

Introduction to the JSTQE Issue on Nanobiophotonics

WELCOME to the IEEE JOURNAL OF SELECTED TOPICS IN QUANTUM ELECTRONICS (JSTQE) Special Issue on **Nanobiophotonics**! Nanobiophotonics is an emerging field of modern science and biomedical nanotechnology. This new field continues to vastly expand with state-of-the-art developments across the entire spectrum of biomedical applications ranging from fundamental studies of light-nanobiomaterial interactions to clinical diagnostics and therapeutics. In nanobiophotonics research areas, there has been great impetus recently for noninvasive imaging and sensing intracellular structures and functions as well as for obtaining quantitative information for light-tissue interactions at the cellular, intracellular and molecular level. The significant interest in these studies is determined by the unique advantages of nanobiophotonics techniques in terms of using non-ionizing radiation, providing noninvasive intracellular, cellular and tissue imaging and sensing *in-vivo* with ultrahigh resolution in the subwavelength nanoscale range (smaller than 100 nm). In this range, however, conventional optical imaging and sensing techniques have a major drawback related to the fundamental optical diffraction limit. Recent efforts to exploit the advanced features of the nanobiophotonics areas beyond the diffraction limit have been leading to the development of innovative nanotechnologies that provide noninvasive optical imaging, sensing, precise diagnostics and therapeutics at cellular, intracellular and molecular levels with an unprecedented ultrahigh resolution in the nanoscale range. In the papers included in this JSTQE Issue on Nanobiophotonics, you will be introduced to some of the latest leading-edge developments in nanobiophotonics. Some of these developments include advanced optical nanoimaging and nanosensing techniques based on nanoprobe enhanced imaging and sensing principles employing various highly effective nanobiomaterials such as nanoparticles, quantum dots and plasmonic nanostructures. These techniques offer a noninvasive, effective and fast way for sensing and monitoring various biomedical quantities *in-vivo* with a nano-resolution beyond the diffraction limit. Other new developments include optical manipulation of nanoparticles, integrated nanoprobe-enhanced diagnostics and therapeutics, and novel nanobiophotonics devices.

The objective of this JSTQE Special Issue on Nanobiophotonics is to highlight recent progress and trends in innovative nanobiophotonics technology development. The papers published in this issue cover a broad range of advanced

nanobiophotonics areas summarized in the following sections:

- **plasmonics:** plasmonic nanostructures for multimodal high-resolution imaging and sensing
- **bioimaging:** super-resolution imaging and microscopy
- **biosensing:** advanced nanostructures, nano-biochips and nanobeams for high-resolution biosensing
- **biophotonic technology and applications:** employing quantum dots, fiber-optic tweezers, plasmonic interferometry, and diffraction phase microscopy in novel biophotonic sensing and diagnostic applications
- **nanobiophotonics:** nanoparticles, nanoprobe and nanolasers enhanced diagnostics, therapeutics and quantum medicine

These key research topics are highlighted as comprehensive overviews of the current status and future trends as well as original results and recent developments in the field of nanobiophotonics.

The Nanobiophotonics issue contains 17 papers, including 2 invited and 15 contributed papers authored by well-regarded research groups and scientists, both established and emerging, from all over the world. The invited papers include extended overviews on recent nanobiophotonics developments and clinical applications in the areas of using plasmonic interferometry-based biochips in novel medical devices for cancer detection, and development of an advanced ultrasound-switchable fluorescence imaging platform for enhanced high-resolution deep-tissue scanning and imaging. The contributed papers cover a broad variety of key nanobiophotonics research areas including recently obtained original results on development and implementation of novel plasmonic nanostructures, nano-biochips, optical tweezers, and nanobeams for ultrahigh-resolution multimodal bioimaging biosensing, diagnostics and therapeutics.

We hope you will find this JSTQE Special Issue on Nanobiophotonics to be an interesting and useful reference that will impact, stimulate and promote further advances in Nanobiophotonics.

ACKNOWLEDGMENT

This Issue was made possible by dedicated efforts of a number of people. First, we would like to 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 would like to thank the IEEE publications staff for their general support, and

Ms. Chin Tan Lutz, in particular, for her prompt help, boundless energy, and excellent organization skills in helping us meet the deadlines. We would like to thank Dr. José Capmany, Editor-in-Chief of the Journal of Special Topics in Quantum Electronics, for his stimulating encouragements for this Special Issue.

The paper by Zeng et al., "Plasmonic Interferometer Array Biochip as a New Mobile Medical Device for Cancer Detection" (vol. 25, no. 1, article number 7201707) should have appeared in this issue, but was published in the January/February Issue on Biophotonics.

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