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Advanced Laser Technologies for Biophotonics

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The annual International Conference on Advanced Laser Technologies (ALT) was established in 1992 by the Nobel Prize Laureate Alexander Prokhorov, member of the Russian Academy of Sciences and Director of the General Physics Institute. It brings together the researchers studying the fundamental and engineering aspects of laser technologies along with their applications in various areas, including biophotonics.

The ALT conference has become a well-recognized meeting for laser physicists, engineers, and end users from hospitals and clinics. The latest in the ALT series of meetings was held in Galway, Ireland, September 12–16, 2016, and the next one took place in Busan, Korea, September 10–15, 2017.

It is always difficult to pick highlights when no one can see all of the presentations, but here follow some worth mentioning. Francesco Pavone (LENS) gave a stimulating talk on the use of photonics to elucidate brain function, including the habits we have, which become hardwired over time. He illustrated this with a colorful example of cultural differences between the north and south of Europe. Being more organized brings many benefits, but apparently it reduces the ability to adapt and cope with less usual circumstances. There is a great need for deep-tissue high-resolution and ideally spectroscopic imaging to drive the translation of new therapies, such as stem cell, to the clinic. Little is known about where they go and what stem cells, exosomes, and similar agents do deep in the body, because there is no technology with the sensitivity and resolution to quantify this. Stefan Andersson-Engels outlined novel and futuristic proposals for deep-tissue imaging including focused ultrasound–modulated optical imaging and perhaps more futuristic quantum entanglement.

This special section presents selected papers mostly from three key topics of ALT-16: biophotonics, photoacoustics, and sensors. All papers submitted to this special section underwent rigorous peer review. It includes two invited papers, one by Marco Andreana et al. discussing an epi-detecting label-free multimodal imaging platform using a compact diode-pumped femtosecond solid-state laser, and Rinat O. Esenaliev's paper describing optoacoustic diagnostic modality of different stages from idea to clinical studies with highly compact laser diode–based systems. Both are open access papers.

A photoacoustic imaging and spectroscopy probe for detecting lymph nodes and spreading of cancer at various depths is presented in the paper by Yong-Jae Lee et al. Optical coherence tomography (OCT) technologies are presented in the papers by Ruchire Eranga Wijesinghe et al. in application to agriculture problems, specifically to analyze germination rate of *Capsicum annum* seeds treated with growth-promoting chemical compounds, and by Manmohan Singh et al. for the evaluation of customized riboflavin/UV-A corneal collagen crosslinking treatment with an OCT elastography technique.

The axial tomography in live-cell laser microscopy with use of green fluorescent protein (GFP) and quantum dots (QDs) is described by Verena Richter et al. Low-frequency vibrational spectroscopic studies of proteins with different secondary structures using FT-IR spectroscopy were performed by Irina Balakhnina et al., and Raman spectroscopy was used by Elena Timchenko and co-workers for assessment of decellularization of heart bioimplants. Sónia Carvalho et al. presented a comparative study between glucose diffusion in normal and cancerous colorectal mucosa using an optical clearing method. They quantified glucose and free water diffusion, as well as balance of free/bound water in these tissues. Johannes Schleusener and co-authors studied the photobleaching of depth-dependent autofluorescence of porcine ear skin *ex vivo* by using laser irradiation of different wavelengths, such as 325, 473, 633, and 785 nm, and

confocal microscopy. In the paper by Janis Spigulis et al., the smartphone snapshot mapping of skin chromophores under triple-wavelength laser illumination is presented. The authors used an RGB color model in their studies. Arkady Abdurashitov and coauthors presented a robust technique on off-axis holographic laser speckle contrast measurements for imaging of blood vessels in tissues. The paper by Kisung Lee is devoted to red blood cell (RBC) optical trapping within a microfluidic channel to provide assessment of the "cross-bridge"–induced interaction of RBCs. The paper by Sandra Bustamante López and Kenith Meissner is also devoted to RBC characterization, in particular for biosensing applications by using luminescence and atomic force microscopy. Optical sensing for pathology recognition is discussed in the paper by Maria Fátima Domingues et al. on the basis of insole optical fiber Bragg grating sensor network for dynamic vertical force monitoring.

An invited paper by Emil Sobol et al. is related to the development of precise laser technologies for therapeutics. They studied laser-induced micropore formation and modification of cartilage structure in the course of osteoarthritis healing.

This collection of papers gives some idea of ALT meeting research topics. We thank all contributors to this special section on Advanced Laser Technologies for Biophotonics.

Martin Leahy completed a DPhil at the University of Oxford. He is an adjunct professor at the Royal College of Surgeons, Fellow of the Institute of Physics, Fellow of the Royal Academy of Medicine in Ireland, and Fellow of SPIE. He is a cochair, executive organizing committee member, and panel moderator for SPIE Photonics West BiOS in San Francisco; editorial board member of the *Journal of Biomedical Optics*; and host of the BioPIC European Bioimaging conference. Since 2010 he has delivered more than 20 international invited lectures and published more than 40 ISI journal articles. He is currently chair of applied physics at NUI Galway and was elected to the Council of the Royal Microscopical Society in 2015.

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Alexander V. Priezzhev graduated and received his PhD degree from the Faculty of Physics, Lomonosov Moscow State University (MSU) in 1971 and 1975, respectively. He has led and participated in various national and international research projects on medical physics and biomedical optics. He is head of the Laboratory of Laser Biomedical Photonics, Faculty of Physics, and International Laser Center, MSU. His areas of expertise include biomedical optics, light scattering diagnostics, physics, and rheology of biological fluids.