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In Vivo Nanostructuring of Biocompatible Materials

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The nanoblade: a magneto-mechanical initiation of apoptosis in cancer cells

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Water-soluble nanoparticles as an universal imaging tool

Authors: Jan Niehaus[+], Sören Becker*, Christian Schmidtke*, Katja Werner[+], Thomas Frahm[+]and Horst Weller*[+]
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15)

The continuous flow reactor – a novel approach of synthesizing fluorescent and magnetic nanoparticles

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S-layers as a Patterning Substrate for Cell Adhesion

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Magnetic Liposomes: Contrast Agents for Targeted Molecular Imaging

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In recent years, computer aided additive manufacturing techniques such as stereo-lithography for the creation of biocompatible and biodegradable scaffolds for tissue engineering have attracted much attention. Using these techniques, plastic models can be fabricated according to the local anatomy [1].

Two-photon-polymerisation, offering the possibility to fabricate high resolving three-dimensional parts (≥200nm) [2], allows reproducing complex anatomic structures and specifically fabricating custom made polymeric scaffolds. 2PP structuring does not harm biological tissue since there is a window of transparency for biological material within the wavelengths used [3] [4] [5]. The challenge is to fabricate scaffolds directly in vivo.

This poster reports the fabrication of scaffolds using methacrylate-based photopolymers with embedded living organisms (Caenorhabditis elegans). Structuring was performed using a pulsed laser with a wavelength of 810nm and adjustable power up to 160mW. Using a 20x magnification microscope objective with a numerical aperture of 0.4, a high resolution scaffold with a base area of 300x300µm and a height of 80µm was fabricated. Taking advantage of high laser intensities (writing speed: 300µm/s), the structuring process took only 12 minutes.

Due to the transparency of biological material within the wavelength applied, environmental stress for the organism is of chemical origin only. To find the ideal trade-off between reactivity and toxicity of the resin, we investigated biocompatible and biodegradable resins known from stereolithography [6] for their suitability to 2PP. A focus was taken on water-based hydrogels processed with water soluble, near-infrared initiators.

Literature

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