Novel strategy to analyse biomarkers in exhaled breath

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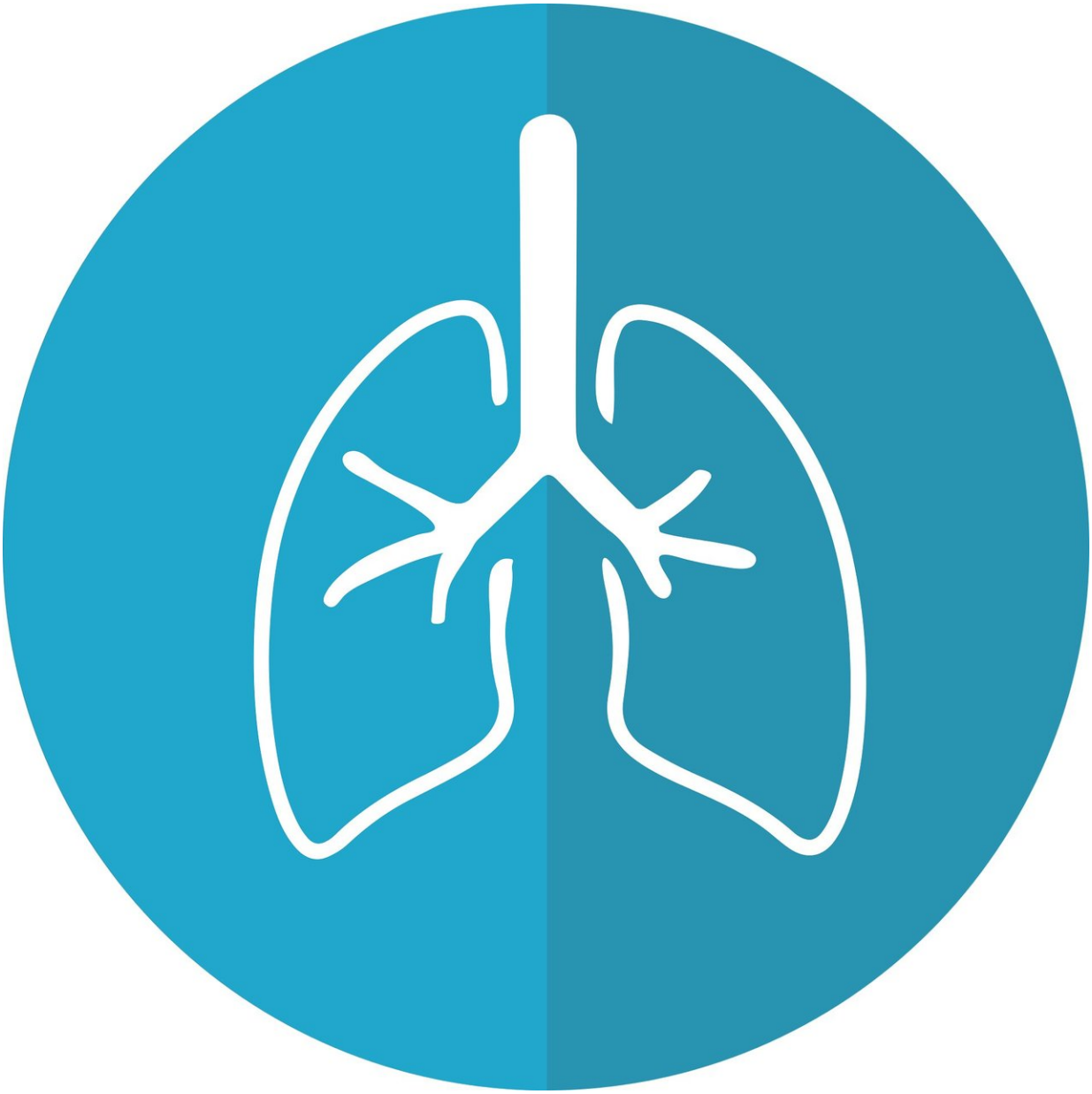

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Breath gas analysis is a promising approach for non-invasive medical diagnostics and physiological monitoring, but further development is needed to increase clinical impact. Ramin Ghorbani presents a novel methodology for the analysis of real-time breath data that opens up for rapid point-of-care assessment of respiratory diseases.

Human breath is a complex mixture of hundreds of gases, most of them present at very low concentrations. Some of these molecular compounds can be used to assess the physiological and metabolic state of the body, or recent exposure. Further insight into biomarker origin and gas exchange in the respiratory tract can be obtained by combining fast measurement and mathematical modelling of the concentration profile during a single exhalation. Ramin Ghorbani has implemented this approach for exhaled carbon monoxide, a potential biomarker for oxidative stress and respiratory diseases.

"We are interested in respiratory diseases as they are among the leading causes of premature death worldwide. Exhaled carbon monoxide mainly reflects blood carboxyhemoglobin, but the shape of the expirogram also depends on lung diffusion properties, airway tissue contributions, exogenous sources and breath sampling conditions. Conventional detection methods cannot distinguish between these factors, which hampers results interpretation," says Ramin Ghorbani.

During the course of his doctoral studies, Ramin has developed a compact instrument based on laser absorption spectroscopy and online breath sampling that enables precise real-time detection of carbon monoxide concentrations in breath and ambient air. He has also adapted a mathematical model for pulmonary gas exchange to simulate carbon

monoxide exhalation profiles that can be fitted to experimental data to extract physiological parameters.

"While the discrimination between endogenous and exogenous carbon monoxide is still a challenge, we are able to detect changes in airway production and how well the gas diffuses across the capillary membrane. We have run clinical studies to establish the baseline of the gas exchange parameters in healthy non-smokers, and investigated the effect of exposure to high levels of ambient carbon monoxide and to wood smoke particles. We hope to provide a basis for improved, easy-to-use breath tests for physiological studies and early disease diagnosis."

More information: Real-time breath gas analysis of carbon monoxide: laser-based detection and pulmonary gas exchange modeling. umu.diva-portal.org/smash/record.jsf?pid=diva2%3A1251325&dswid=-5737

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