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Research in Graubünden

Sensor from Graubünden for EU Research Project

Realistic drug testing with heart-on-a-chip

First prototype of the optical reading module for contractility measurement. Image: CSEM.

Cardiovascular diseases are the leading cause of death in Europe and incur high costs. To advance research, suitable models are needed to realistically test the effects of new drugs. This is where the EU research project EMAPS comes in. The goal of the eight project partners is to develop an artificial “heart-on-a-chip” that can accurately replicate both healthy and diseased heart tissue. The approach aims not only to accelerate drug development but also to largely eliminate the need for animal testing.

Heart muscle cells for research are derived from so-called induced pluripotent stem cells (hiPSCs). These cells can transform into various cell types, including cardiomyocytes, or heart muscle cells. However, these cells often remain immature and do not behave like adult heart cells. Since only mature cells can provide realistic results in drug testing, it is crucial to replicate their development as accurately as possible. To achieve this, the EMAPS researchers rely on a sophisticated interplay of electrical, mechanical, and biochemical stimuli: The heart cells grow on special EMAPS scaffolds, which electrically and mechanically stimulate them, promoting their development. A bioreactor ensures optimal conditions, while an optoelectronic sensor continuously monitors the contraction of the cells.

The EMAPS research project, funded with 5.4 million euros, also involves the CSEM center in Landquart. There, the optoelectronic sensor was developed, which can simultaneously measure the contraction of heart cells for 24 samples. Physicist Ekaterina Möhr was involved in the sensor development and optimization. She integrated electrical stimulation, improved image contrast, and enhanced the sensitivity of the algorithms. Möhr is pleased: “The sensor meets all the specifications, and CSEM has successfully completed its work package by the end of March 2024.” For the physicist, interdisciplinary collaboration is an exciting challenge. She has acquired a great deal of biological knowledge to work efficiently with the biologists in the project.

Meanwhile, the other project partners are working on ensuring that the heart tissue grows stably on the EMAPS scaffolds. Biocompatibility – the ability of the scaffolds to interact with the heart cells without causing harmful reactions – plays an important role in this process. While the heart cells are thriving on the EMAPS scaffolds at the project partner in France, a significant deterioration in biocompatibility is observed after transport to the project partner in Lithuania. The exact cause of this is still unclear and is being

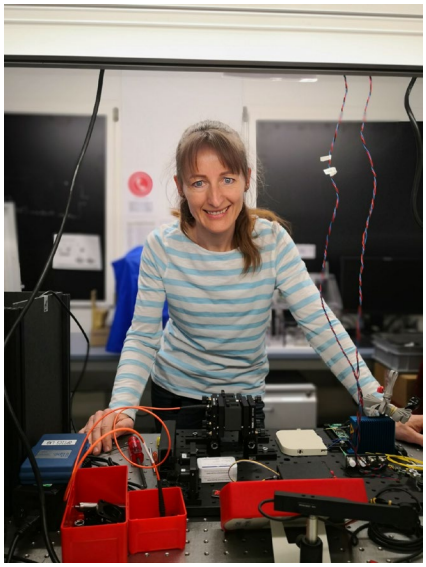
systematically investigated. In June 2025, Möhr will travel to Lithuania, where the integration of the sensor developed at CSEM into the entire setup will be tested one final time. The goal is to further develop the technology to make it suitable for industrial use.

Ekaterina Möhr and Daniela Heinen

CSEM Center Landquart

At the CSEM Center Landquart, a 24-member team from 13 nations develops optoelectronic and electrochemical sensors, as well as miniaturized systems, and translates these technologies into innovative products in collaboration with industrial companies.

www.csem.ch



Ekaterina Möhr
Image: CSEM

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