Introduction: Feature Issue on Optical Imaging and Spectroscopy

Andreas H. Hielscher,¹ Mary-Ann Mycek,² and Lev T. Perelman³

¹*Departments of Biomedical Engineering, Electrical Engineering and Radiology, Herbert Irving Comprehensive Cancer Center, Columbia University, 500 W. 120th Street, ET351 Mudd Bldg., New York, NY 10027, USA*

²*Department of Biomedical Engineering, Comprehensive Cancer Center, University of Michigan, Ann Arbor, MI 48109, USA*

³*Department of ObGyn and Reproductive Biology, Beth Israel Deaconess Medical Center, Harvard University, Boston, MA 02215, USA*

Abstract: The editors introduce the Biomedical Optics Express feature issue, “Optical Imaging and Spectroscopy,” which was a technical area at the 2010 Optical Society of America (OSA), Biomedical Optics (BIOMED) Topical Meeting held on 11–14 April in Miami, Florida. The feature issue includes 23 contributions from conference attendees.

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References and links

Theory

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This feature issue of *Biomedical Optics Express* showcases contributions made to the 2010 Optical Society of America (OSA), Biomedical Optics (BIOMED) Topical Meeting held on 11 – 14 April in Miami, Florida. It focuses on the technical area of Optical Imaging and Spectroscopy, which was chaired by Arjun Yodh, Univ. of Pennsylvania. More than 60 papers were presented in 9 sessions that covered topics such as Cancer Imaging and Monitoring, Brain Imaging and Monitoring, Imaging and Spectroscopy Theory, Clinical Application of Imaging and Clinical Applications of Diffuse Optics.

For this feature issue 23 papers were selected that represent a cross-section of topics covered at this conference. Papers that deal with theoretical aspects of diffuse optical tomography (DOT) continue to have a major presence at this topical meeting and hence 8 manuscripts address the latest developments in this area. Both Srinivasan *et al.* [1] and Fan *et al.* [2] focus on issues related to combining optical tomographic imaging methods with other imaging modalities; an approach that has gained increasing interest in recent years. Tarvainen *et al.* [3] and Tian *et al.* [4] propose methods that correct linear image reconstruction approaches. In their papers they demonstrate how errors introduced by the linearization can be reduced, while maintaining the speed advantage that linear reconstruction methods offer over more complex non-linear algorithms. Also addressing the speed of the DOT reconstruction, Montejo *et al.* [5] and Kim *et al.* [6] introduce novel ways on how to solve the equation of radiative transfer and the related inverse problem in an economical fashion. An increasing number of groups study now the use of spatially modulated light for DOT. D'Andrea *et al.* [7] shows how this approach can be used to reduce the computation times in DOT. Finally Jacques *et al.* [8] introduces a novel approach for rapid spectral analysis for spectral imaging.

The BIOMED meeting has also always been a forum to present novel experimental methods and instruments for tissue diagnostics. Within this feature issue a total of 9 papers fall into this category. Erickson *et al.* [9] present a general-purpose hand-held optical fluorescence imager that provides co-registration facilities. Their system allows to image different tissue volumes and curvatures in near real-time. Another system that allows to rapidly acquire fluorescence wavelength-time matrices of biological tissues is introduced by Lloyd *et al.* [10]. Sun *et al.* [11] focus in their work on the software aspects of a high-speed, multispectral in-vivo optical imaging system that make use of commercially available scientific cameras. Qui *et al.* [12] discuss the potential of gold nanorods as labels for differential light scattering measurements for the detection of human disease through several centimeters of tissue. Looking for ways to improve current systems for sentinel lymph node detection, Tellier *et al.* [13] explore in their paper a new near-infrared optical probe based on the recording of scattered photons. Robles *et al.* [14] investigate the ability to measure tissue hemoglobin concentration and oxygen saturation levels using spectroscopic optical coherence

tomography. They characterize their system by analyzing data obtained from oxygenated and deoxygenated hemoglobin phantoms. A more complex tissue phantom that enables EEG and near-infrared optical tomography to be performed simultaneously over the same volume is described by Cooper *et al.* [15]. In a study by Wood *et al.* [16], the polarization properties of two commercial laparoscopes were characterized and found to exhibit birefringence effects. The authors conclude that this complicates endoscopic polarization imaging, which, in recent years, has been found to reveal diagnostic information about tissue morphology. In an impressive comprehensive work, Venugopal *et al.* [17] describe the design and characterization of a time-resolved small animal imager that is based on a wide-field excitation scheme. They show that their system can be used for whole-body molecular and functional imaging.

Pre-Clinical and Clinical Applications are the focus of 4 papers. Using a rodent model for stepped hypercapnia, Carp *et al.* [18] measured cerebral blood flow (CBF) with near-infrared diffuse correlation spectroscopy (DCS) and arterial spin labeling MRI (ASL), simultaneously. They found that DCS and ASL CBF values show a high correlation. Chen *et al.* [19] report on a study of the spatial and spectral dependence of the optical signals induced by stimulation of the human median and sural nerves. In a companion paper by the same group of researchers, Erb *et al.* [20] focuses on the contribution of non-artifactual vascular motion induced by muscle contraction to the biological origin of the same signal. The influence of muscle fiber motion during exercise on diffuse correlation spectroscopy (DCS) measurements of skeletal muscle blood flow is explored by Shang *et al.* [21].

Leaving the realm of tissue imaging, two final studies address issues related to imaging of sub-cellular structures and function. Antkowiak *et al.* [22] study the quantitative phase of the dynamic cellular response in femtosecond laser photoporation and Pasternack *et al.* [23] elucidate the effects of two-dimensional Gabor filters on the quantification of sub-cellular dynamics in apoptotic cells.