**Tissue optical clearing as an innovative means for optical imaging and phototherapy from UV to terahertz**

*Institute of Physics and Science Medical Center, Saratov State University*

*Institute of Precision Mechanics and Control, FRS “Saratov Scientific Centre of the Russian Academy of Sciences”*

*Laboratory of Laser Molecular Imaging and Machine Learning, Tomsk State University, Russia*

**Valery V. Tuchin**

Email: tuchinvv@mail.ru

Tissue optical clearing (TOC) is based on temporary and reversible suppression of light scattering in tissues and organs using biocompatible immersion optical clearing agents (OCAs) [1-3]. Delivery of the appropriate OCA to living tissue ensures its temporal transparency over a wide spectral range from deep UV to THz, thereby providing higher image depth and contrast for optical techniques and better precision of phototherapy and laser surgery.

The tutorial summarizes the fundamentals and latest advances in the development of the TOC method for solving problems of intravital optical imaging, diagnostics and therapy. TOC can significantly improve advanced multimodal spectroscopy/imaging and phototherapy technologies. The combination of optical techniques with US, CT and MRI is possible through use of commercial coupling or contrast agents. The TOC method provides additional molecular diffusion markers for monitoring *diabetes mellitus* complications and cancer detection, as well as gives important data for optimal cryopreservation of organs. This work was supported by RSF grant № 24-44-00082.

1. L. Oliveira and V.V. Tuchin, *The Optical Clearing Method: A New Tool for Clinical Practice and Biomedical Engineering*, Basel: Springer Nature Switzerland AG, 2019.

2. V.V. Tuchin, D. Zhu, E.A. Genina (Eds.), *Handbook of Tissue Optical Clearing: New Prospects in Optical Imaging*, CRC Press, Boca Raton, FL, 2022.

2. D. Zhu, V.V. Tuchin, Tissue optical clearing imaging from *ex vivo* toward *in vivo*, *BME Front.* **5**, 0058 (2024).

**Valery V. Tuchin** is a Corresponding Member of the Russian Academy of Sciences, Head of the Department of Optics and Biophotonics and Director of the Science Medical Center of Saratov State University. He is also works with several other research centers. He is a laureate of many national and international awards in biophotonics and biomedical optics, has published over 40 books and 1000 articles that have been cited over 45,000 times.

