



DEFINED MICRO-ENVIRONMENTS FOR 3D CELL CULTURES

Task

Today, cell-based biological studies are mainly carried out on hard two-dimensional surfaces, such as a Petri dish. However, this environment does not match the natural environment of cells in living organisms, which are embedded in a dense network of extracellular matrices and cells. This three-dimensional environment fulfils diverse tasks, which range from the supply of nutrients, to cell-cell and cell-matrix communication all the way to physical stimuli. The study of these complex interactions is necessary to understand basic biological contexts, which, for instance, can enable the development of novel drugs for the treatment of cancer. Thanks to these studies, a defined three-dimensional cell microenvironment has been developed, thus providing researchers with a decisive advantage.

Method

To create defined microenvironments, Fraunhofer ILT is researching the two-photon induced crosslinking of synthetic and natural polymers. This technology allows the generation of three-dimensional crosslinked structures from a variety of photosensitive materials, ranging from elastic to inelastic functional polymers all the way to biomaterials, such as proteins. The achievable resolution lies in the micro- to submicro range and hence one to two orders of magnitude under the typical size of a cell.

Result

Two-photon technology can be used to create protein microstructures with high resolution. An example of application can be freely suspended protein microfibers with a width of approx. 0.5 μm and a height of 2 μm . These protein microfibers may additionally be chemically functionalized. Thanks to such protein microfibers, scientists can examine how cells mechanically interact with protein networks, an aspect which, among others, influences metastatic spreading of tumor cells.

Applications

This technology can be used in the area of 3D cell cultures, from the research into basic mechanisms to drug development, as well as in tissue engineering.

Contacts

Dipl.-Phys. Sascha Engelhardt
Telephone +49 241 8906-605
sascha.engelhardt@ilt.fraunhofer.de

Dr. Martin Wehner
Telephone +49 241 8906-202
martin.wehner@ilt.fraunhofer.de

- 3 Fluorescence image of cells growing on protein fibers (green: cytoskeleton, blue: nuclei).
- 4 SEM image of protein microfibers spanned across gaps on which cells grow.