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Alexander Heisterkamp, PhD, is an expert in biomedical optics, with special interest in nonlinear imaging and manipulation of cells and tissues, laser therapy and diagnostics and nanoparticle-laser interaction. He holds a professorship for Biophotonics at Leibniz University Hannover and is a scientific director of Laser Zentrum Hannover (LZH). After his PhD in laser surgery of the eye at LZH he worked as a postdoc at Eric Mazur's lab at Harvard University, focusing on the manipulation of single cell. Later he joined Friedrich-Schiller-University Jena and finally accepted a full professorship at Leibniz University Hannover.

ABSTRACT

Laser applications of biomaterials in cardiac optogenetics

Optogenetic approaches foster from genetically modified cells allowing precise optical control of excitation in neural or muscle cells. We use optogenetics to excite cardiac induced pluripotent stem cell derived cardiomyocytes, using near infrared wavelength at 900nm and 140fs pulse duration to achieve contraction of the cardiac bodies. As an alternative approach the use of upconverting nanoparticles (Yb³⁺ and Tm³⁺) for wavelength conversion to achieve stimulation of ChR2. For targeted delivery, we are developing optical waveguides from biocompatible biomaterials like hydrogels at different molecular weights. Light distribution, biocompatibility and coupling to excitable constructs are investigated and future applications will be discussed.

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