Method and Device for Fluorescence Investigations of fixed and living Three-Dimensional Samples

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Project Status

A prototype of the invention has been designed and tested.

Customer Benefits

- Sample storing in closed environment and defined conditions
- Miniaturization and high-throughput screening possible
- “Optical Clearing” allows for 3D imaging of larger samples
- No sample bleaching
- Fast high-resolution 3D imaging

Publications

- Pampaloni et al., Cell Tissue Res. 2013
- Smyrek et al., Biomed. Opt. Express 2017

Patents

- DE 10 2012 108 158 B4
- EP 2 893 319 A1
- US 2015/0211981 A1
- JP 2015-534049 A

The technologies can be licensed or assigned. Moreover, collaborations regarding further development are welcome.

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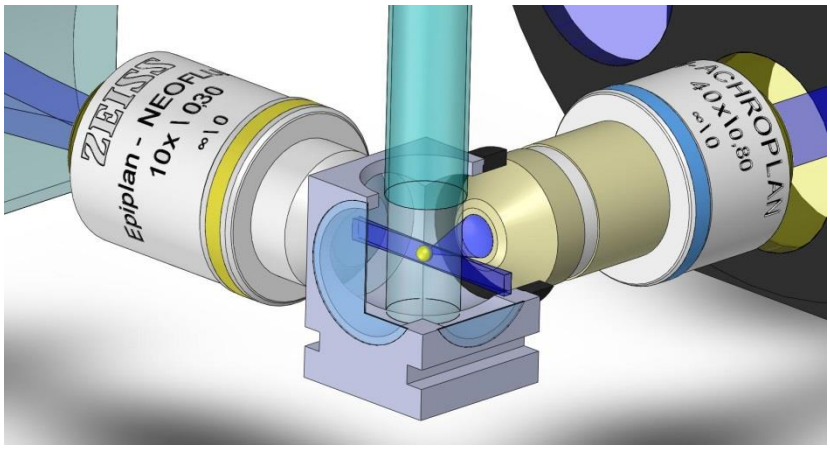
Abstract

Light sheet fluorescence microscopy (LSFM) is a powerful method to analyze 3D living or fixed biological samples - such as cell cultures, embryos, or tissue - with high temporal resolution. An advanced method has been developed to minimize negative effects due to bleaching and light-induced stress. Additionally, it is suited for larger sample sizes.



LSFM is an extremely efficient light-optical tool to monitor 3D fluorophore distributions in biological samples. In comparison to state-of-the-art techniques, e.g. confocal and wide-field fluorescence microscopy, bleaching and light-induced stress is reduced by orders of magnitude. Hence, LSFM is especially suited for imaging of sensitive specimen, living tissues, or living plants over long periods of time. In addition, the method provides a high imaging speed and an exceptional resolution of fixed and cleared probes.

To facilitate and simplify the sample preparation for LSFM, a particular capillary was developed, which can be produced from different materials, e.g. glass, cyclic olefin copolymer or polytetrafluoroethylene to match the refractive index of the surrounding medium and the specimen. The combination of the well-known “optical clearing” technique with a particular developed capillary holding the sample (see figure) enables a aberration-free fluorescence excitation. This is due to the fact that with the capillary the focal plane of the light sheet can be readily and continuously adjusted and therefore compensate for aberrations due to transitions between different media. By rotating the sample holder, the sample can be investigated from different angles. When monitoring living samples properties such as pH, temperature or oxygen concentration can be kept constant within the capillary. Additionally, it is possible to connect a microfluidic perfusion system to the capillary in order to add drugs, agents etc. to the sample.