Annotation

«Nonlinear-optical microscopy of biotissue on the long-wavelength edge of the near infrared region»

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The work is devoted to the development of methods for nonlinear optical microscopy of biological tissues in the infrared (IR) range up to 1450 nm. As was shown in the work, advancing to the long-wave edge of the near-IR range allows increasing the maximum depth of visualization, and also opens up the possibility of studying biological objects using microscopy of optical harmonics generation, as well as fluorescence microscopy with two-photon excitation of promising red proteins and three-photon excitation of the already well-known bright green biomarkers.

The paper demonstrated the possibility of multimodal nonlinear optical microscopy of the rat brain in the specified spectral range based on the generation of optical harmonics and multiphoton fluorescence microscopy. The physical principles leading to the locality of the generated signal are determined, and the most appropriate spectral excitation ranges for one or another method are found. At the same time, signals of various natures detected in this way provide a wide range of possibilities for obtaining detailed complementary information on the structure and metabolism of a living organism.

Also in the work were studied promising genetically encoded fluorescent indicators of calcium ions and acidity in the context of two-and three-photon microscopy. Quantitative measurements of nonlinear optical properties of markers were carried out and physical causes affecting the brightness of proteins were revealed. The sensitivity to the target ion under multiphoton excitation was studied.