Topical Problems of Biophotonics: from Optical Bioimaging to Clinical Biophotonics

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Biophotonics is a rapidly emerging field providing novel instruments and methods for basic and translational studies in biology and medicine. The variety of existing tools includes techniques for biomedical imaging at different scales ranging from sub-cellular to organ levels for proving both structural and functional information, therapeutic approaches involving light-tissue interaction, and high-power tools for laser surgery and tissue modification. Many optical techniques have already become a gold standard both in clinical diagnostics and practice, while others are on their way to clinics, and novel approaches are being actively developed.

This special section presents a collection of papers closely related to the topics of the Optical Bioimaging conference and the satellite workshop on Clinical Biophotonics held within the International Symposium “Topical Problems of Biophotonics” (TPB-2017). The special section was formed on an open call-for-papers basis, and we highly appreciate contributions from the biophotonics community. The symposium takes place biannually on a boat cruising along the Volga River, offering a unique environment for scientific presentations, fruitful discussions, and new impressions. In 2017, the symposium was organized by the Institute of Applied Physics of the Russian Academy of Sciences, the Nizhny Novgorod State Medical Academy, and the University of Nizhny Novgorod. TPB-2017 gathered 186 researchers from 18 countries. The next boat symposium on the Volga River is scheduled for August 3–7, 2019, with the route from Nizhny Novgorod to Uglich and back.

The focus of this section is on optical imaging modalities, and pre-clinical and clinical applications of optical tools. This collection covers various microscopy modalities, fluorescence imaging, optical coherence tomography, optoacoustic techniques, measurement of tissue optical properties and application of nanotechnologies in biophotonics. The optoacoustics section includes papers on development of novel acoustic detectors, image enhancement by synthetic aperture approach and fluence compensation, and image-guided filtering. The optical coherence tomography (OCT) section demonstrates application of different modalities of this technique for monitoring of the outcomes of photodynamic and radiation therapy, as well as an approach for OCT image denoising. The tissue optical properties section presents papers on intraoperative quantification of optical properties, multiple effects of optical clearing on tissue optical properties, and the impact of sample preparation on ex vivo studies of optical properties. The papers of this special section demonstrate clinical applications of biophotonic techniques in oncology, ophthalmology, dentistry, surgery, otolaryngology, and urology.

To conclude, the papers gathered by this special section demonstrate recent exciting developments of optical techniques and their impact in biology and medicine, as supported by the reported results of pre-clinical and clinical applications.
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