

Therapeutic Laser Applications and Laser-Tissue Interactions III

Alfred Vogel

Editor

**18–20 June 2007
Munich, Germany**

Sponsored and Published by
SPIE
OSA—Optical Society of America

Financial Sponsor



EOARD—European Office of Aerospace Research and Development

We wish to thank the following for their contribution to the success of this conference:
European Office of Aerospace Research and Development
Air Force Office of Scientific Research
United States Air Force Research Laboratory (www.london.af.mil)

Cooperating Organizations

EOS—European Optical Society
WLT—Wissenschaftliche Gesellschaft Lasertechnik e.V. (Germany)
DGLM—Deutsche Gesellschaft für Lasermedizin e.V. (Germany)

Volume 6632

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 *Therapeutic Laser Applications and Laser-Tissue Interactions III*, edited by Alfred Vogel, Proceedings of SPIE-OSA Biomedical Optics, Vol. 6632 (SPIE, Bellingham, WA, 2007) Article CID Number.

ISSN 1605-7422
ISBN 9780819467768

Copublished 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

and

OSA—Optical Society of America

2010 Massachusetts Ave., N.W., Washington, D.C., 20036 USA
Telephone +1 202 223 8130 (Eastern Time) · Fax +1 202 223 1096
osa.org

Copyright © 2007, Society of Photo-Optical Instrumentation Engineers and Optical Society of America.

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 the publishers 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 1605-7422/07/\$18.00.

Printed in the United States of America.

Paper Numbering: Proceedings of SPIE-OSA Biomedical Optics 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 they are published online, and connects the same identifier to all online, print, and electronic versions of the publication. In this six-digit CID article numbering system:

- 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*

LASER SURGERY ON TISSUES

- 6632 02 **CO₂ laser free-form processing of hard tissue** [6632-01]
M. Werner, Ctr. of Advanced European Studies and Research (Germany) and Institute of Laser Medicine, Heinrich-Heine Univ. (Germany); M. Klasing, M. Ivanenko, Ctr. of Advanced European Studies and Research (Germany); D. Harbecke, Ctr. of Advanced European Studies and Research (Germany) and Institute of Laser Medicine, Heinrich-Heine Univ. (Germany); H. Steigerwald, Institute of Laser Medicine, Heinrich-Heine Univ. (Germany) and Rheinische Friedrich-Wilhelms-Univ. (Germany); P. Hering, Ctr. of Advanced European Studies and Research (Germany) and Institute of Laser Medicine, Heinrich-Heine Univ. (Germany)
- 6632 03 **Ultrashort pulse laser processing of hard tissue, dental restoration materials, and biocompatibles** [6632-02]
A. Yousif, M. Strassl, Vienna Univ. of Technology (Austria); F. Beer, Vienna Medical Univ. (Austria); L. Verhagen, L.A.M. Verhagen & R.G.H. Waanders Tandheelkundig Ctr. (Netherlands); M. Wittschie, Zahnarztpraxis Dr. Wittschie (Germany); E. Wintner, Vienna Univ. of Technology (Austria)
- 6632 05 **Partial kidney resection based on 1.94 μ m fiber laser system** [6632-04]
D. Theisen-Kunde, Institute of Biomedical Optics, Univ. of Luebeck (Germany); S. Tedsen, Univ. Hospital Schleswig-Holstein, Luebeck (Germany); K. Herrmann, V. Danicke, R. Brinkmann, Institute of Biomedical Optics, Univ. of Luebeck (Germany)
- 6632 06 **Preliminary results on diode-laser assisted vaporization of prostate tissue** [6632-05]
R. Sroka, M. Seitz, O. Reich, A. Bachmann, V. Steinbrecher, A. Ackermann, C. Stief, Ludwig Maximilians Univ. (Germany)
- 6632 07 **Optical coherence tomography monitoring of vocal fold femtosecond laser microsurgery** [6632-06]
H. Wisweh, Hannover Medical School (Germany) and Laser Zentrum Hannover e.V. (Germany); U. Merkel, A.-K. Hüller, K. Lürßen, Hannover Medical School (Germany); H. Lubatschowski, Laser Zentrum Hannover e.V. (Germany)
- 6632 08 **Characterization of biophysical properties of rabbit auricle reshaped via diode laser ($\lambda=980$ nm)** [6632-50]
T. A.-A. El-Tayeb, A. Elkharbotly, M. Yosry, H. Ibrahim, National Institute for Laser Enhanced Sciences, Cairo Univ. (Egypt)

LASER TREATMENT OF VASCULAR MALFORMATIONS

- 6632 09 **Surgical treatment of cerebral ischemia by means of diode laser: first experimental results and comparison with theoretical model** [6632-07]
C. D. Signorelli, A. Giaquinta, G. Iofrida, G. Donato, F. Signorelli, Univ. Magna Graecia of Catanzaro (Italy); C. Bellecci, T. Lo Feudo, University Tor Vergata of Rome (Italy) and Univ. of Calabria (Italy); P. Gaudio, M. Gelfusa, University Tor Vergata of Rome (Italy)
- 6632 0C **Interaction of a dual-wavelength laser system with cutaneous blood vessels** [6632-10]
B. Majaron, Jožef Stefan Institute (Slovenia) and Beckman Laser Institute and Medical Clinic (USA); M. Milanič, Jožef Stefan Institute (Slovenia); J. S. Nelson, Beckman Laser Institute and Medical Clinic (USA) and Univ. of California, Irvine (USA)

TISSUE OPTICS

- 6632 0D **A novel 3D modelling and simulation technique in thermotherapy predictive analysis on biological tissue** [6632-11]
F. Fanjul-Vélez, J. L. Arce-Diego, Univ. de Cantabria (Spain); O. G. Romanov, A. L. Tolstik, Belarusian State Univ. (Belarus)
- 6632 0E **Space-time modeling of the photon diffusion in a three-layered model: application to the study of muscular oxygenation** [6632-13]
C. Mansouri, Groupe ISAIP-ESAIP (France); J. P. L'Huillier, V. Piron, Ecole Nationale Supérieure d'Arts et Métiers (France)
- 6632 0F **Stokes polarimetry for the characterization of bio-materials using liquid crystal variable retarders** [6632-14]
S. Firdous, National Institute of Lasers and Optronics (Pakistan); M. Ikram, Pakistan Institute of Engineering and Applied Sciences (Pakistan)
- 6632 0H **The photons propagation into non trivial geometry** [6632-52]
I. V. Krasnikov, A. Yu. Setejkin, Amur State Univ. (Russia)
- 6632 0J **Regulation of mesenchymal stromal cells differentiation by a blue laser irradiation** [6632-54]
T. Kushibiki, K. Awazu, Osaka Univ. (Japan)
- 6632 0K **The influence of intravenous laser irradiation of blood on some metabolic and functional parameters in intact rabbits and experimental cerebral ischaemia** [6632-55]
N. Nechipurenko, L. Vasilevskaya, Research/Practice Ctr. of Neurology and Neurosurgery (Belarus); J. Musienko, Belorussian Medical Academy of Postgraduate Education (Belarus); G. Maslova, Belorussian State Univ. (Belarus)
- 6632 0L **Time-resolved photon migration through an adult head model: comparison between finite element and Monte Carlo calculations** [6632-56]
C. Mansouri, Groupe ISAIP-ESAIP (France); J. P. L'Huillier, Ecole Nationale Supérieure d'Arts et Métiers (France)

PDT BASICS AND ANTIMICROBIAL TREATMENT

- 6632 0P **Frequency domain, time-resolved, and spectroscopic investigations of photosensitizers encapsulated in liposomal phantoms** [6632-18]
O. Mermut, J.-P. Bouchard, J.-F. Cormier, Institut National d'Optique (Canada); K. R. Diamond, McMaster Univ. (Canada) and Juravinski Cancer Ctr. (Canada); I. Noiseux, M. L. Vernon, Institut National d'Optique (Canada); M. S. Patterson, McMaster Univ. (Canada) and Juravinski Cancer Ctr. (Canada)
- 6632 0Q **Mechanisms in photodynamic therapy: photosensitizers and cellular localization on K562 cells** [6632-57]
R.-M. Ion, National Institute of R&D for Chemistry and Petrochemistry-ICECHIM (Romania) and Valahia Univ. (Romania); M. Neagu, G. Manda, C. Constantin, Victor Babes National Institute (Romania); M. Calin, National Institute of R&D for Optoelectronics (Romania)
- 6632 0U **5-aminolevulinic acid in aqueous gel: effective delivery system for ALA based PDT** [6632-62]
N. A. Sakharova, State Research Ctr., NIOPIK (Russia); N. I. Kazachkina, A. A. Pankratov, R. I. Yakubovskaya, Herten Moscow Research Institute of Oncology (Russia); N. V. Osikov, V. M. Negrimovsky, S. G. Kuzmin, E. A. Lukyanets, G. N. Vorozhtsov, State Research Ctr., NIOPIK (Russia)

PDT: PRECLINICAL AND CLINICAL STUDIES

- 6632 0V **Photodynamic therapy of non melanoma skin cancer murine model by topical application of a novel mTHPC liposomal formulation** [6632-19]
E. Alexandratou, M. Kyriazi, National Technical Univ. of Athens (Greece); T. Trebst, CeramOptec GmbH (Germany); S. Gräfe, Biolitec AG (Germany); D. Yova, National Technical Univ. of Athens (Greece)
- 6632 0W **Photodynamic therapy of murine non-melanoma skin carcinomas with diode laser after topical application of aluminum phthalocyanine chloride** [6632-20]
M. Kyriazi, E. Alexandratou, D. Yova, Engineering National Technical Univ. of Athens (Greece); M. Rallis, National Univ. of Athens (Greece); T. Trebst, CeramOptec GmbH (Germany)
- 6632 0Y **Design of a light delivery system for the photodynamic treatment of the Crohn's disease (Invited Paper)** [6632-22]
T. Gabrecht, CHUV Univ. Hospital (Switzerland); F. Borle, H. van den Bergh, Lab. of Photomedicine, Swiss Federal Institute of Technology (Switzerland); P. Michetti, M.-A. Ortner, CHUV Univ. Hospital (Switzerland); G. Wagnières, Lab. of Photomedicine, Swiss Federal Institute of Technology (Switzerland)
- 6632 1Z **Photodynamic therapy for treatment of subretinal neovascularization** [6632-63]
S. E. Avetisov, M. V. Budzinskaja, T. N. Kiseleva, Eye Disease Research Institute (Russia); N. V. Balatskaya, SUE ISCC Intermedbiophyschim (Russia); I. V. Gurova, Eye Disease Research Institute (Russia); V. B. Loschenov, S. A. Shevchik, General Physics Institute (Russia); S. G. Kuzmin, G. N. Vorozhtsov, SUE ISCC Intermedbiophyschim (Russia)

- 6632 13 **Adjuvant photodynamic therapy (PDT) with photosensitizer photosens for superficial bladder cancer: experimental investigations to treat prostate cancer by PDT with photosens** [6632-64]
O. I. Apolikhin, I. V. Chernishov, A. V. Sivkov, D. V. Altunin, Roszdrav Institute of Urology (Russia); S. G. Kuzmin, G. N. Vorozhtsov, SUE ISCC Intermedbiophyschem (Russia)
- 6632 14 **Results of photodynamic therapy in the combined treatment of choroidal metastasis** [6632-65]
V. G. Likhvantseva, E. V. Osipova, M. V. Petrenko, O. Yu. Merzlyakova, Eye Disease Research Institute (Russia); S. G. Kuzmin, G. N. Vorozhtsov, SUE ISCC Intermedbiophyschem (Russia)

OPHTHALMOLOGY: CORNEA AND RETINA

- 6632 15 **Temperature control during diode laser welding in a human cornea** [6632-25]
F. Rossi, P. Matteini, R. Pini, Istituto di Fisica Applicata, Nello Carrara (Italy); L. Menabuoni, Azienda USL 4 (Italy)
- 6632 17 **Femtosecond refractive eye surgery: study of laser parameters for even more efficiency and safety** [6632-27]
R. Le Harzic, Fraunhofer Institute of Biomedical Technology (Germany) and JenLab GmbH (Germany); C. Wüllner, Wavelight Laser Technologie AG (Germany); D. Bruneel, Fraunhofer Institute of Biomedical Technology (Germany); C. Donitzky, Wavelight Laser Technologie AG (Germany); K. König, Fraunhofer Institute of Biomedical Technology (Germany) and Univ. of the Saarland (Germany)
- 6632 19 **Interferometric optical online dosimetry for selective retina treatment (SRT)** [6632-29]
H. Stoehr, L. Ptaszynski, A. Fritz, R. Brinkmann, Institute of Biomedical Optics, Univ. of Lübeck (Germany)
- 6632 1B **Optoacoustic online temperature determination during retinal laser photocoagulation** [6632-67]
K. Schlott, Institute of Biomedical Optics, Univ. of Luebeck (Germany); J. Stalljohann, B. Weber, Medical Laser Ctr., Luebeck (Germany); J. Kandulla, K. Herrmann, Institute of Biomedical Optics, Univ. of Luebeck (Germany); R. Birngruber, R. Brinkmann, Institute of Biomedical Optics, Univ. of Luebeck (Germany) and Medical Laser Ctr., Luebeck (Germany)
- 6632 1C **Dynamics and detection of laser-induced microbubbles in the retinal pigment epithelium (RPE)** [6632-68]
A. Fritz, L. Ptaszynski, H. Stoehr, R. Brinkmann, Institute of Biomedical Optics, Univ. of Lübeck (Germany)
- 6632 1D **Influence of choroidal perfusion on retinal temperature increase during retinal laser treatments** [6632-69]
K. Herrmann, Medical Laser Ctr., Luebeck (Germany); C. Flöhr, Univ. Eye Hospital, Kiel (Germany); J. Stalljohann, Medical Laser Ctr., Luebeck (Germany); G. Apiou-Sbirlea, Air Liquide (France); J. Kandulla, R. Birngruber, R. Brinkmann, Institute of Biomedical Optics, Univ. of Luebeck (Germany)

OPHTHALMOLOGY: LENS

- 6632 1E **Ophthalmic drug delivery utilizing two-photon absorption: a novel approach to treat posterior capsule opacification** [6632-30]
H.-C. Kim, J. Träger, M. Zorn, N. Haberkorn, Univ. of Marburg (Germany); N. Hampf, Univ. of Marburg (Germany) and Material Sciences Ctr., Marburg (Germany)
- 6632 1F **Materials for intraocular lenses enabling photo-controlled tuning of focal length in vivo** [6632-31]
J. Träger, J. Heinzer, H.-C. Kim, Univ. of Marburg (Germany); N. Hampf, Univ. of Marburg (Germany) and Material Sciences Ctr., Marburg (Germany)
- 6632 1G **fs-lentotomie: changing the accommodation amplitude of presbyopic human lenses by fs laser pulses** [6632-32]
S. Schumacher, Laser Zentrum Hannover e.V. (Germany); U. Oberheide, Laserforum e.V. (Germany); H. Theuer, M. Fromm, T. Ripken, Laser Zentrum Hannover e.V. (Germany); G. Gerten, Laserforum e.V. (Germany); W. Ertmer, H. Lubatschowski, Laser Zentrum Hannover e.V. (Germany)
- 6632 1H **Femtosecond laser-induced cavitations in the lens of the human eye** [6632-33]
L. Kessel, J. Nymand, M. Harbst, Glostrup Hospital, Univ. of Copenhagen (Denmark); M. van der Poel, Technical Univ. of Denmark (Denmark); L. Eskildsen, Glostrup Hospital, Univ. of Copenhagen (Denmark) and Technical Univ. of Denmark (Denmark); M. Larsen, Glostrup Hospital, Univ. of Copenhagen (Denmark) and National Eye Clinic, Kennedy Institute (Denmark)

NANOPARTICLE AND CHROMOPHORE ASSISTED CELL SURGERY: JOINT SESSION WITH WLT-GOVERNMENT SCIENTIFIC LASER SOCIETY

- 6632 1U **Efficacy of a single high dose versus multiple low doses of LLLT on wounded skin fibroblasts** [6632-46]
D. H. Hawkins, H. Abrahamse, Univ. of Johannesburg (South Africa)
- 6632 1V **Cationic colloidal gold assisting delivery of macromolecular fluoresceins into target CHO-K1 cells by focused femtosecond laser** [6632-72]
Z. Li, Z. Zhang, X. Qu, J. Wang, Xi'an Jiaotong Univ. (China); G. Hüttmann, Institute of Biomedical Optics, Univ. Lübeck (Germany)

FOCUSSED LASER EFFECTS II: JOINT SESSION WITH WLT-GOVERNMENT SCIENTIFIC LASER SOCIETY

- 6632 1W **Laser-mediated perforation of plant cells** [6632-47]
M. Wehner, P. Jacobs, D. Esser, Fraunhofer-Institute for Laser Technology (Germany); H. Schinkel, S. Schillberg, Fraunhofer-Institute for Molecular Biology and Applied Ecology (Germany)

Author Index

Conference Committee

General Chairs

David Boas, Massachusetts General Hospital (USA)
Stefan Andersson-Engles, Lunds Tekniska Högskola (Sweden)

Program Chairs

Wolfgang Drexler, Cardiff University (United Kingdom)
Mary-Ann Mycek, University of Michigan (USA)

Conference Chair

Alfred Vogel, Universität zu Lübeck (Germany)

Program Committee

Stanley B. Brown, University of Leeds (United Kingdom)
Heyke C. Diddens, Medizinisches Laserzentrum Lübeck GmbH
(Germany)
Martin Frenz, Universität Bern (Switzerland)
Raimund Hibst, Universität Ulm (Germany)
Giulio Jori, Università degli Studi di Padova (Italy)
Karsten König, Fraunhofer-Institut für Biomedizinische Technik
(Germany) and University of the Saarland (Germany)
Holger Lubatschowski, Laser Zentrum Hannover e.V. (Germany)
Dieter Manstein, Wellman Center for Photomedicine (USA)
Michael C. Mrochen, ETH Zürich (Switzerland)
Günther Paltauf, Karl-Franzens-Universität Graz (Austria)
Ronald Sroka, Ludwig-Maximilians-Universität München (Germany)
Herbert G. Stepp, Ludwig-Maximilians-Universität München (Germany)
Hubert van den Bergh, École Polytechnique Fédérale de Lausanne
(Switzerland)
Zhenxi Zhang, Xi'an Jiaotong University (China)

Session Chairs

- 1 Laser Surgery on Tissues
Ronald Sroka, Ludwig-Maximilians-Universität München (Germany)
- 2 Laser Treatment of Vascular Malformations
Raimund Hibst, Universität Ulm (Germany)

- 3 Tissue Optics
Martin Frenz, Universität Bern (Switzerland)
- 4 PDT Basics and Antimicrobial Treatment
Heyke C. Diddens, Medizinisches Laserzentrum Lübeck GmbH (Germany)
Tanja Gabrecht, CHUV University Hospital (Switzerland)
- 5 PDT: Preclinical and Clinical Studies
Herbert G. Stepp, Ludwig-Maximilians-Universität München (Germany)
- 6 Ophthalmology: Cornea and Retina
Holger Lubatschowski, Laser Zentrum Hannover e.V. (Germany)
- 7 Ophthalmology: Lens
Ralf Brinkmann, Universität zu Lübeck (Germany)
- 8 Laser Catapulting: Joint Session with WLT-Government Scientific Laser Society
Alfred Vogel, Universität zu Lübeck (Germany)
Karsten König, Fraunhofer-Institut für Biomedizinische Technik (Germany) and University of the Saarland (Germany)
- 9 Focused Laser Effects I: Joint Session with WLT-Government Scientific Laser Society
Karsten König, Fraunhofer-Institut für Biomedizinische Technik (Germany) and University of the Saarland (Germany)
Alfred Vogel, Universität zu Lübeck (Germany)
- 10 Nanoparticle and Chromophore Assisted Cell Surgery: Joint Session with WLT-Government Scientific Laser Society
Gereon Hüttmann, Universität zu Lübeck (Germany)
- 11 Focused Laser Effects II: Joint Session with WLT-Government Scientific Laser Society
Karsten König, Fraunhofer-Institut für Biomedizinische Technik (Germany) and University of the Saarland (Germany)
Alfred Vogel, Universität zu Lübeck (Germany)