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Lihong V. Wang
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Editors

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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