Introduction to the Special Issue on Biophotonics - Part 1

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Introduction to the Special Issue on Biophotonics—Part 1

Welcome to the IEEE Journal of Selected Topics in Quantum Electronics (JSTQE) Special Issue on Biophotonics—Part 1! In the papers included in this issue, you will be introduced to the latest developments in the field of biophotonics. This field is an emerging biomedical technology that has opened up new horizons for transfer of state-of-the-art techniques in quantum electronics, lasers, and electrooptics to the life sciences and medicine. Recently, minimally-invasive, cost-effective, and rapid biophotonics techniques have been developed as potential alternatives to conventional medical methods for diagnostics, sensing, monitoring, and treatment of a variety of diseases. Devices utilizing minimally invasive biophotonics technology are rapidly finding their way into the mainstream for early disease diagnosis and improved patient acceptance and comfort. As an increasingly ageing world population presents new health problems, biophotonics provides an alternative approach for light-assisted diagnostics and therapy, restoring of impaired biological functions, and tissue engineering. In addition, recent research efforts and developments in the area of biophotonics technology have confirmed its compatibility with the modern nanotechnology trends, which will lead to the development of novel ultrahigh-resolution nanobioimaging and nanobiosensor modalities for precise diagnostics and therapeutics at cellular, intracellular, and molecular levels.

The goal of this Special Issue of JSTQE is to highlight recent progress and trends in the development of novel biophotonics technologies. The papers published in this issue cover a broad range of advanced biophotonics areas, which are summarized in the following six sections:

1) advanced bioimaging;
2) multimodality diagnostics;
3) light–cell interactions;
4) novel biosensing approaches;
5) infrared biophotonics;
6) nanobiophotonics.

These key biophotonics topics are discussed in both invited and contributed papers published, which provide comprehensive overviews of the current status and future trends as well as original results and recent developments in biophotonics. We hope you will find this Special Issue to be interesting and a useful reference that stimulates the promotion of further advances in the biophotonics field.

Acknowledgment

This issue was made possible by dedicated efforts of a number of people. First, we thank the authors of all the papers in this issue as well as many reviewers around the world, who, despite their many other commitments, provided high-quality reviews of the manuscripts. We also thank the IEEE publications staff for their general support and C. Tan-Yan, in particular, for her prompt help, boundless energy, and excellent organization skills in helping us meet the deadline. We thank Dr. Ramesh Shori, Editor-in-Chief of the Journal of Special Topics in Quantum Electronics, for his stimulating encouragements for this Special Issue.

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Ilko Ilev received the M.S. degree from Sofia University, Sofia, Bulgaria, in 1983 and the Ph.D. degree from the Technical University of Sofia, Sofia, in 1992, both in laser physics.

During 1995, he was with the Optoelectronics Division, Strathclyde University, Glasgow, U.K. From 1995 to 1997, he was with the Laser Technology Laboratory, Institute of Physical and Chemical Research (RIKEN), Tokyo, Japan. From 1998 to 2001, he was an American Academy of Science/National Research Council (NRC) Research Associate in the U.S. Food and Drug Administration (FDA), Rockville, MD, where since May 2001, he has been with the Center for Devices and Radiological Health and is the Leader of the Optical Therapeutics and Medical Nanophotonics Laboratory. He has over 20 years of experience in the United States, Europe, and Japan in the field of quantum physics and laser technologies, fiber optics, laser medicine, noninvasive optical diagnostics and biosensing, and ultrahigh-resolution optical imaging. He is the author or coauthor of more than 280 papers published in peer-reviewed journals and presentations at major national and international conferences and meetings. His current research interests include development of novel and simple minimally invasive biophotonics techniques including smart tissue-activated fiber-optic structures and nanobiosensors for studying single-cell and intracellular chemical analytes, mechanisms of light–tissue interactions at subcellular level, and ultrahigh-resolution bioimaging beyond the diffraction limit in the subwavelength nanoscale range.

Dr. Ilev serves as LEOS Biophotonics Committee Chair. He has co-organized and chaired conferences on biophotonics topics within LEOS, SPIE and Optical Society of America.

Brian C. Wilson received the Graduate and Ph.D. degrees from Glasgow University, Glasgow, U.K., in 1967 and 1971, respectively.

In 1993, he was a Professor of Medical Biophysics at the Ontario Cancer Institute, University of Toronto, Toronto, ON, Canada. He has also been with the Institute of Cancer Research, London followed by a stint in Australia. He is also the Head of the Biophotonics Program, Canadian Institute for Photonic Innovations. In 1981, he moved to McMaster University, Hamilton, ON, where he initiated a research program in photodynamic therapy. This developed into a broad program in biophotonics, including fundamental studies in optical biophysics and translational/clinical projects in fluorescence/Raman/optical coherence tomography for early cancer detection, photodynamic therapy for brain, gastrointestinal and prostate cancer, fluorescence image-guided surgery, and new technologies for molecular pathology. Recently, this program has expanded to include participation in an effort to use nanoparticles as image contrast agents for endoscopy and molecular pathology. He is a consultant to several Canadian, European, and U.S. biophotonics companies, and is a Co-Founder of two start-up companies. He serves on numerous national and international advisory committees. He is the author or coauthor of more than 250 scientific papers.

Vadim Backman received the Ph.D. degree in medical engineering and medical physics from the Massachusetts Institute of Technology, Harvard University, Cambridge, in 2001.

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Stefan Andersson-Engels was born in Ängelholm, Sweden, on February 21, 1960. He received the M.Sc. degree in engineering physics and the Ph.D. degree in physics from Lund University, Lund, Sweden, in 1985 and 1990, respectively.

He was with McMaster University, Hamilton, ON, where he was engaged in research along with Prof. B. C. Wilson and Prof. M. Patterson on problems in tissue optics as well as on confocal and two-photon microscopy. He was an Assistant Professor in 1993, an Associate Professor in 1994, and a Professor in 1999 at Lund University. He is the author or coauthor of more than 110 articles in peer-reviewed journals. His current research interests include optical characterization of tissue for biomedical applications and photodynamic therapy of malignant tumors.

Prof. Andersson-Engels has co-organized the Gordon Conference on Lasers in Biology and Medicine 2000 and the European Conference on Biomedical Optics 2003. He is also co-organizing a series of biannual international summer-schools in biophotonics.