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The special issue of „Biophotonics“ journal „Optics and Spectroscopy“ includes 20 articles based on scientific reports presented at the annual International Conference „Saratov Fall Meeting 2024“ (SFM'24, N.G.Chernyshevsky SSU, Saratov, Russia, 23–September 27, 2024, URL: <https://sfmconference.org/>). The conference was held in a part-time format and was dedicated to the 115th anniversary of Saratov State University and the 75th anniversary of diplomatic relations between Russia and China.

The following events were successfully held as part of SFM'24: The XII International Symposium on Optics and Biophotonics, the XXVIII International Scientific School for Students and Young Scientists in Optics, Laser Physics and Biophotonics and the International Scientific School for Students and Young Scientists on Fluorescent Dyes, Proteins and devices in the field of life sciences. In total, more than 400 participants from 20 countries took part in 19 thematic conferences, seminars and round tables, and more than 250 reports and papers were presented, including the reports of the Internet section, 7 plenary and 25 invited papers. Students, young scientists and schoolchildren had an opportunity to listen to lectures devoted to topical problems of biophotonics and application of optical and laser technologies in biology and medicine, including precise mechanics and control of properties of biological tissues and cells, coherent optics of random and ordered media, materials and environmental science, nonlinear dynamics of laser systems, laser physics, spectroscopy and molecular modeling, terahertz photonics, nanophotonics and nanobiophotonics.

The plenary speakers were world leaders in the field of biophotonics: Alexei M. Yaschenok from Skolkovo Institute of Science and Technology (Russia), Xunbin Wei from Peking University (China), Honggen Liao from Shanghai

Jiaotong University (China), Yu Cheng from Fujian Normal University (China), Igor V. Meglinsky from Aston University (UK) and Sechenov University (Russia), Tianong Dai from Harvard Medical School Photomedical Center (USA), Andrey Yu. Abramov from University College London (UK) and Orel State University (Russia).

The articles included in the special section cover a variety of optical methods for studying biological media in normal conditions and in the presence of pathologies. Biological objects of plant origin are also considered.

Four papers in the special section are devoted to the study of blood and blood flow using various optical technologies. The idea of instrumental noninvasive assessment of microcirculation parameters using photoplethysmography during photodynamic therapy is considered in the paper of A.V. Guryleva et al. The paper of A.A. Platonova et al. describes a compact sapphire fiber probe using the principles of diffusely scattered radiation analysis for intraoperative analysis of tissue microcirculation disorders. In the article by E.B. Pykhova and T.E. Pylaev, the features of tissue blood flow in obesity modeling were investigated using laser Doppler flowmetry. As a result, it was shown that nutritional obesity in white outbred rats leads to a violation of the microcirculatory system, and it was also shown that a change in lipid metabolism is one of the significant pathogenetic mechanisms of microcirculation disorders. The paper of V.Y. Chuchin et al. studied the effect of blood oxygenation and the content of methemoglobin in it on the reflection, absorption and transmittance of light in the wavelength range of 400–1100 nm by a layer of blood of various thicknesses within the framework of a numerical optical model of human blood. The results obtained in the work can be used in the development of feedback systems in laser medical devices.

The method of optical brightening of biological tissues is applied in both papers for conducting studies using optical coherence tomography (OCT). P.A. Moldon et al. in their paper have shown using OCT the effectiveness of radiopaque and magnetically contrasting substances for improving the visualization of subsurface structures in the area of the nailbed of a human finger. The article by K.V. Berezin et al. describes the application of the OCT method to study the immersion optical illumination of human skin *in vivo*. Aqueous solutions of a number of sugars and dimethyl sulfoxide were used as immersion agents. The methods of molecular dynamics were used to explain the interaction of molecules of immersion agents with collagen. The results of measurements of the refractive index of rat head tissue samples *ex vivo* in the visible and near-infrared spectral ranges using refractometry and OCT are presented in the paper by A.S. Shanshul et al.

Fluorescent methods are used in three studies. The article by P.K. Nurgalieva et al. describes the possibility of using fluorescence spectroscopy of blood plasma and cerebrospinal fluid for the diagnosis of cerebral gliomas. The article by A.B. Konovalov et al. describes an experiment to improve the accuracy of reconstruction of data obtained using mesoscopic fluorescence molecular tomography, and also discusses the issues of increasing the depth sensitivity of the method. The article by T.N. Tikhonova et al. is devoted to the analysis of the fluorescence attenuation time of single cells using the Segment Anything model to evaluate the biocompatibility of peptide hydrogels, which is relevant in regenerative technologies.

The paper of V.V. Teplyakov et al. presents the results of using a unique source of high-power and broadband terahertz radiation to study the interaction of this type of radiation with a protein. The paper of E.V. Timchenko et al. using the Raman spectroscopy showed that the lyophilization process does not significantly affect the composition and structure of the bladder capsule. The Raman spectroscopy method was used in the article by L.Y. Kozlova et al. to analyze the structure of polyethylene glycols.

E.N. Lazareva et al. in their article demonstrated a number of changes in the structure of the skin and thigh muscles of rats with alloxan-induced diabetes mellitus using scanning electron microscopy. The article by S.A. Khrushchalina et al. describes the synthesis of dielectric nanoparticles based on zirconium dioxide, presents the results of a study of compounds with different particle sizes that can be used to treat surface tumors when irradiated with laser radiation with a wavelength of 980 nm, and studies the cytotoxicity of nanoparticles.

The article by O.A. Kalmatskaya et al. shows the possibility of non-invasive monitoring of the photosynthetic apparatus of plants at various stages of plant cultivation by the optical properties of their leaves using the example of bean leaves. A comprehensive study of the optical properties of dissolved organic matter in the natural water of the stratified lagoon of Lake Sweet and Sour was conducted

in the paper of Yu.G. Sokolovskaya et al. The results of the analysis of absorption and fluorescence spectra, as well as the kinetics of fluorescence attenuation, are presented.

The article of I.A. Shikunova et al. presents irradiators developed by the authors based on sapphire needle capillaries for transmitting radiation through quartz optical fibers. The study of Slepchenkov et al. conducts a prognostic analysis of the effect of stretching/compression deformation on the optical and optoelectronic properties of van der Waals quasi-2D heterostructures formed by corrugated borophene with a triangular crystal lattice and graphene-like gallium nitride GaN and zinc oxide ZnO using *ab initio* methods. The spectrophotometric titration method was used in the paper of Ts.B. Sumyanova et al. to determine the effect of a central metal ion on the stability constants of thorium, lanthanum, neodymium, europium, and lutetium complexes with phosphonate ligands based on 2,2'-bipyridine and 1,10'-phenanthroline.

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