PRESS RELEASE

Fast Personalized Therapeutic Choices Thanks to the Light-Based Sorting of Biomolecules and Cells

Biomolecules and cells circulating in the blood carry diagnostic information, the analysis of which makes highly effective, individualized therapies possible. In order to tap this information, scientists from the Fraunhofer Institute for Laser Technology ILT have developed a microchip-based diagnostic device: The "AnaLighter" analyzes and sorts clinically relevant biomolecules and cells in a blood test with light. As a result, physicians can make early diagnoses, for example, of tumor and cardiovascular diseases and initiate patient-specific therapies with great efficacy. Experts from Fraunhofer ILT will be presenting this technology at the COMPAMED 2017 in Düsseldorf from November 13 to 16.

The "AnaLighter" is a compact diagnostic device for sorting cells and biomolecules. Its technological core is based on an optically switchable microfluidic chip whose optical sensors and switches are connected to the chip via optical fibers. The "Microchip Based Fluorescence Activated Cell Sorter", µFACS, functions in the following way: The biomolecules and cells to be analyzed by fluorescence are guided through a microfluidic channel and focused hydrodynamically on a cross-section of 10 µm at the site of the optical measurement. Laser light from an optical fiber stimulates the analyte in the microfluidic channel to fluoresce. Then, micro-optics focus the laser light emerging from the fiber into the microfluidic channel, collect the fluorescent light generated there and guide it through optical fibers to the photodetector. This fiber-optic design allows a significant reduction in the installation space and makes the µFACS more rugged compared to the prior state-of-the-art. The "AnaLighter technology" is, therefore, ideally suited for automated diagnostic applications in 24/7 operation.

Furthermore, fiber splitter technology makes it possible to generate several optical excitation channels from a laser beam cost-effectively. The advantage of our µFACS, explains the head of the Group of Clinical Diagnostics at Fraunhofer ILT, Dr. Achim Lenenbach, "lies in its ability to offer patients customized solutions designed for a specific application".

Multispectral Detection

Depending on the application, the Aachen experts can adapt the "AnaLighter technology" individually: Via standardized fiber interfaces, wavelengths can be exchanged and easily adapted to a special measuring task without additional adjustment effort. Multiple wavelengths can be superimposed in a fiber and used for

Editorial Notes
Petra Nolis M.A. | Group Manager Communications | Phone +49 241 8906-662 | petra.nolis@ilt.fraunhofer.de
Fraunhofer Institute for Laser Technology ILT | Steinbachstraße 15 | 52074 Aachen, Germany | www.ilt.fraunhofer.de

multispectral measurements. Currently, a system with 16 detection channels is available using 6 different excitation wavelengths. This means that 16 different species can be detected simultaneously. However, the number of detection channels is not a limitation in principle and can be expanded as required.

A special feature of "AnaLighter technology" is the opto-fluidic sorting function. It is based on the fact that the viscosity of the fluid is thermally influenced by infrared laser radiation. By heating the fluid before branching, the system deflects and separates the liquid stream along with the detected analyte before the branching. In this way, biomolecules or cells can be sorted out and stored in sample containers on the fluidic chip for further investigation. Since the branches are arranged serially, the systems can solve complex sorting tasks for separating different species.

Multiplex Diagnostics: Detecting Many Disease Markers with One Analysis

The spectrally separated detection channels of the "AnaLighter" can simultaneously detect different marker molecules in the blood. In such multiplex diagnostics, these marker molecules from a blood sample are specifically bound by a mixture of microparticles, each particle species binding exactly one molecule species to be detected. The detection of bound marker molecules is encoded by a characteristic fluorescence label and its signal measured by one of the 16 detection channels. Such multiplex diagnosis can detect up to 16 different disease markers with only one measurement run. In annual routine checks, a general practitioner can detect a large number of possible diseases early in the course of a single blood test in order to prevent widespread diseases, i.e. cardiovascular disease.

Detecting Tumors Early

In contrast to conventional FACS systems, the µFACS technology of the Fraunhofer ILT can also process water-in-oil emulsions in addition to aqueous solutions. A few micrometer-sized aqueous droplets are passed through the fluidic channel in an oily fluid as carrier medium. The aqueous droplets can be used as closed reaction volumes for screening applications in chemistry or biotechnology. The sorting function also makes it possible to separate out the appropriate candidates from the others during screening, in order to dispose of the relevant gene sequences in e.g. genetically modified variants.

Fraunhofer ILT at the COMPAMED

From November 13 to 16, 2017, our scientists will present the "AnaLighter technology" at the joint IVAM stand, F34.4, in Hall 8a.

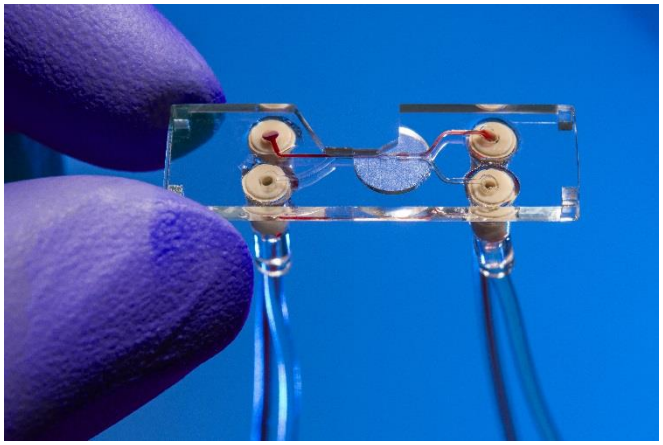

Image 1:
Sorting chip for analyzing and isolating cells in a blood sample.
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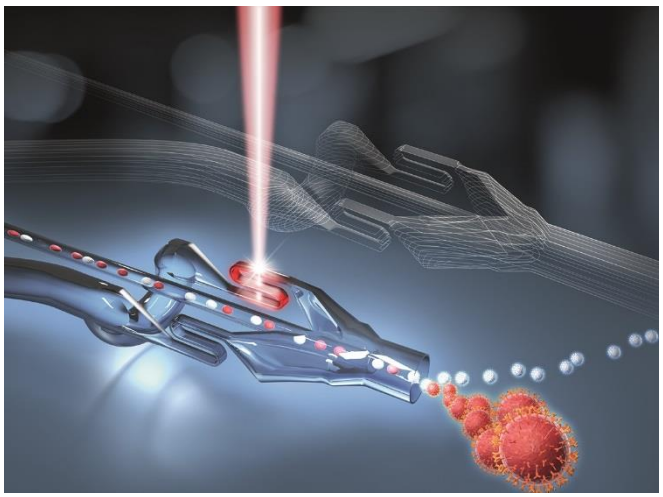

Image 2:
Structure of the sorting chip for sorting cells and particles with laser light.
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Further information
Dr. rer. nat. Achim Lenenbach | Manager of the Group Clinical Diagnostics and Microsurgical Systems
Phone +49 241 8906-124 | achim.lenenbach@ilt.fraunhofer.de
Fraunhofer Institute for Laser Technology ILT | Steinbachstraße 15 | 52074 Aachen, Germany | www.ilt.fraunhofer.de