



## Project “Hybrid-sensor breath analysis for colorectal cancer screening (HYCOR)” summary

**The overall aim** of the HYCOR project is to facilitate the realization of the Smart Specialization Strategy (3S) priorities in Latvia, therefore advancing the research potential of the country, strengthening knowledge-based society, and promoting the competitive advantages of the national economy and tightening international research collaboration.

**The specific aim** is to promote breath volatile marker concept for colorectal cancer (CRC) screening by advancing developing the application of a novel hybrid analyzer for the purpose.

**The rationale of the project** is based on the previous experience of the group as well as novel technological developments in the field of volatile organic compound (VOC) detection in human breath for detecting cancer. The hybrid analyzer concept is expected to benefit of combining metal-oxide (MOX) and infrared spectrum (IR) sensor acquired data. The current study will be the first globally to address this concept in CRC detection. In addition, traditional methods, in particular, gas chromatography coupled to mass spectrometry (GC-MS) will be used to address the biological relevance of the VOCs emission from cancer tissue and will assist in further advances of the hybrid-sensing approach.

For addressing the aims of the project, four **specific research objectives** have been set:

Specific Objective 1 (SO1). To identify cancer-related VOCs emitted by the CRC tissue via the comparison of VOCs emitted from cancer tissue with VOCs emitted by non-cancerous tissue (*ex vivo* surgery material) by GC-MS.

Specific Objective 2 (SO2). To identify the VOCs differentiating human breath from CRC patients and controls (by GC-MS) as well as compare the chemical signature of CRC patients' breath to the chemical signature of cancer tissue.

Specific Objective 3 (SO3). To evaluate the performance of the set of sensors in the hybrid analyzer and the performance of particular sensors for detecting CRC; to develop and validate a mathematical model for CRC detection.

Specific Objective 4 (SO4). To validate the hybrid analyzer in real-life CRC screening settings, i.e. versus the generally accepted CRC screening approach of faecal occult blood detection.

**The scientific results** of the current project will provide new knowledge on the potential application of the hybrid breath analyzer for CRC screening with the possible replacement of the current screening modalities in population-based screening programs. Although currently screening programs do exist in most of the European Union (EU) countries, the tests that are used at present are still far from the ideal. Therefore, the obtained results would be important for clinical practice either in Latvia or globally – in countries with an average or high burden of CRC.

It is planned to do an industrial research project (TRL 3-4), and the planned activities are not related to commercial activities. According to the Organisation for Economic Co-operation and Development (OECD) classification project corresponds to Health Science (3.3, Fields of R&D classification, Frascati Manual, 2015).

**The research** will be leading to the development of new medical technology with a high added value, therefore contributing to the implementation of the 1st growth priority of Latvian RIS3 strategy, in particular the priority: “Knowledge-intensive Medicine, including Biomedicine, Medical technologies.”

**The project is aimed** at developing a principally novel approach for cancer detection employing exhaled breath analysis. A mathematical model on VOC results will be developed; validation of hybrid analyzer will be conducted. Previously acquired knowledge will be utilized.

It is planned to prepare and to publish 3 original scientific publications in peer-reviewed journals, 2 of them in journals with citation index >50% of the average in the field., The results are expected to be disseminated in 5 abstract presentations. In this project 5 students, including 2 PhD students will be employed; 2 new working positions will be maintained after the completion of the project.

The project will be realized under the leadership of the University of Latvia (LU) in partnership with a commercial entity, Liepajas Regional hospital (Hospital).

**The total budget of the project** – 540 540.00 EUR, of this public funding 92,5% - 499 999.50 EUR (including public funding from ERAF – 82,29% 444 810.37 EUR, Latvian government 10.21% - 55 189.13 EUR) and private sector 7,50% 40 540.50 EUR.

Project duration – 29 months (July 2021 – November 2023).

Keywords: volatile organic compounds, breathe, sensor technologies, hybrid analyzer, colorectal cancer