiomodulation therapy [10048-22]
- 10048 OR Photonic modulation of EGFR: 280nm low level light arrests cancer cell activation and migration [10048-24]

Authors

Numbers in the index correspond to the last two digits of the seven-digit citation identifier (CID) article numbering system used in Proceedings of SPIE. The first five digits reflect the volume number. Base 36 numbering is employed for the last two digits and indicates the order of articles within the volume. Numbers start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B...0Z, followed by 10-1Z, 20-2Z, etc.

Adnan, Ather, 07 Bagnato, Vanderlei S., 00 Bartels, Kenneth E., OM Botelho, Cláudia Manuela, OR Cangussú, Maria Cristina T., 08, 0N Cyprien, Thomas P., OJ de Carvalho, Fabiola B., 08, 0N de Oliveira, Susana Carla P. S., 08, 0N, 0O Duncan, Christine N., 07 Gendron, Denis J., OK Gomes, Andreia Castro, OR Gonçalves, Odete, OR Jones, Brett J. L., OJ Juliano, Amy F., 07 Kamenoff, J., 09, 0P Laakso, E-Liisa, OJ Lee, B. K., OI Lee, S. J., 01 Li, Ting, OH Lim, S., 01 Liu, Hanli, 06 London, Wendy B., 07 Marques, Aparecida Maria C., 08, 0N, 0O Marques, Rogério, OR Ménage, Alexander R., OK Monteiro, Juliana S. de C., 00 Neves-Petersen, Maria Teresa, OR Oliveira, Murilo X., OJ Pan, Boan, OH Park, H. C., Ol Piao, Daging, OM Pinheiro, Antônio L. B., 08, 0N, 0O Pires Santos, Gustavo M., 00 Renno, Ana C. M., 0J Sabapathy, Surendran, OJ Soares, A. P., ON Soares, Luiz Guiherme P., 08, 0N Soni, Sagar, 06 Sonis, Stephen T., 07 Sypniewski, Lara A., 0M Tian, Fenghua, 06 Tier, Matthew R., OJ Toma, Renata L., OJ Treister, Nathaniel S., 07 Viruthachalam, Thiagarajan, OR Vorum, Henrik, OR Wallace, Cameron A., 0J Wang, Pengbo, OH Wang, Xinlong, 06

Wu, Mei X., 0E Yang, Jingke, 0E Yaroslavsky, Anna N., 07 Zhang, Qi, 0E Zhong, Fulin, 0H

Conference Committee

Symposium Chairs

James G. Fujimoto, Massachusetts Institute of Technology (United States)

R. Rox Anderson, Wellman Center for Photomedicine, Massachusetts General Hospital (United States) and Harvard Medical School (United States)

Program Track Chair

Brian Jet-Fei Wong, Beckman Laser Institute and Medical Clinic (United States)

Conference Chairs

Michael R. Hamblin, Wellman Center for Photomedicine (United States) James D. Carroll, THOR Photomedicine Ltd. (United Kingdom) Praveen Arany, University at Buffalo (United States)

Conference Program Committee

Heidi Abrahamse, University of Johannesburg (South Africa)
Tomas Hode, Immunophotonics, Inc. (United States)
Clark E. Tedford, LumiThera (United States)
Mei X. Wu, Harvard Medical School (United States) and Wellman Center for Photomedicine (United States)

Session Chairs

Mechanisms of Photobiomodulation Therapy I James D. Carroll, THOR Photomedicine Ltd. (United Kingdom) Michael R. Hamblin, Wellman Center for Photomedicine (United States)

Mechanisms of Photobiomodulation Therapy III **Praveen Arany**, University at Buffalo (United States)

Mechanisms of Photobiomodulation Therapy IV Mei X. Wu, Harvard Medical School (United States) and Wellman Center for Photomedicine (United States)