

PROGRESS IN BIOMEDICAL OPTICS AND IMAGING

Vol. 14 No. 4

Optical Methods for Tumor Treatment and Detection: Mechanisms and Techniques in Photodynamic Therapy XXII

David H. Kessel
Tayyaba Hasan
Editors

2–4 February 2013
San Francisco, California, United States

Sponsored and Published by
SPIE

Volume 8568

Proceedings of SPIE, 1605-7422, V. 8568

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

Optical Methods for Tumor Treatment and Detection: Mechanisms and Techniques in Photodynamic Therapy XXII,
edited by David H. Kessel, Tayyaba Hasan, Proc. of SPIE Vol. 8568, 856801 · © 2013 SPIE
CCC code: 1605-7422/13/\$18 · doi: 10.1117/12.2022387

Proc. of SPIE Vol. 8568 856801-1

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 this book:

Author(s), "Title of Paper," in *Optical Methods for Tumor Treatment and Detection: Mechanisms and Techniques in Photodynamic Therapy XXII*, edited by David H. Kessel, Tayyaba Hasan, Proceedings of SPIE Vol. 8568 (SPIE, Bellingham, WA, 2013) Article CID Number.

ISSN: 1605-7422

ISBN: 9780819493378

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 © 2013, 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 1605-7422/13/\$18.00.

Printed in the United States of America.

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



SPIDigitalLibrary.org

Paper Numbering: Proceedings of SPIE follow an e-First publication model, with papers published first online and then in print and on CD-ROM. Papers are published as they are submitted and meet publication criteria. A unique, consistent, permanent 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 six-digit CID article numbering system in which:

- The first four 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. Numbers in the index correspond to the last two digits of the six-digit CID Number.

Contents

ix Conference Committee

SESSION 1 PDT BASIC SCIENCE I

- 8568 02 **Effects of oxygenation on PDT efficacy as a function of reactive oxygen species formation (Invited Paper)** [8568-1]
D. Kessel, M. Price, Wayne State Univ. School of Medicine (United States)
- 8568 03 **Environmental effects on of molecular biomarkers expression in pancreatic and brain cancer** [8568-2]
L. Mensah, S. Mallidi, I. Massodi, S. Anbil, Z. Mai, T. Hasan, Wellman Ctr. for Photomedicine, Massachusetts General Hospital, Harvard Medical School (United States)

SESSION 2 BASIC SCIENCE II

- 8568 05 **A theoretical comparison of macroscopic and microscopic modeling of singlet oxygen during Photofrin and HPPH mediated-PDT** [8568-4]
B. Liu, M. M. Kim, T. C. Zhu, The Univ. of Pennsylvania (United States)
- 8568 06 **Photonic cancer therapy: modulating cellular metabolism with light** [8568-5]
I. Coutinho, International Iberian Nanotechnology Lab. (Portugal); M. Correia, Aalborg Univ. (Denmark); T. Viruthachalam, G. P. Gajula, International Iberian Nanotechnology Lab. (Portugal); S. B. Petersen, International Iberian Nanotechnology Lab. (Portugal) and Aalborg Univ. (Denmark); M. T. Neves-Petersen, International Iberian Nanotechnology Lab. (Portugal)
- 8568 07 **Mechanism of enhanced responses after combination photodynamic therapy (cPDT) in carcinoma cells involves C/EBP-mediated transcriptional upregulation of the coproporphyrinogen oxidase (CPO) gene** [8568-6]
S. Anand, Cleveland Clinic (United States); T. Hasan, Wellman Ctr. for Photomedicine, Massachusetts General Hospital, Harvard Medical School (United States); E. V. Maytin, Cleveland Clinic (United States) and Wellman Ctr. for Photomedicine, Massachusetts General Hospital, Harvard Medical School (United States)
- 8568 09 **Subsurface PpIX imaging in vivo with ultrasound-guided tomographic spectroscopy: reconstruction vs. born-normalized data** [8568-8]
B. P. Flynn, A. V. D'Souza, S. C. Kanick, Thayer School of Engineering at Dartmouth (United States); E. Maytin, Cleveland Clinic Lerner Research Institute (United States); T. Hasan, Wellman Ctr. for Photomedicine, Massachusetts General Hospital, Harvard Medical School (United States); B. W. Pogue, Thayer School of Engineering at Dartmouth (United States)

SESSION 3 PHOTOPHYSICS	
8568 0B	A theoretical and experimental examination of fluorescence in enclosed cavities [8568-11] K. Lambson, X. Liang, A. V. Sharikova, T. C. Zhu, J. C. Finlay, Univ. of Pennsylvania (United States)
8568 0C	Noninvasive imaging of absolute PpIX concentration distribution in nonmelanoma skin tumors at pre-PDT [8568-12] U. Sunar, D. Rohrbach, J. Morgan, N. Zeitouni, Roswell Park Cancer Institute (United States)
8568 0E	Modelling the hypersensitivity of cancer cells to infra-red laser pulse: breaking ROS defence machinery [8568-14] S. G. Sokolovski, The Univ. of Dundee (United Kingdom); A. Goltsov, The Univ. of Abertay Dundee (United Kingdom); E. U. Rafailov, The Univ. of Dundee (United Kingdom)
SESSION 4 BASIC SCIENCE III	
8568 0H	Modeling stromal determinants of 3D tumor growth to inform PDT-mediated combination treatments [8568-17] I. Rizvi, S. Anbil, J. P. Celli, N. Alagic, I. Massodi, T. Hasan, Wellman Ctr. for Photomedicine, Massachusetts General Hospital, Harvard Medical School (United States)
8568 0I	Photodynamic characterization and optimization using multifunctional nanoparticles for brain cancer treatment [8568-18] K. Herrmann, Y.-E. Lee Koo, D. A. Orringer, O. Sagher, M. Philbert, R. Kopelman, The Univ. of Michigan (United States)
SESSION 5 PDT CLINICAL I	
8568 0J	Photodynamic therapy of locally advanced pancreatic cancer (VERTPAC study): final clinical results (Invited Paper) [8568-49] M. T. Huggett, Univ. College London (United Kingdom); M. Jermyn, Thayer School of Engineering at Dartmouth (United States); A. Gillams, Univ. College Hospital (United Kingdom); S. Mosse, Univ. College London (United Kingdom); E. Kent, Univ. College Hospital (United Kingdom); S. G. Bown, Univ. College London (United Kingdom); T. Hasan, Wellman Ctr. for Photomedicine, Massachusetts General Hospital, Harvard Medical School (United States); B. W. Pogue, Thayer School of Engineering at Dartmouth (United States); S. P. Pereira, Univ. College London (United Kingdom)
SESSION 6 PDT CLINICAL II	
8568 0N	Clinical studies of combined photodynamic therapy using 5-fluorouracil and methyl-aminolevulinate in patients at high risk for squamous cell carcinoma [8568-22] E. V. Maytin, S. Lohser, A. Tellez, L. Wene, R. Ishak, S. Anand, Cleveland Clinic Lerner Research Institute (United States)

- 8568 0O **Real-time treatment feedback guidance of Pleural PDT** [8568-23]
T. C. Zhu, M. M. Kim, X. Liang, B. Liu, J. L. Meo, J. C. Finlay, A. Dimofte, C. Rodriguez, C. B. Simone II, K. Cengel, Univ. of Pennsylvania (United States); J. S. Friedberg, Penn Presbyterian Medical Ctr. (United States)
- 8568 0P **Effects of modeled optical properties on recovered fluorophore concentration during image-guided fluorescence tomography** [8568-24]
A. V. D'Souza, B. P. Flynn, S. C. Kanick, B. W. Pogue, Thayer School of Engineering at Dartmouth (United States)
- 8568 0Q **A robotic multi-channel platform for interstitial photodynamic therapy** [8568-25]
A. V. Sharikova, J. C. Finlay, A. Dimofte, T. C. Zhu, Univ. of Pennsylvania (United States)

SESSION 7 PDT: PRECLINICAL AND CLINICAL III

- 8568 0R **Overcoming therapeutic resistance in pancreatic cancer is not a simple mix of PDT and chemotherapy: Evaluation of PDT-chemotherapy combinations in 3D tumor models** [8568-46]
J. P. Celli, Univ. of Massachusetts Boston (United States) and Wellman Ctr. for Photomedicine, Massachusetts General Hospital, Harvard Medical School (United States); L. Petrovic, Univ. of Massachusetts Boston (United States); I. Masdodi, I. Rizvi, T. Hasan, Wellman Ctr. for Photomedicine, Massachusetts General Hospital, Harvard Medical School (United States)
- 8568 0S **A photobleaching-based PDT dose metric predicts PDT efficacy over certain BPD concentration ranges in a three-dimensional model of ovarian cancer** [8568-47]
S. Anbil, I. Rizvi, Wellman Ctr. for Photomedicine, Massachusetts General Hospital, Harvard Medical School (United States); J. P. Celli, Univ. of Massachusetts Boston (United States); N. Alagic, T. Hasan, Wellman Ctr. for Photomedicine, Massachusetts General Hospital, Harvard Medical School (United States)
- 8568 0U **Monte Carlo simulation of light fluence calculation during pleural PDT** [8568-27]
J. L. Meo, T. Zhu, Univ. of Pennsylvania (United States)
- 8568 0V **Light dosimetry and dose verification for pleural PDT** [8568-28]
A. Dimofte, A. V. Sharikova, J. L. Meo, C. B. Simone II, J. S. Friedberg, T. C. Zhu, Univ. of Pennsylvania (United States)
- 8568 0W **LEDs as excitation source for time resolved singlet oxygen luminescence detection in cell suspensions** [8568-29]
S. Hackbarth, A. Preuss, T. Perna, J. Schlothauer, B. Röder, Humboldt-Univ. zu Berlin (Germany)
- 8568 0Y **In-vivo luminescence model for the study of tumor regression and regrowth following combination regimens with differentiation-promoting agents and photodynamic therapy** [8568-31]
K. Rollakanti, Cleveland State Univ. (United States) and Cleveland Clinic (United States); S. Anand, Cleveland Clinic (United States); E. V. Maytin, Cleveland State Univ. (United States) and Cleveland Clinic (United States)

- 8568 0Z **Photodynamic therapy light dose analysis of a patient based upon arterial and venous contrast CT scan information** [8568-10]
M. Jermyn, S. C. Davis, Thayer School of Engineering at Dartmouth (United States);
H. Dehghani, The Univ. of Birmingham (United Kingdom); M. Huggett, Univ. College London (United Kingdom); T. Hasan, Wellman Ctr. for Photomedicine, Massachusetts General Hospital, Harvard Medical School (United States); S. P. Pereira, Univ. College London (United Kingdom); B. W. Pogue, Thayer School of Engineering at Dartmouth (United States) and Wellman Ctr. for Photomedicine, Massachusetts General Hospital, Harvard Medical School (United States)

POSTER SESSION

- 8568 10 **Parameter determination for singlet oxygen modeling of BPD-mediated PDT** [8568-32]
D. D. McMillan, Univ. of Pennsylvania (United States) and Colorado State Univ. (United States); D. Chen, M. M. Kim, X. Liang, T. C. Zhu, Univ. of Pennsylvania (United States)
- 8568 12 **A novel near real-time laser scanning device for geometrical determination of pleural cavity surface** [8568-34]
M. M. Kim, T. C. Zhu, Univ. of Pennsylvania (United States)
- 8568 14 **Monitoring PDT response of head and neck lesions with diffuse optical spectroscopies** [8568-36]
D. J. Rohrbach, N. Rigual, E. Tracy, K. Keymel, M. T. Cooper, H. Baumann, B. W. Henderson, U. Sunar, Roswell Park Cancer Institute (United States)
- 8568 15 **A probe specific empirical light transport model for improved quantification of optical parameters for accurate PDT dosimetry** [8568-37]
D. J. Rohrbach, A. Kowalczewski, B. Chen, U. Sunar, Roswell Park Cancer Institute (United States)
- 8568 16 **Imaging nonmelanoma skin cancers with combined ultrasound-photoacoustic microscopy** [8568-38]
U. Sunar, D. J. Rohrbach, J. Morgan, N. Zeitouni, Roswell Park Cancer Institute (United States)
- 8568 17 **PDT dose dosimetry for pleural photodynamic therapy** [8568-39]
A. V. Sharikova, J. C. Finlay, X. Liang, T. C. Zhu, Univ. of Pennsylvania (United States)
- 8568 19 **Targeted imaging of ovarian cancer cells using viral nanoparticles doped with indocyanine green** [8568-41]
Y. Guerrero, B. Bahmani, B. Jung, V. Vullev, Univ. of California, Riverside (United States); V. Kundra, Univ. of Texas MD Anderson Cancer Ctr. (United States); B. Anvari, Univ. of California, Riverside (United States)
- 8568 1A **An ultrasound-guided fluorescence tomography system: design and specification** [8568-42]
A. V. D'Souza, B. P. Flynn, S. C. Kanick, S. Torosean, S. C. Davis, Thayer School of Engineering at Dartmouth (United States); E. V. Maytin, Cleveland Clinic Lerner Research Institute (United States); T. Hasan, Wellman Ctr. for Photomedicine, Massachusetts General Hospital, Harvard Medical School (United States); B. W. Pogue, Thayer School of Engineering at Dartmouth (United States)

- 8568 1C **Towards image-guided photodynamic therapy of Glioblastoma** [8568-45]
S. Mallidi, H.-C. Huang, J. Liu, Z. Mai, T. Hasan, Wellman Ctr. for Photomedicine,
Massachusetts General Hospital, Harvard Medical School (United States)
- 8568 1D **Calculation of singlet oxygen formation from one photon absorbing photosensitizers used
in PDT** [8568-48]
M. Potasek, E. Parilov, K. Beeson, Simphotek, Inc. (United States)
- 8568 1E **Pancreas tumor model in rabbit imaged by perfusion CT scans** [8568-50]
J. Gunn, K. Tichauer, Thayer School of Engineering at Dartmouth (United States);
K. Moodie, S. Kane, J. Hoopes, Geisel School of Medicine (United States); E. E. Stewart,
J. A. Hadway, T.-Y. Lee, Western Univ. (Canada); S. P. Pereira, Univ. College London (United
Kingdom); B. W. Pogue, Thayer School of Engineering at Dartmouth (United States) and
Geisel School of Medicine (United States)

Author Index

Conference Committee

Symposium Chairs

James Fujimoto, Massachusetts Institute of Technology (United States)
R. Rox Anderson, Wellman Center for Photomedicine, Massachusetts General Hospital (United States) and Harvard School of Medicine (United States)

Program Track Chair

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

Conference Chairs

David H. Kessel, Wayne State University (United States)
Tayyaba Hasan, Wellman Center for Photomedicine, Massachusetts General Hospital (United States) and Harvard School of Medicine (United States)

Conference Program Committee

Charles J. Gomer, Children's Hospital Los Angeles (United States)
Nancy L. Oleinick, Case Western Reserve University (United States)
Ravindra K. Pandey, Roswell Park Cancer Institute (United States)
Brian W. Pogue, Thayer School of Engineering at Dartmouth (United States)
Kenneth K. Wang M.D., Mayo Clinic (United States)

Session Chairs

- 1 PDT Basic Science I
David H. Kessel, Wayne State University (United States)
- 2 Basic Science II
Tayyaba Hasan, Wellman Center for Photomedicine, Massachusetts General Hospital (United States) and Harvard School of Medicine (United States)
- 3 Photophysics
Timothy C. Zhu, The University of Pennsylvania Health System (United States)

- 4 Basic Science III
Imran Rizvi, Wellman Center for Photomedicine, Massachusetts
General Hospital (United States) and Harvard School of Medicine
(United States)
- 5 PDT Clinical I
Kenneth K. Wang M.D., Mayo Clinic (United States)
- 6 PDT Clinical II
Merrill A. Biel M.D., University of Minnesota, Twin Cities (United States)
- 7 PDT: Preclinical and Clinical III
Jonathan Celli, University of Massachusetts (United States)