

PROGRESS IN BIOMEDICAL OPTICS AND IMAGING
Vol. 17 No. 18

Optical Interactions with Tissue and Cells XXVII

E. Duco Jansen
Editor

14–17 February 2016
San Francisco, California, United States

Sponsored and Published by
SPIE

Volume 9706

Proceedings of SPIE 1605-7422, V. 9706

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

Optical Interactions with Tissue and Cells XXVII, edited by E. Duco Jansen
Proc. of SPIE Vol. 9706, 970601 · © 2016 SPIE · CCC code: 1605-7422/16/\$18 · doi: 10.1117/12.2229268

Proc. of SPIE Vol. 9706 970601-1

The papers 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. Additional papers and presentation recordings may be available online in the SPIE Digital Library at SPIDigitalLibrary.org.

The papers 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 *Optical Interactions with Tissue and Cells XXVII*, edited by E. Duco Jansen, Proceedings of SPIE Vol. 9706 (SPIE, Bellingham, WA, 2016) Six-Digit Article CID Number.

ISSN: 1605-7422
ISSN: 2410-9045 (electronic)
ISBN: 9781628419405

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 © 2016, 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 1605-7422/16/\$18.00.

Printed in the United States of America.

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

SPIE. DIGITAL LIBRARY
SPIDigitalLibrary.org

Paper Numbering: *Proceedings of SPIE* follow an e-First publication model. A unique citation identifier (CID) number is assigned to each article at the time of 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 and print versions of the publication. SPIE uses a six-digit CID article numbering system structured as follows:

- 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.

Contents

vii	<i>Authors</i>
ix	<i>Conference Committee</i>

SESSION 1 THZ SENSING AND IMAGING

- 9706 02 **Adaptive enhancement and visualization techniques for 3D terahertz images of breast cancer tumors (Invited Paper) [9706-1]**
- 9706 03 **Breast cancer margin detection with a single frequency terahertz imaging system (Invited Paper) [9706-2]**

SESSION 2 PHOTOTHERMAL INTERACTIONS I

- 9706 0E **Low-cost 420nm blue laser diode for tissue cutting and hemostasis [9706-13]**
- 9706 0F **Light-assisted drying (LAD) of small volume biologics: a comparison of two IR light sources [9706-14]**
- 9706 0G **Heating drug delivery to vascular wall with Rhodamine B and fluorescence labeled Paclitaxel ranging 50 to 70°C: ex vivo study [9706-15]**
- 9706 0H **Influence of temperature on the myocardial cells death by an extracellular talaporfin sodium-induced photosensitization reaction [9706-16]**
- 9706 0I **Development of 2-micron nonlinear frequency conversion laser system and tissue interaction monitoring using optical coherence tomography [9706-17]**

SESSION 3 PHOTOTHERMAL INTERACTIONS II

- 9706 0J **Selective ablation of rabbit atherosclerotic plaque with less thermal effect by the control of pulse structure of a quantum cascade laser in the 5.7 μm wavelength range [9706-18]**
- 9706 0K **A non-contact temperature measurement system for controlling photothermal medical laser treatments [9706-19]**
- 9706 0M **Monitoring gold nanoparticle distribution with high resolution using photo-magnetic imaging [9706-21]**

SESSION 4 ULTRAFAST LASER-TISSUE INTERACTIONS

- 9706 0N **Femtosecond laser subsurface scleral treatment in cadaver human sclera and evaluation using two-photon and confocal microscopy [9706-22]**

- 9706 0O **Laser assisted bioprinting using a femtosecond laser with and without a gold transductive layer: a parametric study** [9706-23]
- 9706 0P **Precision resection of intestine using ultrashort laser pulses** [9706-24]
- 9706 0Q **Time resolved digital-holographic analysis of femtosecond laser-induced photodisruption** [9706-25]
- 9706 0R **Chromatically encoded high-speed photography of cavitation bubble dynamics inside inhomogeneous ophthalmic tissue** [9706-26]

SESSION 5 PHOTOMECHANICAL INTERACTIONS

- 9706 0T **Lead extraction by selective operation of a nanosecond-pulsed 355nm laser** [9706-28]
- 9706 0V **Conductivity affects nanosecond electrical pulse induced pressure transient formation** [9706-30]

SESSION 6 TISSUE OPTICS AND OPTICAL PROPERTIES OF TISSUE I

- 9706 0Y **Laser dosimetry planning tool for colonoscopic tumor resection** [9706-33]
- 9706 0Z **Influence of the scattering phase function in numerical modeling of hyperspectral imaging** [9706-34]
- 9706 11 **Coherent-wave Monte Carlo method for simulating light propagation in tissue** [9706-36]

SESSION 7 TISSUE OPTICS AND OPTICAL PROPERTIES OF TISSUE II

- 9706 12 **Methods for variance reduction in Monte Carlo simulations** [9706-37]
- 9706 14 **Accurately modeling Gaussian beam propagation in the context of Monte Carlo techniques** [9706-39]
- 9706 15 **Noninvasive optical measurement of bone marrow lesions: a Monte Carlo study on visible human dataset** [9706-40]

SESSION 8 TISSUE OPTICS AND OPTICAL PROPERTIES OF TISSUE III

- 9706 18 **Radiation absorption in different kinds of tissue analysis: ex vivo study with supercontinuum laser source** [9706-43]
- 9706 19 **Transmittance of MCF-7 breast tumor cell line through visible and near infrared spectrum** [9706-44]
- 9706 1A **Extraction of optical properties from hyperspectral images by Monte Carlo light propagation model** [9706-45]

SESSION 9 TISSUE OPTICS AND OPTICAL PROPERTIES OF TISSUE IV

- 9706 1B **Transcranial light-tissue interaction analysis** [9706-46]
- 9706 1C **Extraction of optical properties in the sub-diffuse regime by spatially resolved reflectance spectroscopy** [9706-47]
- 9706 1D **An improved analytic function for predicting light fluence rate in circular fields on a semi-infinite geometry** [9706-48]
- 9706 1E **Increased epidermal laser fluence through simultaneous ultrasonic microporation** [9706-49]
- 9706 1F **Parameterized source term in the diffusion approximation for enhanced near-field modeling of collimated light** [9706-62]

SESSION 10 PHOTOCHEMICAL AND CELLULAR BIO-RESPONSE

- 9706 1H **Patency of heart blood vessels under photosensitization reaction shortly after intravenous injection of talaporfin sodium in canine model** [9706-51]
- 9706 1I **Action spectrum for photochemical retinal pigment epithelium (RPE) disruption in an in vivo monkey model** [9706-52]
- 9706 1J **Protein-protein binding before and after photo-modification of albumin** [9706-53]
- 9706 1M **Photothermal damage is correlated to the delivery rate of time-integrated temperature (Invited Paper)** [9706-70]

POSTER SESSION

- 9706 1N **Multi-channel photon migration study in visible Chinese human muscle for optical detection of deep vein thrombosis** [9706-57]
- 9706 1O **Biophysical mechanism of transient retinal phototropism in rod photoreceptors** [9706-58]
- 9706 1Q **Simulation of the dependence of spatial fluence profiles on tissue optical properties** [9706-60]
- 9706 1R **Laser photoactivation gibberellin molecules in the surface tissues of plants** [9706-61]
- 9706 1U **Sensor structure concepts for the analysis or local radiation exposure of biological samples at terahertz and millimeter wave frequencies** [9706-65]
- 9706 1V **Time of flight estimation for breast cancer margin thickness using embedded tumors** [9706-66]
- 9706 1W **Regional spectroscopy of paraffin-embedded breast cancer tissue using pulsed terahertz transmission imaging** [9706-67]

9706 1Y **Investigation of superparamagnetic (Fe_3O_4) nanoparticles and magnetic field exposures on CHO-K1 cell line** [9706-69]

Authors

Numbers in the index correspond to the last two digits of the six-digit citation identifier (CID) article numbering system used in Proceedings of SPIE. The first four 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.

Ahmed, Elharith M., 1M
Ahn, Jin-Chul, 0I
Antonopoulos, Georgios, 0Q
Arai, Tsunenori, 0G, 0H, 1H
Arce-Diego, J. L., 0Y
Artiges, C., 0O
Aulakh, Kavleen, 1B
Awazu, Kunio, 0J
Barnes, Ronald A. Jr., 0V
Beck, Rainer J., 0P
Beier, Hope T., 0V
Bixler, Joel N., 12, 14
Bogdan, Stefan, 0T
Bowman, Tyler, 02, 1V, 1W
Brancaleon, Lorenzo, 1J
Bubel, Tracy, 1I
Bürmen, Miran, 1A, 1C
Campbell, Lucas, 1V, 1W
Catros, S., 0O
Chassagne, B., 0O
Chen, Xueying, 1F
Chininis, Jeff A., 1E
Choi, Tae-Youl, 1Y
Chung, Phil-Sang, 0I
Coker, Zachary, 1Y
Cucinotta, Annamaria, 18
Cugmas, Blaž, 1C
Deloison, F., 0O
Denton, Michael L., 1M
Desrus, H., 0O
Devillard, R., 0O
Dornuf, Fabian, 1U
Dörr, Roland, 1U
Elliott, Gloria D., 0F
Elpers, Gabriel, 12, 14
El-Shenawee, Magda, 02, 1V, 1W
Estlack, Larry, 1Y
Fan, Zhongwei, 0N
Fanjul-Vélez, F., 0Y
Fornaini, Carlo, 18
Fricain, J. C., 0O
Gai, Shaoyan, 1O
Gamboa, B. Giovanna, 1M
Gao, Feng, 1F
Gauch, John, 02
Glick, Stephen, 03
Glickman, Randolph D., 0V, 1J
Glikson, Michael, 0T
Gora, Wojciech S., 0P
Grishkanich, Alexander, 1R
Guillemot, F., 0O
Gulsen, Gultekin, 0M
Gülsoy, Murat, 0K
Hamada, Risa, 1H
Hand, Duncan P., 0P
Hashimura, Keisuke, 0J
Herzog, Amir, 0T
Hokr, Brett H., 12, 14
Homma, R., 0G
Hunt, Heather K., 1E
Hunter, Jennifer J., 1I
Hussain, Saber, 1Y
Ibey, Bennett L., 0V, 1Y
Ishaaya, Amiel A., 0T
Ishii, Katsunori, 0J
Ivančić, Matic, 1A
Jayne, David, 0P
Jia, Mengyu, 1F
Juhász, Tibor, 0N
Karellas, Andrew, 03
Kart, Turkey, 0M
Kascheev, Sergey, 1R
Kaya, Özgür, 0K
Kelly, Patrick A., 03
Khan, Ashraf, 03
Kim, Bongkyun, 0I
Kim, DaeYu, 0I
Kling, R., 0O
Kranert, F., 0R
Kraszewski, Maciej, 1I
Krozer, Viktor, 1U
Krüger, Alexander, 0Q, 0R
Kurtz, Ron, 0N
Lämmle, David, 1U
Li, Ting, 15, 1N
Lian, Fuqiang, 0N
Likar, Boštjan, 1A, 1C
Linden, Kurt J., 0E
Love, Charles, 0T
Lu, Amy, 1D
Lubatschowski, Holger, 0Q
Luk, Alex T., 0M
Majaron, Boris, 0Z
Mak, Andrey, 1R
Marks, Michael, 0M
Matsuzaki, Ryota, 1H
Matthias, B., 0R
Merigo, Elisabetta, 18

Milanič, Matija, 0Z
 Miller, S., 1Q
 Mitra, K., 1Q
 Naglič, Peter, 1A, 1C
 Noojin, Gary D., 1M
 Nouzi, Farouk, 0M
 Ogawa, Emiyu, 0H, 1H
 Ong, Yi-Hong, 1D
 Pelayo-Fernández, M. L., 0Y
 Peruš, Franjo, 1A, 1C
 Petit, S., 0O
 Pluciński, Jerzy, 1I
 Qian, Chenxi, 1E
 Ripken, Tammo, 0Q, 0R
 Rockwell, Benjamin A., 1M
 Roth, Caleb C., 0V
 Rozinek, Sarah C., 1J
 Ruzankina, Julia, 1R
 Sabarinathan, Ranjani, 1I
 Saerchen, Emanuel, 0Q
 Salas-García, I., 0Y
 Schellenberg, Mason W., 1E
 Schlaak, Helmut F., 1U
 Scully, Marlan O., 14
 Selleri, Stefano, 18
 Shephard, Jonathan D., 0P
 Shimazaki, N., 0G
 Shinozuka, M., 0G
 Sidorov, Igor, 1R
 Siqueira, Paul R., 03
 St. Peter, Benjamin, 03
 Su, Yu, 15
 Sun, Hui, 0N
 Sun, Yunlong, 1N
 Tabakoğlu, H. Özgür, 19
 Takenoya, Hiromi, 0H
 Thapa, Damber, 1O
 Thomas, Robert J., 12, 14, 1J
 Tinne, N., 0R
 Trammell, Susan R., 0F
 Van Vorst, Matthew, 0F
 Wang, Benquan, 1O
 Wang, Shuang, 1F
 Wenzel, Johannes, 0Q
 Wetzel, C., 0R
 Whiteside, Paul J. D., 1E
 Williams, David R., 1I
 Willmore, William G., 1B
 Winblad, Aidan, 12, 14
 Wu, Yuhao, 02
 Yakovlev, Alexey, 1R
 Yakovlev, Vladislav V., 14
 Yan, Ying, 0N
 Yao, Xincheng, 1O
 Ye, Winnie N., 1B
 Yngvesson, Sigfrid K., 03
 Young, Madison A., 0F
 Zakaib, Scott, 1B
 Zhang, Jie, 1I
 Zhao, Huijuan, 1F
 Zhao, Xiaohui, 1O
 Zhevlakov, Alexander, 1R
 Zhu, Timothy C., 1D
 Zollars, Byron, 12, 14
 Zverev, M., 0Y

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 School of Medicine
(United States)

Program Track Chair

Steven L. Jacques, Oregon Health & Science University
(United States)

Conference Chair

E. Duco Jansen, Vanderbilt University (United States)

Conference Program Committee

Hope Thomas Beier, Air Force Research Laboratory (United States)

Randolph Glickman, The University of Texas Health Science Center at
San Antonio (United States)

Steven L. Jacques, Oregon Health & Science University
(United States)

Bennett L. Ibey, Tri Service Research Laboratory (United States)

Beop-Min Kim, Korea University (Korea, Republic of)

Alexander J. Makowski, Prozess Technologie (United States)

Jessica C. Ramella-Roman, Florida International University
(United States)

Marissa Nicole Rylander, Virginia Polytechnic Institute and State
University (United States)

Zachary D. Taylor, University of California, Los Angeles (United States)

Robert J. Thomas, Air Force Research Laboratory (United States)

Alfred Vogel, Universität zu Lübeck (Germany)

Gerald J. Wilmink, WiseWear Corporation (United States)

Session Chairs

1 THz Sensing and Imaging
Zachary D. Taylor, University of California, Los Angeles (United States)

2 Photothermal Interactions I
E. Duco Jansen, Vanderbilt University (United States)

- 3 Photothermal Interactions II
Morgan S. Schmidt, Engility Corporation (United States)
- 4 Ultrafast Laser-Tissue Interactions
Joel N. Bixler, Air Force Research Laboratory (United States)
- 5 Photomechanical Interactions
Alexander J. Makowski, Prozess Technologie (United States)
- 6 Tissue Optics and Optical Properties of Tissue I
Alexandra J. Walsh, Air Force Research Laboratory (United States)
- 7 Tissue Optics and Optical Properties of Tissue II
Michael L. Denton, Engility Corporation (United States)
- 8 Tissue Optics and Optical Properties of Tissue III
Joel N. Bixler, Air Force Research Laboratory (United States)
- 9 Tissue Optics and Optical Properties of Tissue IV
Jessica C. Ramella-Roman, Florida International University
(United States)
- 10 Photochemical and Cellular Bio-response
Randolph D. Glickman, The University of Texas Health Science Center
at San Antonio (United States)