

Journal of Biomedical Optics

BiomedicalOptics.SPIEDigitalLibrary.org

Adaptive Optics and Wavefront Control for Biological Systems

Thomas G. Bifano
Joel A. Kubby
Sylvain Gigan

Adaptive Optics and Wavefront Control for Biological Systems

Thomas G. Bifano

Boston University
Photonics Center
8 Saint Mary's Street
Boston, Massachusetts 02215, United States
E-mail: tgb@bu.edu

Joel A. Kubby

University of California, Santa Cruz
Department of Electrical Engineering
Santa Cruz, California 95064, United States
E-mail: jkubby@soe.ucsc.edu

Sylvain Gigan

Pierre and Marie Curie University
Laboratoire Kastler Brossel
75005 Paris, France
E-mail: sylvain.gigan@lkb.ens.fr

Adaptive optics and wavefront control have greatly expanded the capability of optical microscopy and measurements in biological systems. Recent breakthroughs in measuring and controlling high-order optical wavefront have led to many important applications, including deep tissue microscopy with improved imaging quality and depth, optical tweezers with sophisticated shape and momentum distribution, and three-dimensionally patterned optogenetic excitation.

This special section includes contributions from leading experts in a variety of research fields that employ innovative adaptive optics for biomedical applications including optical coherence tomography (OCT) in ophthalmology, endoscopy, wide-field stimulated emission/depletion (STED), multiphoton microscopy, and adaptive optics applied to cleared tissue. Contributions in wavefront control technologies include the dynamic performance of MEMS deformable mirrors, liquid crystal devices, and dynamic red blood cells. Finally, applications in wavefront control include focusing light through dynamic diffusive media, reduction of out-of-focus background light, and the use of coherent optical adaptive techniques (COATS) for improvement of the spatial resolution in thick samples.

We would like to thank all of the authors who contributed to this special section, as well as the reviewers whose hard work

ensured its high quality. Finally, we express our gratitude also to Lihong Wang, Editor-in-Chief of JBO, for giving us the opportunity to publish this special section, as well as JBO staff for their support.

Thomas G. Bifano directs the Photonics Center at Boston University. He is a professor of mechanical engineering. He is also a co-founder and Chief Technical Officer for Boston Micromachines Corporation. His research focuses on design and manufacturing of microelectromechanical systems for optical applications, and on adaptive optics techniques in microscopy.

Joel A. Kubby is in the Baskin School of Engineering at the University of California at Santa Cruz. His research area is in the application of micro-electro-mechanical systems (MEMS) for biological imaging. Prior to joining the University of California at Santa Cruz in 2005, he was with the Wilson Center for Research and Technology in Rochester, New York (1987–2005). Prior to Xerox, he was at the Bell Telephone Laboratories in Murray Hill, New Jersey (1985–1987).

Sylvain Gigan is at the Laboratoire Kastler-Brossel, at the Physics Department of Ecole Normale Supérieure in Paris. He is a professor at University Pierre and Marie Curie in Paris. His research focuses on light propagation in complex media, wavefront shaping, imaging, and classical and quantum computing.