

Laser technologies in biophotonics

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This and the following issues of *Quantum Electronics* comprise articles reflecting the state of the art of laser technologies both currently applied and promising for application in biomedical research. Rapid development of biophotonics that we witness nowadays is due to a number of factors. These include the new results in basic studies of the interaction of laser radiation with biological tissues and cells, essential progress in the field of development of means for delivery, detection and imaging of optical radiation, and implementation of novel computer- and nanotechnologies.

One of perspective fields of application of gold nanoparticles is the thermotherapy of malignancies. In the article by G.S. Terentyuk et al., it is shown that the regime of hyperthermia is less efficient for antitumour therapy than thermal damage of a tissue induced by its fast short-duration heating to the destruction temperature. Possibility is studied of gold nanoshells delivery to tissues *in vivo* with the help of micro ablation and ultrasound action. Another promising direction of application of nanoparticles is a possibility of their use for imaging the structure of internal organs, i.e., by means of optical coherence tomography (OCT). E.A. Genina et al. have presented the results of investigation of the feasibility of imaging the distribution of nanocages in the liver both in model experiments *in vitro* and at intravenous administration of the nanoparticles *in vivo*.

Detection and correlation processing of the speckle structures allow obtaining diagnostic information on the spatiotemporal entity of biological objects. Articles by V.M. Gelikonov et al. and S.G. Proskurin are focused on the development of the OCT technique and are devoted to suppressing the autocorrelation artefacts and reducing the effect of speckles in OCT. Application of OCT for morphologic study of scaffolds is considered in the article by B.A. Veksler et al.

A special place in the problems of optical diagnostics is occupied by the development of noninvasive techniques of *in*

vivo imaging and quantitative evaluation of blood flow. The article by M.A. Vilensky et al. presents the results of experimental approbation of a laser speckle-imaging technique for monitoring the alterations in microcirculation in the brain of laboratory animals under the conditions of development of stroke and administration of medicines.

Tumour diagnostics is currently carried out, as a rule, by means of roentgenography, ultrasound imaging, tissue biopsy, and fluorescence diagnostics. One of acute problems is the development of new approaches to monitoring the growth and regression of a tumour in the process of cancer treatment. The article by S.S. Ulianov et al. is devoted to adapting the LASCA technique for diagnosing malignancies in laboratory animals.

Acoustooptic tomography is a relatively new method for imaging the objects hidden in strongly scattering media including the biologic tissues. A.P. Solov'ev et al. have experimentally studied the effect of diaphragms with various numbers of slits on the amplitude of photocurrent at the ultrasound frequency, sensitivity of the receiving system, as well as the contrast and sharpness of the image when imaging an absorbing object embedded into a scattering medium.

The article by A.A. Dolmashkin et al. is devoted to the analysis of possibilities provided by the combination of the ultrasound action on the reacting mixture 'blood and serum' with digital detection and handling of the data obtained in the process of agglutination and sedimentation of erythrocytes. Special attention is paid to the issues of modelling the proposed method of blood typing and raising the resolution of the determination of human blood type.

The article by A.Yu. Maklygin et al. demonstrates a possibility of application of a dual-channel laser tweezer for measuring the forces of interaction of red blood cells. It was found experimentally that long-duration trapping of live cells in a strong focused NIR laser beam does not result in alterations of their shape or size.

In contemporary medicine, research is actively pursued on the study of the properties of biologically active nanocompound materials aiming at their further use in diagnostics of and treatment from various diseases. The article by Yu.S. Samsonova et al. is devoted to the study of interactions of albumin protein molecules with diamond nanoparticles in aqueous solutions.

The papers presented in the special issue were discussed at the XV Annual International Interdisciplinary School for Young Scientists and Students on Optics, Laser Physics and Biophotonics, held in Saratov from 27 to 30 September 2011, which was attended by more than 500 people from 22 countries of the world. The guest-editors of this issue are deeply grateful to all authors and express their hope that the presented articles will be interesting to a wide range of readership.

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