PROGRESS IN BIOMEDICAL OPTICS AND IMAGING
Vol. 10, No. 16

Dynamics and Fluctuations in Biomedical Photonics VI

Valery V. Tuchin
Lihong V. Wang
Donald D. Duncan
Editors

24, 26 January 2009
San Jose, California, United States

Sponsored and Published by
SPIE

Volume 7176

Proceedings of SPIE, 1605-7422, v. 7176

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 *Dynamics and Fluctuations in Biomedical Photonics VI*, edited by Valery V. Tuchin, Lihong V. Wang, Donald D. Duncan, Proceedings of SPIE Vol. 7176 (SPIE, Bellingham, WA, 2009) Article CID Number.

ISSN 1605-7422
ISBN 9780819474223

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

Printed in the United States of America.

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

SPIE Digital Library

SPIEDigitalLibrary.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 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

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 Chairs

Steven L. Jacques, Oregon Health & Science University (United States)
William P. Roach, Air Force Research Laboratory (United States)

Conference Chairs

Valery V. Tuchin, Saratov State University (Russian Federation)
Lihong V. Wang, Washington University in St. Louis (United States)
Donald D. Duncan, Oregon Health & Science University (United States)

Program Committee

Vadim S. Anischenko, Saratov State University (Russian Federation)
Wei R. Chen, University of Central Oklahoma (United States)
Joseph P. Culver, Washington University in St. Louis (United States)
Jingying Jiang, Tianjin University (China)
Sean J. Kirkpatrick, Oregon Health & Science University (United States)
Jürgen M. Lademann, Charité Universitätsmedizin Berlin (Germany)
Kirill V. Larin, University of Houston (United States)
Hong Liu, University of Oklahoma (United States)
Qingming Luo, Huazhong University of Science and Technology (China)
Igor V. Meglinski, Cranfield University (United Kingdom)
Vladislav Y. Toronov, Ryerson University (Canada)
Ruikang Wang, Oregon Health & Science University (United States)
Vladimir P. Zharov, University of Arkansas for Medical Sciences (United States)
Dmitry A. Zimnyakov, Saratov State University (Russian Federation)

Session Chairs

1 Dynamic Light Scattering and Speckle Technologies
Sean J. Kirkpatrick, Oregon Health & Science University (United States)

Introduction

These proceedings are from the Dynamics and Fluctuations in Biomedical Photonics VI, held 24–26 January 2009 at the SPIE Photonics West Conference in San Jose, California. It was a two-day meeting featuring 26 oral and poster presentations from leading international research groups.

The goal of the conference was to gather essentially different groups of leading researchers such as biophysicists, physicians, mathematicians, optical and laser engineers, and students to facilitate future progress in the development of optical and laser technologies based on dynamics and fluctuations approaches toward biomedical science and clinical applications. These approaches should be useful for diagnosis and therapy of dangerous diseases such as those of the heart, cancer, vascular, mental illness, and many others that manifest as a breach of the living organism's auto-control systems at the level of molecule, cell, organ, or organism as a whole. We hope the proceedings of this conference will contribute to the development of such interdisciplinary fields of science and applications as dynamics and structures of living systems, biomedical optics and laser medicine, and that it will be helpful for scientists, medical doctors, engineers, and students.

The conference was organized into several sessions: dynamic light scattering and speckle technologies; cell and tissue spectroscopy and imaging; nanophotonics in medical applications; optical clearing and monitoring of drug delivery; and dynamics and fluctuations in biological systems, and included five invited papers.

During the oral session on dynamic light scattering and speckle technologies recent advances in imaging the blood microcirculation, including laser speckle imaging accounting for temporal and spatial effects, characterization of dental composite curing kinetics using dynamic light scattering, and ocular microtremor laser speckle metrology were presented and discussed.

In the session cell and tissue spectroscopy and imaging, fluorescence and polarization imaging of membrane dynamics in living cells, spectral features of normal and cancerous human breast tissues with lamp and laser excitation, and automated segmentation of fluorescent in situ hybridization signals in interphase nuclei of pap-smear specimens, were analyzed and discussed.

The nanophotonics in medical applications session featured an invited paper on in vivo integration of multiwavelength photoacoustic lymphography, sentinel lymph nodes mapping, and metastasis assessment using multiplex nanoparticle targeting.

In the session optical clearing and monitoring of drug delivery, and in a corresponding portion of the poster session, the following topics were discussed:

SHG imaging and modeling of the optical clearing mechanisms in striated muscle and tendon, the nonlinear relationship between concentration of analyte and its permeability coefficient in ocular tissues, microvisualizing assay of delivered drug infiltration using 2-color optical coherence dosigraphytomography, monitoring of interaction of hemoglobin and glucose molecules by spectral method, and backscattered polarization patterns at multiple scattering versus single scattering.

The oral session on dynamics and fluctuations in biological systems and the corresponding portion of the poster session presented advanced studies in dynamics and fluctuations in molecule orientations and electrical signal propagations in neurons with SHG microscopy, spontaneous neuronal fluctuations measured with diffuse optical tomography reveal functional connectivity networks, generation of the synchronized burst in the cultured neuron networks, separation of extracellular spikes with wavelets and neural networks, and wavelet-based analysis of blood pressure dynamics in rats.

The conference chairs would like to thank the members of the technical program committee for their help in organizing the conference. We sincerely appreciate the support of the SPIE and the conference staff. Finally, we would like to thank all of the conference attendees and manuscript authors for their contributions and participation, especially invited speakers, which helped to make this meeting a success.

Valery V. Tuchin
Lihong V. Wang
Donald D. Duncan