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Volatile Organic Compounds (VOCs) in exhaled breath as biomarkers for disease screening and for the assessment of the effects of alternative medicine using Deep Ultraviolet Vacuum Analysis (DUVA)

Thomas Ludenberg

Danderyds Sjukhus, Sweden

The smell of human breath has been used for diagnostic purposes since ancient times. The possibility of using it for detecting diseases has also been investigated for many years. Metabolomic analysis of exhaled breath generally focuses on the quantitative determination of metabolites with low molecular weight. Increase or decrease in the levels of these molecules is induced by diverse pathophysiological stimuli, genetic modifications, or environmental factors acting on living systems. Changes in the levels of some metabolites in exhaled breath may be warning signs for diseases such as lung cancer, chronic obstructive lung diseases and diabetes etc. Thus, detection of these changes has potential utility for diagnosing, screening, and characterizing the biological pathways of these diseases. Also, by detecting changes in quantities (from ppm to less than ppb levels) treatment effects may be assessed. Therefore, determination of VOCs in exhaled breath is a challenging task, requiring excellent sensitivity and selectivity to detect trace metabolites with the presence of those at higher concentrations. The present presentation focuses on the identification of VOCs produced by biochemical pathways relevant to lung cancers, chronic obstructive lung disease (COPD) and diabetes; identification of VOCs produced by biochemical pathways relevant to inflammation with special relevance to acupuncture effects; fingerprint analysis in VOC research for early diagnosis; and determination of specific disease as well as treatment specific biomarkers. Accelerating the pace of discovery in order to produce a biomarker or a panel of markers that can be adapted for reliable clinical use will require progress in three key areas: greater understanding of the biochemical pathways involved in disease development, more sensitive and selective tools and methods for determining VOCs, and larger and more standardized clinical trials. As presented the DUVA technique may be one option for the future for disease screening and for the assessment of treatment effects.

thomas.lundeborg@sl.se