

Optical Engineering

OpticalEngineering.SPIEDigitalLibrary.org

Translational Biophotonics

Aaron D. Aguirre
Gabriela Apiou-Sbirlea
Darren Roblyer
Bruce J. Tromberg

SPIE.

Aaron D. Aguirre, Gabriela Apiou-Sbirlea, Darren Roblyer, Bruce J. Tromberg, "Translational Biophotonics," *J. Biomed. Opt.* **22**(12), 121601 (2017), doi: 10.1117/1.JBO.22.12.121601.

Translational Biophotonics

Aaron D. Aguirre

Massachusetts General Hospital
Cardiology Division and Center for Systems Biology
Harvard Medical School
185 Cambridge Street
Boston, Massachusetts 02114, United States

Gabriela Apiou-Sbirlea

Massachusetts General Hospital Research Institute
Wellman Center for Photomedicine and Harvard Medical School
Department of Dermatology
40 Blossom Street
Boston, Massachusetts 02114, United States

Darren Roblyer

Boston University
Department of Biomedical Engineering
44 Cummington Mall
Boston, Massachusetts, 02118, United States

Bruce J. Tromberg

Beckman Laser Institute and Medical Clinic
1002 Health Sciences Road East
University of California, Irvine
Irvine, California 92612, United States

For the second consecutive year, the *Journal of Biomedical Optics* is offering a collection of papers related to the growing area of research and development termed translational biophotonics. This special section is again in follow up to the SPIE BiOS Translational Research Symposium at Photonics West, which highlights research in biomedical optics aimed at clinically relevant science and technology development at various stages along the translation pipeline. Ongoing interest in these forums from a diverse group of international researchers conveys not only growing excitement about the potential for photonics technologies to impact clinical medicine, but also the need for sustained commitment to overcoming the many hurdles and challenges that prevent an idea in the lab from becoming a clinical reality. The collection presented here consists of 13 original articles published in the *Journal of Biomedical Optics*, Volume 22, Issue 12.

While encompassing many unique ideas and applications, these papers raise some common themes in the field of biophotonics. First, emerging optical methods continue to show promise in the area of surgical guidance and monitoring. Highlighted here are an innovative blue diode laser for excisional biopsy in the oral cavity (Gobbo et al.), a photoacoustic imaging approach for anatomic assessment in robotic surgery (Gandhi et al.), a new phantom for advancing fluorescence-guided tumor resection (Samkoe et al.), novel activatable antibody-based fluorophores for image-guided surgery (Obaid et al.), and the use of optical coherence tomography for tracking otitis media after surgical intervention (Monroy et al.).

Second, the role for spectroscopic imaging and sensing in cancer diagnostics also continues to evolve rapidly. New

papers present important results from human patients using diffuse optical spectroscopic imaging (DOSI) to evaluate breast cancer in a 2-year study (Leproux et al.) and in a pilot study on bone sarcoma (Peterson et al.), a potential new application. The focus on breast cancer is further strengthened with data on the use of near-infrared spectroscopy to predict tumor response to chemotherapy (Lee et al.), an assessment of tissue compression techniques to enhance the ability of spatial frequency domain imaging to visualize breast tumors (Robbins et al.), and a technique for improving diffuse optical tomography of the breast using ultrasound (Mostafa et al.).

Third, new compact and portable optical systems technology for the clinic (Nogueira et al. and Lee et al.) will enable new applications such as blood perfusion monitoring in reconstructive surgery (Lee et al.) and measurement of muscle changes in response to rehabilitation training (Warren et al.).

Translational research by nature demands a highly collaborative and multidisciplinary approach between scientists, engineers, and clinicians as well as between academic and industry partners. The process of matching a clinical need to a promising technology in the right patient population and iteratively optimizing and advancing this technology to bring it to the bedside challenges conventional departmental, funding, regulatory, and commercial boundaries. The papers in this special section demonstrate many points along this translation process and reinforce these concepts. The future growth and success of the field of biomedical optics will depend upon creative approaches to bridge the gaps along the translational pipeline. The guest editors hope that ongoing emphasis on translational research in the published literature and in scientific meetings such as Photonics West will engage more of

the biophotonics community to debate, discuss, and collaborate going forward.

The guest editors wish to thank the authors who contributed to this special section as well as the many anonymous reviewers who dedicated their time and expertise to selecting the most promising papers. We also wish to thank Lihong Wang, the editor in chief of JBO, for his ongoing commitment to this series on Translational Biophotonics; Gwen Weerts, the managing editor for SPIE journals for her diligence and support; and the remaining JBO staff who helped get this issue across the finish line.

Aaron D. Aguirre, MD, PhD, is an assistant professor of medicine at Harvard Medical School, an intensive care cardiologist at the Massachusetts General Hospital (MGH), and an investigator at the MGH Center for Systems Biology. His active research interests include the development of intravital optical microscopy techniques for the study of heart disease in animal models, the use of optical coherence tomography for clinical intravascular imaging, and the development of point-of-care optical and ultrasound based diagnostics for applications in intensive care medicine.

Gabriela Apiou-Sbirlea, PhD, is an assistant professor of dermatology at Harvard Medical School, director of Translational Research Core at Wellman Center for Photomedicine and of Translation Research Training and Development at Mass General Research Institute. She received her PhD degree in biomedical engineering and Habilitation a Diriger des Recherches (HDR) in France. She has over 20 years of experience performing and directing biomedical research in both industry and academia internationally.

Darren Roblyer, PhD, is an assistant professor of biomedical engineering at Boston University. His research is focused on cancer imaging. He received his BS degree in biomedical engineering from Johns Hopkins University in 2004, and received his PhD in bioengineering at Rice University in 2009. He did his postdoctoral work at the Beckman Laser Institute at the University of California, Irvine.

Bruce J. Tromberg, PhD, is a professor of biomedical engineering and surgery at the University of California, Irvine, and director of UCI's Beckman Laser Institute and Medical Clinic. He has pioneered the development and clinical translation of nonlinear optical microscopy and diffuse optical spectroscopy technologies for noninvasive label-free imaging of tissue composition and metabolism.