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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 intraoperational 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, otorhinolaryngology, 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.

Conference snapshots:



Boat conference venue



A picturesque Russian landscape

Acknowledgments

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Mikhail Yu. Kirillin is a senior researcher at the Laboratory of Biophotonics of Institute of Applied Physics of Russian Academy of Sciences. He received his MSc and PhD degrees from M.V. Lomonosov Moscow State University in 2003 and 2006, respectively; and Dr. Sc. (Tech.) degree from University of Oulu in 2008. His scientific interests include optics of biotissues and other scattering media, Monte Carlo techniques, optical imaging modalities, techniques for optical clearing and contrast enhancement. His current research aims at developing novel protocols for photodynamic therapy.

Kirill V. Larin is a professor of biomedical engineering at the University of Houston. He received his first MS in laser physics and mathematics from the Saratov State University in Russia (1995), his second MS in cellular physiology and molecular biophysics (2001) and a PhD in biomedical engineering (2002) from the



At the conference session



Recreational sport event

University of Texas Medical Branch in Galveston. His research contributions are in biomedical optics and biophotonics and development and application of various optical methods for noninvasive and non-destructive imaging and diagnostics of tissues and cells. He has authored more than 120 peer-reviewed publications (with h-index 43, according to Google Scholar, August 2018). He is the recipient of numerous awards including prestigious Presidential Award from Russian President Boris Yeltsin. He was inducted as Fellow of SPIE in 2015 and Fellow of OSA in 2016.

Ilya V. Turchin is the head of the Department for Radiophysical Methods in Medicine at the Institute of Applied Physics of RAS and is an expert in optical imaging systems design (optical diffuse imaging, fluorescence imaging, photoacoustics) and biomedical applications. He has over 10 years of experience as a primary investigator in optical imaging, photodynamic therapy, and translation of optical techniques into clinics.

Valery V. Tuchin is a professor and head of optics and biophotonics at Saratov State University (National Research University of Russia) and several other universities. His research interests include tissue optics, laser medicine, tissue optical clearing, and nanobiophotonics. He is a fellow of SPIE and OSA, has been awarded Honored Science Worker of the Russia, Honored Professor of Saratov University, SPIE Educator Award, FiDiPro (Finland), Chime Bell Prize of Hubei Province (China), and Joseph W. Goodman Book Writing Award (OSA/SPIE). He has 20,574 citations and h-index 66 (Google Scholar, August 30, 2018).