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Dynamics and Fluctuations in Biomedical Photonics VI

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

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

DYNAMIC LIGHT SCATTERING AND SPECKLE TECHNOLOGIES

- 7176 02 **Recent advances in imaging the microcirculation (Invited Paper)** [7176-01]
M. J. Leahy, N. T. Clancy, J. G. Enfield, P. McNamara, Univ. of Limerick (Ireland); J. O'Doherty, Univ. of Limerick (Ireland) and Royal Surrey County Hospital (United Kingdom)
- 7176 03 **Laser speckle contrast imaging for the quantitative assessment of flow** [7176-02]
D. D. Duncan, S. J. Kirkpatrick, J. C. Gladish, S. A. Hurst, Oregon Health & Science Univ. (United States)
- 7176 04 **Spatial and temporal effects in speckle perfusion measurement** [7176-03]
O. B. Thompson, M. K. Andrews, Industrial Research Ltd. (New Zealand)
- 7176 05 **Characterization of dental composite curing kinetics using dynamic light scattering** [7176-04]
E. M. Wells-Gray, S. J. Kirkpatrick, R. L. Sakaguchi, Oregon Health & Science Univ. (United States)
- 7176 06 **Ocular microtremor laser speckle metrology** [7176-05]
M. Al-Kalbani, St. James's Hospital (Ireland); E. Mihaylova, Dublin Institute of Technology (Ireland); N. Collins, St. James's Hospital Dublin (United States) and Royal Victoria Eye and Ear Hospital (Ireland); V. Toal, Dublin Institute of Technology (Ireland); D. Coakley, G. Boyle, St. James's Hospital (Ireland)

CELL AND TISSUE SPECTROSCOPY AND IMAGING

- 7176 07 **Fluorescence and polarization imaging of membrane dynamics in living cells (Invited Paper)** [7176-06]
M. Wagner, P. Weber, T. Bruns, Hochschule Aalen (Germany); W. S. L. Strauss, Univ. Ulm (Germany); H. Schneckenburger, Hochschule Aalen (Germany) and Univ. Ulm (Germany)
- 7176 08 **Comparative study of laser and lamp fluorescence of cancer and normal tissue through wavelet transform and singular value decomposition** [7176-07]
A. H. Gharekhan, Gujarat Univ. (India); D. Rath, Indian Institute of Technology Kanpur (India); A. N. Oza, Gujarat Univ. (India); A. Pradhan, Indian Institute of Technology Kanpur (India); M. B. Sureshkumar, M.S. Univ. of Baroda (India); P. K. Panigrahi, Physical Research Lab. (India) and Indian Institute of Science Education and Research, Kolkata (India)

- 7176 09 **Automated segmentation and analysis of fluorescent in situ hybridization (FISH) signals in interphase nuclei of pap-smear specimens** [7176-08]
X. Wang, Univ. of Oklahoma (United States); B. Zheng, Univ. of Pittsburgh (United States); S. Li, R. R. Zhang, Univ. of Oklahoma Health Sciences Ctr. (United States); Y. Li, Univ. of Oklahoma (United States); J. J. Mulvihill, Univ. of Oklahoma Health Sciences Ctr. (United States); W. R. Chen, Univ. of Central Oklahoma (United States); H. Liu, Univ. of Oklahoma (United States)

OPTICAL CLEARING AND MONITORING OF DRUG DELIVERY

- 7176 0D **The nonlinear relationship between concentration of analyte and its permeability coefficient in ocular tissues** [7176-13]
M. G. Ghosn, Univ. of Houston (United States); V. V. Tuchin, Saratov State Univ. (Russian Federation); K. V. Larin, Univ. of Houston (United States) and Saratov State Univ. (Russian Federation)
- 7176 0E **Study on microvisualizing assay of delivered drug infiltration using 2-color optical coherence dosigraphy** [7176-14]
Y. Nakamichi, S. Saeki, T. Saito, T. Hiro, M. Matsuzaki, Yamaguchi Univ. (Japan)

DYNAMICS AND FLUCTUATIONS IN BIOLOGICAL SYSTEMS

- 7176 0H **The generation of the synchronized burst in the cultured neuronal networks** [7176-17]
X. Li, J. Sun, W. Chen, S. Zeng, Q. Luo, Huazhong Univ. of Science and Technology, (China)
- 7176 0I **Error analysis in the measurement of x-ray photon fluence: an analysis on the uncertainty from energy calibration** [7176-18]
D. Zhang, Univ. of Oklahoma (United States); X. Wu, The Univ. of Alabama at Birmingham (United States); M. Wong, Y. Ni, Univ. of Oklahoma (United States); J. Rong, The Univ. of Texas M.D. Anderson Cancer Ctr. (United States); W. R. Chen, Univ. of Central Oklahoma (United States); H. Liu, Univ. of Oklahoma (United States)

POSTER SESSION

- 7176 0J **Improved double-integrating-spheres system for multiwavelength optical properties measurement: investigation and application** [7176-19]
C. Li, H. Zhao, J. Ma, J. Liang, K. Xu, Tianjin Univ. (China)
- 7176 0K **Potential application of Chinese traditional medicine (CTM) as enhancer for tissue optical clearing** [7176-20]
W. Chen, J. Jiang, Tianjin Univ. (China); R. K. Wang, Oregon Health & Science Univ. (United States); K. Xu, Tianjin Univ. (China)
- 7176 0L **Typical application of skin diffusion optical model to quantitative description of tissue optical properties** [7176-21]
W. Chen, J. Jiang, W. Zhang, Tianjin Univ. (China); R. K. Wang, Oregon Health & Science Univ. (United States); K. Xu, Tianjin Univ. (China)

- 7176 0M **Separation of extracellular spikes with wavelets and neural networks** [7176-22]
A. N. Tupitsyn, A. N. Pavlov, Saratov State Univ. (Russian Federation); V. A. Makarov, Univ. Complutense de Madrid (Spain)
- 7176 0N **Wavelet-based analysis of blood pressure dynamics in rats** [7176-23]
A. N. Pavlov, A. A. Anisimov, O. V. Semyachkina-Glushkovskaya, V. A. Berdnikova, A. S. Kuznecova, E. G. Matasova, Saratov State Univ. (Russian Federation)
- 7176 0O **Monitoring of interaction of hemoglobin and glucose molecules by spectral method** [7176-24]
E. N. Lazareva, Saratov State Univ. (Russian Federation); V. V. Tuchin, Institute of Precise Mechanics and Control (Russian Federation)
- 7176 0P **Influence factors for the optical parameters measurement with time-resolved diffusion reflectance** [7176-25]
B. Yu, H. Li, H. Yang, Fujian Normal Univ. (China)
- 7176 0Q **Accessing the structure and function information of deep skin blood vessels with noninvasive optical method** [7176-26]
J. Wang, Z. Zhi, Z. Han, C. Liu, Z. Mao, X. Wen, D. Zhu, Huazhong Univ. of Science and Technology (China)

Author Index

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- 1 Dynamic Light Scattering and Speckle Technologies
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- 2 Cell and Tissue Spectroscopy and Imaging
Wei R. Chen, University of Central Oklahoma (United States)
- 3 Nanophotonics in Medical Applications
Kirill V. Larin, University of Houston (United States)
- 4 Optical Clearing and Monitoring of Drug Delivery
Ruikang Wang, Oregon Health & Science University (United States)
- 5 Dynamics and Fluctuations in Biological Systems
Lihong V. Wang, Washington University in St. Louis (United States)
Valery V. Tuchin, Saratov State University (Russian Federation)

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