Bachelor/ Master Thesis

Optical System for Two-Photon Excitation with Temporal Focusing

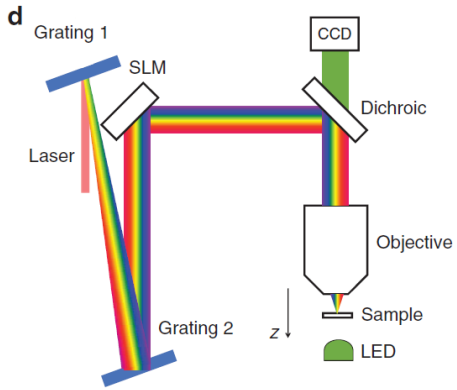
Motivation

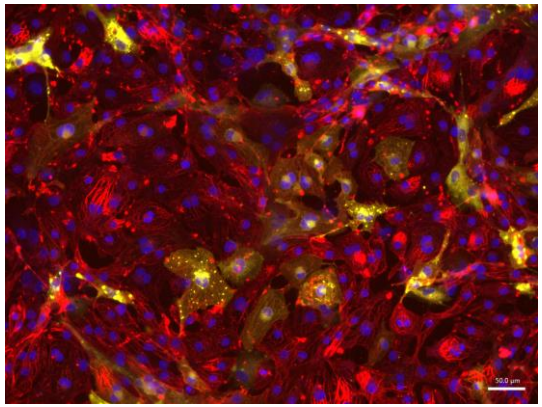
Background:

Many different optical methods are used for studying biological tissue. The penetration depths of these methods is usually limited to several tens of micrometers by the strongly wavelength-dependent scattering in tissue. Powerful ultrashort pulsed lasers allow e.g. the excitation of two photon fluorescence processes, which can penetrate much deeper into tissue due to a wavelength shift to the near infrared regime.

Scope:

In this work, a femtosecond laser will be used to set up an optical system to realize the cutting edge two-photon excitation method of temporal focusing. Here, femtosecond light pulses are spread out temporally by a grating such that all components only overlap in the desired measurement volume. The setup will be characterized optically as well as in ist ability to stimulate light-sensitized biological tissue using exemplary measurements..





Left: Exemplary setup for the two-phtoton stimulation of light-sensitive tissue with temporal focusing. Right: in-vitro cell cutlure of light-sensitive cardiac tissue. Blue: Nuclei, Red: Cardiac troponin positive cardiomyocytes, Yellow: light-sensitive cardiomyocytes.

Range of Tasks

- Design and setting up of an optical system for two photon stimulation with temporal focusing
- Optical characterization of the system
- Assessment off suitability for cell stimulation with exemplary measurements

Related Topics

– Optics, Two-photon microscopy, Temporal Focusing, Ultrashort pulsed laser

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