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Computations and Data Analysis: from Nanoscale Tools to Brain Functions

Dmitry E. Postnov

Editor

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Introduction

The Seventh International Symposium on Optics and Biophotonics (Saratov Fall Meeting, SFM19) was held in Saratov, Russian Federation, 23–27 September 2019 with more than 500 participants from the Russian Federation, United States, Canada, Europe and Pacific Ocean countries. It covered a wide range of modern problems of fundamental and applied optics, laser physics, photonics, and biomedical optics, as well as related fields of material science.

The Proceedings of the symposium are published in three SPIE volumes. The present volume includes selected papers of the following conferences and workshops organized in the framework of the symposium:

Computation Biophysics and Analysis of Biomedical Data VI

Dmitry E. Postnov (*Chair*)

Nonlinear Dynamics X

Vadim S. Anishchenko (*Chair*)

This volume begins with a section devoted to the analysis of electroencephalogram data. The results of the study of EEG changes in solving various mental and cognitive tasks, while maintaining the balance of the body, while comparing the actual and imaginary activity, while processing visual information are presented. The works collected in this part of the volume carry a general main message: the analysis of EEG data allows us to solve more and more subtle tasks of detecting brain states, such as a really performed action or just the intention to do it. Of particular interest are works where changes in the EEG are compared with data obtained by other methods, such as fMRI.

The next section of the volume contains works that also operate on electrophysiological and optical data but are more focused on improving the method of extracting information. Here we can see a tendency towards more intelligent and complex post-processing of data using spatial-temporal analysis methods, such as wavelet-analysis.

The next section is devoted to model studies of physiological processes, both in the neurovascular unit of the brain, where, in particular, the activity of astrocytes is modeled, and at the systemic level, as applied to the cardiovascular system as a whole.

Finally, the last but not the least section on theoretical biophysics and nonlinear dynamics covers a range of studies of the basic dynamics patterns that underlie many biophysical processes, including complex network dynamics at levels from neural to atomic (crowdions).

This is the third volume of *Saratov Fall Meeting 2019*. The preface to the first volume *Optical and Nano-Technologies for Biology and Medicine*, edited by Elina A. Genina and Valery V. Tuchin, provides the reader with thorough and impressive information about the entire event of Saratov Fall Meeting 2019.

On behalf of SFM19 organizers, the editor of this volume thanks all authors for their contributions to the symposium. We are also grateful to all the sponsoring organizations and programs that efficiently supported the meeting: Saratov State University (Russian Federation); Research Center of Biotechnology RAS (Russian Federation); SPIE – The International Society of Photo-Optical Instrumentation Engineers; The Optical Society ; Art Photonics GmbH (Germany); Avesta Projects Ltd. (Russian Federation); Becker & Hickl GmbH (Germany); RME INJECT, LLC (Russian Federation); LLC SPE Nanostructured Glass Technology (Russian Federation).

Dmitry E. Postnov

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