Hindawi Publishing Corporation
Advances in Optical Technologies
Volume 2008, Article ID 134215, 2 pages
doi:10.1155/2008/134215

Editorial

Biophotonics

Stoyan Tanev,[1] Brian C. Wilson,[2] Valery V. Tuchin,[3] and Dennis Matthews[4]

[1] *Department of Systems and Computer Engineering, Faculty of Engineering and Design, Carleton University, Ottawa, ON, Canada K1S 5B6*
[2] *Division of Biophysics and Bioimaging, Ontario Cancer Institute, University Health Network and University of Toronto, Toronto, ON, Canada M5G 2M9*
[3] *Research-Educational Institute of Optics and Biophotonics, Saratov State University, 410012 Saratov, Russia*
[4] *Center for Biophotonics Science and Technology and Lawrence Livermore National Laboratory, University of California Davis, CA 95817, USA*

Correspondence should be addressed to Stoyan Tanev, tanev@sce.carleton.ca

Received 19 November 2008; Accepted 19 November 2008

The application of innovative optical technologies in medicine, biology, agriculture, environmental sciences, and public health has emerged as one of the new paradigms in today's knowledge economy. This convergence between optical and biosciences is due to the recent significant advances of photonics and biotechnologies driven by the various health, environment, and defense challenges faced by humanity at the beginning of 21st century.

Biophotonics technologies can impact biomedical research and human health, since they can yield the critical information bridging molecular structure and physiological function, which is the most important process in understanding, treating, and preventing a disease, as well as in pathology in general. As increasingly aging world population represents new health problems, biophotonics offer great hope for the early detection of diseases and for new technologies for light-guided and light-activated therapies. These technologies continue to advance at a spectacular rate, contributing to the growth of novel platforms that affect medical healthcare in virtually all medical specialties.

Advances in photonics have contributed dramatically to the biological revolution that is being currently witnessed. Very few biological science disciplines have not been touched by photonics, since optical methods play a critical role in biotechnologies, ranging from genomics to cell-based assays, providing new knowledge on individual life forms and their related biochemistry, on how living things interact with each other, and on how new and emerging optical technologies could be used to measure, quantify, and understand their biological properties. Biology has also advanced photonics, since biomaterials have shown a great promise as new photonic media for technological applications. The collective effects of this revolution have already influenced the quality of human life and behavior in a way that was never imagined before.

Along with the positive aspects of this revolution, there come some potential negative aspects. They include, to name a few, an increased potential for human plagues caused by the increased rates of human contact and resistance to antibiotics, agricultural plagues exacerbated by extensive use of single-genetic-strain crops and livestock, and purposely induced plagues of human or agricultural pathogens: bio- and agroterrorism. Significant international medical, agricultural, and environmental science research activities are directed to the development of pathogen detection and identification systems that are lower in cost, more biochemically specific, more accurate, faster, smaller, less demanding of infrastructure, and more accessible to a larger number of people. The role of biophotonics in these research and development efforts is significant.

The aim of this special issue is to provide a snapshot of recent progress in biophotonics and point out the emerging future developments in this broad and rapidly evolving field. The guest editors have previously cooperated in running a similar project (*Advances in Biophotonics*, B. C. Wilson, V. V. Tuchin and S. Tanev, Eds., NATO Science Series I: Life and Behavioural Sciences, vol. 369, IOS Press, Amsterdam, 2005), and are firmly convinced in the value of such initiatives. Although the objectives of this special issue and of our previous publication are practically the same, there are a number of qualitative points of difference that are largely due to the way biophotonics research and development (R&D) has progressed in the last four years. Biophotonics R&D in 2009 could be characterized by a greater focus on (i) nano-biophotonics and, specifically, nanoplasmonics, (ii) a higher degree of applicability of biosensing techniques, and (iii) a stronger link to the clinical realm.

These three trends are clearly visible in the articles published in this issue. All the articles are invited reviews or invited research papers by leading biophotonics researchers and research groups from universities, as well as industry and government laboratories, and they can be structured in three major themes: (i) biophotonics instrumentation and experimental techniques, (ii) biophotonic sensors, and (iii) nano-biophotonics:

(I) Biophotonics instrumentation and experimental techniques

"A ratiometric fluorescence imaging system for surgical guidance" by E. Moriyama et al.; "5-ALA mediated fluorescence detection of gastrointestinal tumors" by E. Borisova et al.; "The impact of autonomic dysreflexia on blood flow and skin response in individuals with spinal cord injury" by J. C. Ramella-Roman et al.; and "Optical clearing of cranial bone" by E. Genina et al.

(II) Biophotonics sensors

"Optical biomedical diagnostics: sensors with optical response based on two-photon excited luminescent dyes for biomolecule detection" by V. Yashchuk et al. and "Sensitive label-free biomolecular detection using thin silicon waveguides" by Adam Densmore et al.

(III) Nano-biophotonics

"Nanotomography of cell surfaces with evanescent fields" by M. Wagner et al.; "A proposed method for thermal specific bioimaging and therapy technique for diagnostic and treatment of malignant tumors by using magnetic nanoparticles" by I. M. Gescheit et al.; "Ultra-short laser pulse heating of nanoparticles: Comparison of theoretical approaches" by Renat Letfullin et al.; and "A new 3D simulation method for the construction of optical phase contrast images of gold nanoparticle clusters in biological cells" by S. Tanev et al.

The authors are grateful to all contributors for their constructive cooperation in providing informative overviews of their respective topics and new insights into ongoing and potential developments. They have greatly enjoyed the design and preparation of this special issue and strongly believe that it will be valuable to those working in this multidisciplinary field by helping its advances in new and inspiring directions.

Stoyan Tanev
Brian C. Wilson
Valery V. Tuchin
Dennis Matthews