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Development of a tomography system for 3D imaging in the short-wave infrared (SWIR) spectral region

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In order to resolve the internal structure of extended biological samples, i.e. entire organisms, organs, or tissue sections, by optical microscopy, these samples require optical clearing in order to become optically transparent. Optical clearing typically involves a harsh chemical treatment process, where samples are first fixed by chemical crosslinking, lipids are removed by transfer from aqueous buffers to 100% alcohol, and finally the removal or bleaching of chromophores. Obviously, this harmful process cannot be extended to living specimen. Light in the short-wave infrared (SWIR) region, however, can penetrate much deeper into biological samples, often up to many millimeters deep - without the need for optical clearing. We are currently developing an imaging system capable of resolving the internal structure of optical samples down to the sub-100 µm scale that utilizes a high pixel-count camera sensitive between 400 - 1700 nm. This will allow us to utilize multiple contrast mechanisms in the infrared spectral region, i.e. absorption and fluorescence of SWIR-active fluorophores to image the water and lipid distribution in these specimen as well as specifically labeled molecular structures. Our current status with regard to these developments will be detailed and explained, and a short outlook to future applications will be provided.

Category

Other

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