Special issue in honour of Professor Valery V Tuchin's contribution to the field of biomedical optics

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EDITORIAL

Special issue in honour of Professor Valery V Tuchin's contribution to the field of biomedical optics

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Valery V Tuchin

This special issue of *Journal of Physics D: Applied Physics* is dedicated to Professor Valery V Tuchin, one of the pioneers in biomedical optics. Professor Tuchin's contributions to the field of biomedical optics are diverse and cover areas such as fundamental aspects of tissue optics, laser spectroscopy and clinical applications of light waves.

Born on 4 February 1944 by the Volga River in Saratov, Russia, Valery received his education from Saratov State University (SSU), Department of Physics, graduating in 1966 with a master of science in radiophysics and electronics. He defended his first dissertation for Candidate of Sciences in Optics in 1973 on the 'Study of Spectral Characteristics of Gas Discharge Lasers by a Small Disturbing Signal', and carried on to defend his second dissertation for Doctor of Sciences in quantum electronics in 1982 on 'Laser Modulation and Technical Fluctuations'.

His professional experience and positions are mostly connected with SSU: from 1966 to 1970 he was an engineer in the Research Institute of Mechanics and Physics; from 1971 he was invited to teach firstly as an Assistant Professor at the Chair of Optics, then as a Senior Lecturer and Associate Professor of the same Chair (1973–1982). Since 1982 he has been a Full Professor as Head of Chair of Optics. From 1982 to 1989 he was Dean of the Faculty of Physics. Since 1989 he has also been working for the Russian Academy of Sciences as Head of the Laboratory of Laser Diagnostics of Technical and Living Systems at the Precision Mechanics and Control Institute of the Saratov Branch of the Russian Academy of Sciences. In 2004 he initiated and became a director of the International Research–Education Institute of Optics and Biophotonics at SSU.

Professor Tuchin's contributions to the fields of optical and laser measurements, biomedical optics and the fundamentals of laser and photo medicine are reflected in his more than 200 peer-reviewed papers and books. His latest books include *Tissue Optics: Light Scattering Methods and Instrumentation for Medical Diagnosis* (*SPIE Tutorial Texts in Optical Engineering*, volume TT38, 2000), *Handbook of Optical Biomedical Diagnostics* (SPIE Press, volume PM107, 2002), *Coherent-Domain Optical Methods for Biomedical Diagnostics, Environmental and Material Science* (Kluwer Academic Publishers, volumes 1 and 2, 2004), and *Optical Polarization in Biomedical Applications*, (Springer Verlag, 2005, co-authored with Lihong Wang and Dmitry Zimnyakov). He is the holder of more than 20 patents.

Professor Tuchin and his group have designed and developed light scattering and coherence-domain techniques, as well as polarization-sensitive diagnostic methods and instrumentation for early diagnostics and monitoring of disease in ophthalmology, dermatology and other branches of medicine. His latest achievements are in the field of tissue optical clearing using biocompatible immersion agents. The research group headed by Professor Tuchin at Saratov State University actively collaborates with numerous university laboratories,

research centres and companies in Russia and worldwide. There is no doubt that it is a leading group in the world in this field.

Professor Tuchin has made numerous and important contributions to designing and teaching biomedical optics courses, and organizing schools for junior scientists and students. During the last decade, he has been an instructor for more than 20 SPIE and OSA short courses on biomedical optics for international audiences of PhD students, engineers, private company workers, and medical doctors in USA, Germany, Hungary, Finland, China and Singapore. He is a guest Professor of Huazhong University of Science and Technology and of Tianjin University in China.

He actively serves as an editorial board member and reviewer for a number of high ranking scientific journals, including *Journal of Biomedical Optics* (USA), *Quantum Electronics* (Russia), *Journal of Applied Nonlinear Dynamics* (Russia), *Lasers in the Life Sciences* (USA) and *Journal of X-Ray Science and Technology* (USA).

Professor Tuchin has organized numerous international conferences, including the following well-known symposia: SPIE's Annual Conference on Coherence-Domain Optical Methods and Optical Coherence Tomography in Biomedicine (San Jose, 1997–2005, co-chaird by J Izatt and J Fujimoto) and SPIE's Annual Fall School for Young Scientists and Students on Optics, Laser Physics, and Biophysics (Saratov, 1997–2005). Recently, together with Professor Brian Wilson from the Ontario Cancer Institute and Dr Stoyan Tanev from Vitesse Re-Skilling Canada, he has been a co-director of the NATO Advanced Study Institute in Biophotonics (Biophotonics—from Fundamental Principles to Health, Environment, Security and Defence Applications, Ottawa, Canada, 29 September–9 October 2004).

He is one of the leading scientists in Russia, being an Honoured Science Worker of the Russian Federation (since 1999), winner of the Russian Federation individual grant for leading scientists (1994–2003), an active member of the International Academy of Informatization and the Russian Academy of Natural Sciences, and a recipient of the George Soros Professor Award in 1997, 1998 and 1999. In 2005, he became a Fellow of SPIE.

Because of all of Professor Tuchin's achievements, contributions, and dissemination activities in the field of biomedical optics, we felt that there was a debt to be repaid by encouraging his students, co-workers and colleagues to contribute to this special issue in his honour. This issue of *Journal of Physics D: Applied Physics* therefore highlights recent research in biomedical optics that has been influenced, both directly and indirectly, by Professor Tuchin's work.

Twenty-seven papers are included in this special issue. The first paper, By Professor Tuchin, gives an overview of the current status of the optical clearing approach in biomedical optics, a new and novel approach pioneered by him, while the second paper describes current developments in optical coherence tomography, its theory and applications with close attention paid to biomedical imaging and its metrological issues. The third overview paper is dedicated to the current development and evaluation of automated systems for detection and classification of banded chromosomes. The next four papers are concerned with the optical properties of biotissues and how those properties can be manipulated by exogenous agents and particles. There are seven papers presenting and discussing the latest developments in optical coherence tomography and microscopy, including theoretical modelling, experimental investigations and light source developments. The photoacoustic effect from biological tissue and cells can be used to efficiently monitor a number of parameters in biotissues. In this regard, we have included five papers in this special issue that cover

monitoring of temperature, tissue coagulation and glucose, imaging and photoacoustic tweezers. A further three papers describe current developments in using near-infrared spectroscopy to perform noninvasive glucose measurement and to monitor rat breast tumour oxygen consumption. The remaining papers cover miscellaneous topics in biomedical optics, including resonance Raman spectroscopic investigations in dermatology, a near-infrared fluorescence catheter for atherosclerotic plaque detection, fibre-optic systems applicable to measuring the thickness of transparent tissues and tumor diagnosis, and a lattice of optical islets in photomedicine.

We thank all the authors for their valuable contributions and their prompt responses to the reviewers' comments. We are also very grateful to the reviewers for their hard work and their considerable efforts to meet tight deadlines.