

The goal of this project is to develop a modern, non-invasive diagnostic tool that analyses human exhaled breath to detect metabolic syndrome at an early stage. Metabolic syndrome is a cluster of risk factors including abdominal obesity, elevated blood sugar, and abnormal cholesterol levels. It significantly increases the risk of type 2 diabetes and cardiovascular diseases.

Human breath contains thousands of chemical compounds (called VOCs – volatile organic compounds) that reflect a person's health status. Using gas sensors and artificial intelligence algorithms, it is possible to detect these compounds and assess whether metabolic diseases are developing – even before symptoms appear or blood test results become abnormal.

The research team has already developed a prototype of an electronic nose capable of predicting cholesterol levels based on breath. The next step is to extend the research to other parameters such as glucose, HDL, LDL, and triglycerides. The study will use commercial gas sensors, Tedlar® bags for breath sample collection, and specially prepared gas mixtures that mimic the breath of patients with specific conditions.

Machine learning algorithms will analyse the collected data to identify characteristic chemical patterns associated with diseases such as diabetes and cardiovascular disorders. The ultimate goal is to create a portable diagnostic device that is affordable, easy to use, and accessible even in less developed parts of the world.

The project is being carried out at the specialized Biomarkers Analysis LAB, which has the necessary experience and infrastructure for breath analysis and gas sensor research.