Biomedical Applications of Light Scattering VI

Adam P. Wax Vadim Backman Editors

21–22 January 2012 San Francisco, California, United States

Sponsored and Published by SPIE

Volume 8230

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 *Biomedical Applications of Light Scattering VI*, edited by Adam P. Wax, Vadim Backman, Proceedings of SPIE Vol. 8230 (SPIE, Bellingham, WA, 2012) Article CID Number.

ISSN 1605-7422 ISBN 9780819488732

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 © 2012, 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 1605-7422/12/\$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 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

vii Conference Committee

SESSION 1 DYNAMIC LIGHT SCATTERING AND SPECKLE

8230 02 Measuring intracellular motion using dynamic light scattering with optical coherence tomography in a mouse tumor model [8230-01]

G. Farhat, Univ. of Toronto (Canada) and Sunnybrook Health Sciences Ctr. (Canada); A. Mariampillai, Ryerson Univ. (Canada) and Univ. Health Network (Canada); K. K. C. Lee, Ryerson Univ. (Canada) and Univ. of Toronto (Canada); V. X. D. Yang, Sunnybrook Health Sciences Ctr. (Canada) and Ryerson Univ. (Canada); G. J. Czarnota, Univ. of Toronto (Canada) and Sunnybrook Health Sciences Ctr. (Canada); M. C. Kolios, Univ. of Toronto (Canada) and Ryerson Univ. (Canada)

8230 04 Eliminating the effect of bulk scattering when measuring skin surface roughness using speckle contrast: a skin phantom study [8230-03]

L. Tchvialeva, I. Markhvida, D. I. McLean, Vancouver Coastal Health Research Institute (Canada) and Univ. of British Columbia (Canada); H. Lui, H. Zeng, Vancouver Coastal Health Research Institute (Canada) and Univ. of British Columbia (Canada) and BC Cancer Research Ctr. (Canada); T. K. Lee, Vancouver Coastal Health Research Institute (Canada) and Univ. of British Colmbia (Canada) and BC Cancer Research Ctr. (Canada) and Simon Fraser Univ. (Canada)

8230 06 Label-free mitosis detection in tumor spheroids using tissue dynamics imaging [8230-05]
R. An, Purdue Univ. (United States); K. Jeong, Korean Military Institute (Korea, Republic of);
J. Turek, D. Nolte, Purdue Univ. (United States)

SESSION 2 NOVEL TECHNIQUES I

8230 08 Lasing modes in disordered media for single-nanoparticle quantitation: a new approach for biosensing [8230-07]

S. H. Choi, Y. L. Kim, Purdue Univ. (United States)

8230 0A Use of a radial angular filter array to estimate the position of an optically attenuating object within a turbid medium [8230-09]

Y. Zhang, Simon Fraser Univ. (Canada); F. Vasefi, Simon Fraser Univ. (Canada) and Lawson Health Research Institute (Canada) and Univ. of Western Ontario (Canada); M. Najiminaini, Simon Fraser Univ. (Canada) and Lawson Health Research Institute (Canada); B. Kaminska, Simon Fraser Univ. (Canada); J. J. L. Carson, Lawson Health Research Institute (Canada) and The Univ. of Western Ontario (Canada)

SESSION 3	NOVEL TECHNIQUES II
8230 0D	Optical phase measurements in red blood cells using low-coherence spectroscopy [8230-12] I. Shock, A. Barbul, P. Girshovitz, U. Nevo, R. Korenstein, N. T. Shaked, Tel Aviv Univ. (Israel)
8230 OG	Hyperspectral stray light imaging of chromosomes: a novel concept for label-free karyotyping [8230-15] S. Luckow, Reutlingen Research Institute (Germany); K. Rebner, Reutlingen Research Institute (Germany) and BASF SE (Germany); D. Oelkrug, Eberhard Karls Univ. Tübingen (Germany); R. W. Kessler, Reutlingen Research Institute (Germany)
SESSION 4	MODELING AND THEORY
8230 OH	Improved empirical models for extraction of tissue optical properties from reflectance spectra (Invited Paper) [8230-16] K. W. Calabro, E. Aizenberg, I. J. Bigio, Boston Univ. (United States)
8230 01	Determination of the scattering coefficient, the reduced scattering coefficient, and the anisotropy factor of tissue with differential interference contrast microscopy [8230-17] B. DeAngelo, G. Arzumanov, P. Shanley, Fairfield Univ. (United States); Z. Xu, Wenzhou Medical College (China); M. Xu, Fairfield Univ. (United States)
8230 OL	Numerical modelling and <i>in vivo</i> analysis of fluorescent and laser light backscattered from glial brain tumors [8230-20] T. A. Savelieva, N. A. Kalyagina, M. N. Kholodtsova, V. B. Loschenov, A. M. Prokhorov General Physics Institute (Russian Federation); S. A. Goryainov, A. A. Potapov, N.N. Burdenko Neurosurgical Institute (Russian Federation)
SESSION 5	IN VITRO
8230 00	Direct and highly sensitive measurement of the spatial arrangement of microstructures within biological samples [8230-23] N. N. Boustany, H. Sierra, R. M. Pasternack, Rutgers Univ. (United States); B. Rabin, OFS Labs (United States)
8230 OP	Correlating the light scattering pattern of a biological cell to its mitochondrial properties using a Gabor filter technique [8230-24] M. Moran, XH. Hu, J. Q. Lu, East Carolina Univ. (United States)
SESSION 6	LOW COHERENCE LIGHT SCATTERING
8230 OU	Characterization of dynamic physiology of the bladder by optical coherence tomography (Invited Paper) [8230-29] Z. Yuan, K. Keng, R. Pan, H. Ren, C. Du, J. Kim, Y. Pan, Stony Brook Univ. (United States)

SESSION 7 CLINICAL AND PRE-CLINICAL

8230 10 Enhanced tumor contrast during breast lumpectomy provided by independent component analysis of localized reflectance measures [8230-35]

A. Eguizabal, Univ. de Cantabria (Spain); A. M. Laughney, Thayer School of Engineering at Dartmouth (United States); P. B. Garcia Allende, Helmholtz Zentrum München GmbH (Germany); V. Krishnaswamy, Thayer School of Engineering at Dartmouth (United States); W. A. Wells, Dartmouth Hitchcock Medical Ctr. (United States); K. D. Paulsen, B. W. Pogue, Thayer School of Engineering at Dartmouth (United States); J. M. Lopez-Higuera, O. M. Conde, Univ. de Cantabria (Spain)

8230 11 Non-invasive detection of periodontal disease using diffuse reflectance spectroscopy: a clinical study [8230-36]

C. S. Prasanth, Ctr. for Earth Science Studies (India); J. Betsy, Government Dental College (India); N. Subhash, J. L. Jayanthi, Ctr. for Earth Science Studies (India); J. Prasanthila, Government Dental College (India)

POSTER SESSION

- Polarized Monte Carlo simulation of blood vessel structure in colon tissue [8230-37] W. Yip, A. Gomes, V. Backman, A. Sahakian, Northwestern Univ. (United States)
- 8230 14 Blind breast tissue diagnosis using independent component analysis of localized backscattering response [8230-39]

A. Eguizabal, Univ. de Cantabria (Spain); A. M. Laughney, Thayer School of Engineering at Dartmouth (United States); P. B. García Allende, Helmholtz Zentrum München GmbH (Germany); V. Krishnaswamy, Thayer School of Engineering at Dartmouth (United States); W. A. Wells, Dartmouth Hitchcock Medical Ctr. (United States); K. D. Paulsen, B. W. Pogue, Thayer School of Engineering at Dartmouth (United States); J. M. Lopez-Higuera, O. M. Conde, Univ. de Cantabria (Spain)

8230 17 Improving diffuse optical tomography with structural a priori from fluorescence diffuse optical tomography [8230-42]

W. Ma, F. Gao, L. Duan, Q. Zhu, X. Wang, W. Zhang, L. Wu, X. Yi, H. Zhao, Tianjin Univ. (China)

8230 19 Development and eigenvalue calibration of an automated spectral Mueller matrix system for biomedical polarimetry [8230-44]

H. Purwar, J. Soni, H. Lakhotia, Indian Institute of Science Education and Research (India); S. Chandel, CELOS, Cochin Univ. of Science and Technology (India); C. Banerjee, N. Ghosh, Indian Institute of Science Education and Research (India)

8230 1A A new imaging technique for the study of polarimetric properties using light polarization [8230-45]

I. C. Buscemi, S. Guyot, Lissy Lab. Univ. Paris-Est Créteil, (France)

8230 1C The reconstruction algorithm for endoscopic diffuse optical tomography based on effective detection area [8230-47]

Z. Qin, Y. Wang, H. Zhao, Y. Yang, X. Zhou, Y. Fan, F. Gao, Tianjin Univ. (China)

- 8230 1D **Detection of glucose-induced scattering change in turbid medium** [8230-48] L.-P. Yu, C. Chou, Chang Gung Univ. (Taiwan); L.-C. Su, J.-S. Wu, Chang Gung Univ. (Taiwan) and National Central Univ. (Taiwan); Y.-T. Wu, National Yang Ming Univ. (Taiwan); C.-S. Lai, Chang Gung Univ. (Taiwan)
- 8230 1G Single mode and sub-cellular fiber probes for cell scattering and density variation measurements [8230-51]

D. Kokkinos, T. Holden, S. Dehipawala, L. Mora, W. Huazhco, N. Gadura, U. Golebiewska, P. Schneider, G. Tremberger, Jr., D. Lieberman, T. Cheung, Queensborough Community College of CUNY (United States)

Author Index

Conference Committee

Symposium Chairs

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

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

Program Track Chairs

Ammasi Periasamy, University of Virginia (United States) **Daniel L. Farkas**, Cedars-Sinai Medical Center (United States)

Conference Chairs

Adam P. Wax, Duke University (United States) **Vadim Backman**, Northwestern University (United States)

Program Committee

Irving J. Bigio, Boston University (United States)

Stephen A. Boppart, University of Illinois at Urbana-Champaign (United States)

Bernard Choi, Beckman Laser Institute and Medical Clinic (United States)

Steven L. Jacques, Oregon Health & Science University (United States) **Lev T. Perelman**, Harvard University (United States)

Brian W. Pogue, Dartmouth College (United States)

Bruce J. Tromberg, Beckman Laser Institute and Medical Clinic (United States)

Session Chairs

Dynamic Light Scattering and Speckle
 Bernard Choi, Beckman Laser Institute and Medical Clinic (United States)

2 Novel Techniques I

Adam P. Wax, Duke University (United States)

3 Novel Techniques II

Adam P. Wax, Duke University (United States)

- Modeling and Theory
 Vadim Backman, Northwestern University (United States)
- 5 In Vitro

 Vadim Backman, Northwestern University (United States)
- 6 Low Coherence Light Scattering Stephen A. Boppart, University of Illinois at Urbana-Champaign (United States)
- 7 Clinical and Pre-Clinical **Irving J. Bigio**, Boston University (United States)