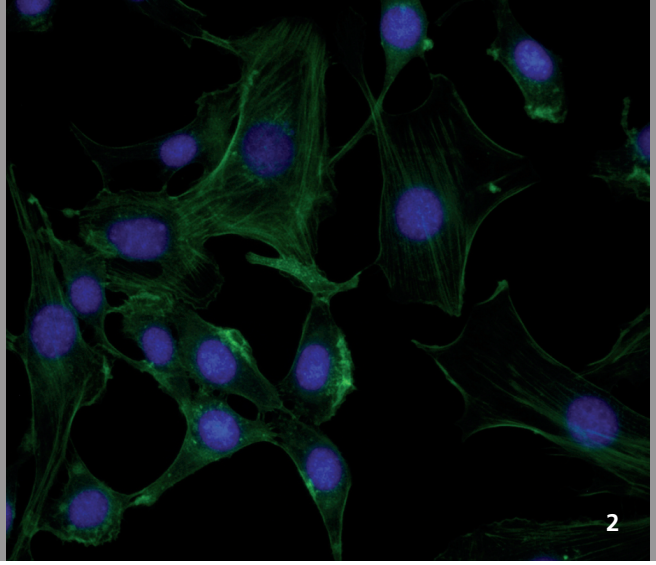

FUNCTIONALIZING SOFT TISSUE IMPLANTS

Task

A tissue fracture denotes a tear in the abdominal wall which allows inner organs, for example, the intestine, to penetrate outwards. The most common form (approx. 2 to 3 percent of the population) stems from hernias. Defects in the abdominal wall can be inborn or a consequence of operations. After operation upon such a tissue fracture, 30 percent of the patients suffer from chronic pain, and 10 percent of the patients require further operations. When an appropriate bioactive implant is used, however, these aftereffects can be reduced.

Method

The implant under examination consists of a side pointing outwards, which should grow well into the abdominal wall. Thanks to the other, smooth side lying in the abdominal cavity, the implant should prevent the inner organs from growing together. Silk from silk worms is used to produce a raw fleece and a smooth membrane, which are bound together. Both sides receive a specific bioactive functionalization from laser radiation. In addition to doing basic investigations, Fraunhofer ILT is also researching concepts to transfer the different processes from the laboratory to industrial production. The silk membrane is irradiated with light having a wavelength of 330 - 370 nm in a Sulfo-LC-SDA and TGF-ß solution.

1 Silk membrane with fleece surface for integration in the abdominal wall.

2 Silk membrane cultivated with 3T3 cells after UV functionalization.

In this solution, a photochemical reaction takes place, which binds bioactive molecules onto the silk membrane. In a subsequent washing step, the adhesive-bound molecules are removed so that only the covalently bound anchor groups remain in the laser-functionalized areas.

Result

A process has been established for coupling the anchor groups using UV light. The proof of the photochemical bonding was furnished by means of binding a fluorescent dye. Here, it could be shown that the share of photochemical bonds lies higher than unspecified adsorption by approximately a factor of ten. With the help of contact angle measurements, the binding of the growth factor TGF-ß could be demonstrated.

Applications

The process of functionalization observed here is still in a laboratory stage and should be transferred into reliable and reproducible fabrication processes. Innovative and improved implants can be produced thanks to the different kinds of functionalization.

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