

ADVANCED DIGITAL TECHNOLOGIES IN LIFE SCIENCES: PHOTONICS AND BEYOND

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ABSTRACT

CSEM technologies aim to improve the quality of life of patients and make new treatments accessible for all. Life sciences companies' central role in drug pricing and access to medicines puts them on the frontline of societal challenges like aging populations, disease outbreaks, increasing incidence of cancer and cardiac disorders, and antibiotic resistance. Technology is opening new possibilities for patient care and operational efficiency across the life sciences sector. Photonics is a key 21st-century technology at the heart of autonomous cars, 5G networks and next-generation medical devices. Our technology platforms are addressing the evolving needs of the life sciences field using automated cell technologies, biomonitoring and wearables, and artificial intelligence.

KEYWORDS: life sciences, photonics, digital health, point of care diagnostics, wearables, in vitro models.

INTRODUCTION

Life sciences companies' central role in drug pricing and access to medicines puts them on the frontline of societal challenges like aging populations, disease outbreaks, increasing incidence of cancer and cardiac disorders, and antibiotic resistance. Companies are also having to adapt to a dynamically changing clinical, regulatory, and business landscape. They are forming the basis of new medicines, diagnostics, and tissue-engineered products as well as gene and cell therapies. They are providing enhanced performance as well as deepening our understanding of how our body is working and how it is affected by different drugs and chemicals. Technology is opening new possibilities for patient care and operational efficiency across the life sciences sector.

Photonics is a key 21st-century technology. CSEM has decades of experience in the transfer of several technologies – including nanoscale optical structures, photonics integrated circuits, laser sources, optical instruments for metrology and gas sensing as well as intelligent imaging – to the industrial sector. Our solutions are used in a wide range of domains, including non-invasive health diagnostics, lighting, energy, security, manufacturing, communication, metrology, lidar, quantum science and mobility.

CONCEPT

At CSEM, we develop disruptive technologies with a high societal impact in the fields of precision manufacturing, digitalization, ultra-low-power electronics, optical elements, AI, and sustainable energy. We then transfer these innovations to industry partners in a variety of sectors, including renewable energy, aerospace, watchmaking, and healthcare, or encourage start-up creations. As a public-private, not-for-profit organization, our mission is to support the innovation of Swiss companies and strengthen the economy through ongoing collaboration with leading universities, research institutes, and industrial partners.

MATERIALS AND METHODS

From concept to prototyping and validation in biosafety level II laboratories, CSEM helps industry to innovate and develop new products across the following application domains:

- Micro physiological systems and organoids
- Point-of-care diagnostics
- Vital signs monitoring
- Labs of the future
- Decision support systems
- Personalized treatment

RESULTS AND DISCUSSION

CSEM technologies aim to improve the quality of life of patients and make new treatments accessible for all. Our technology platforms are addressing the evolving needs of the life sciences field using automated cell technologies, biomonitoring, vital sign monitoring and artificial intelligence. We are using our expertise in miniaturization, integration, and microengineering to develop new devices, tools, and systems for toxicology, pharmacology, diagnostics, and regenerative medicine.

Among others, our recent successful collaboration with the industrial partner Aktiia demonstrates CSEM skills and wearable competences in miniaturization, integration, optics and AI. Figure a) shows Aktiia's Class IIa medical device clinically validated by five major clinical studies associated to more than 20 peer-reviewed publications. Aktiia's device have measured to date more than 50 million of recordings.

Another successful partnership is illustrated in Figure b): a novel screening platform 'MUSTANG' (Muscle Tissue Analyzer Gear) first-of-its-kind automated solution capable of measuring the contractility (strength) of 3D printed micro-muscles via electrical pulse stimulation. Developed by Novartis, CSEM, Life Imaging Services, Weidmann Medical Technology and the Zurich University of Applied Sciences (ZHAW), the apparatus is set to enhance the reliability and robustness of drug development for Musculoskeletal Diseases.

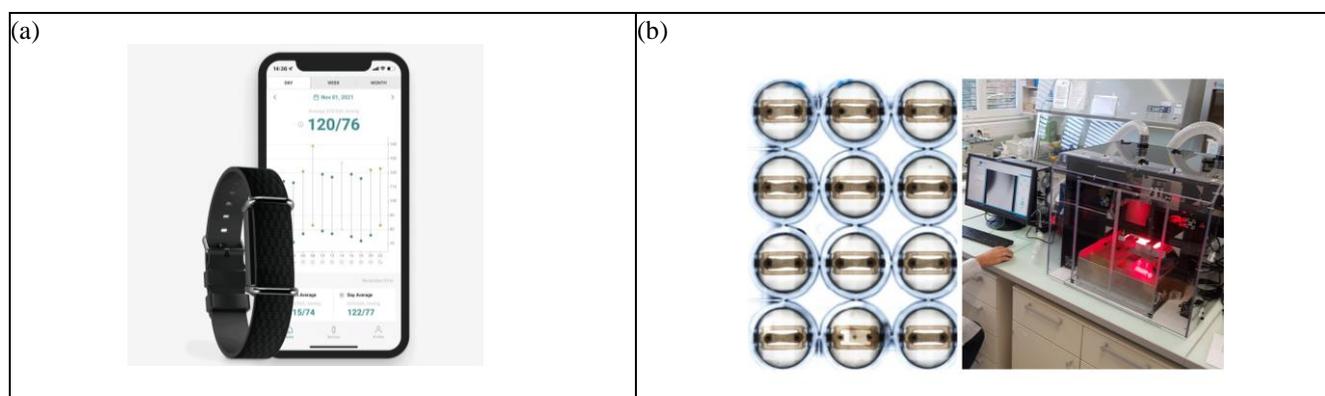


Figure 1: (a) Aktiia's blood pressure bracelet, (b) MuscleAnalyzer.

CONCLUSIONS

Creating the right solutions involves combining technology with innovative thinking and a data-driven strategy. That's where CSEM is helping the industry meet the evolving needs of patients around the world. Investment in technology is a priority across the healthcare sector. New biotechnologies are allowing clinicians to meet the needs of patients and their families more effectively.

The medical wearable technologies we develop help patients track their health and give healthcare professionals access to information that drives improvements in treatments, medical services, insurance, as well as our understanding of the human body itself.

ACKNOWLEDGEMENTS

Part of CSEM work is supported by Swiss Innovation Agency and European Research Grants. We are grateful of the collaborations with our industrial and academic partners as Aktiia, Novartis, Life Imaging Services, Weidmann Medical Technology and the Zurich University of Applied Sciences (ZHAW).

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