METABOLIC PROFILING: LIMITATIONS, CHALLENGES, PERSPECTIVES FOR THE ANALYTICAL CHEMIST

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Metabolic profiling represents the fastest growing omics field. Analytical chemistry is in the core of metabolomics. Technologies involve NMR spectroscopy and mostly LC-MS and GC-MS; chemometrics are necessary for data mining and extraction of information.

After a decade of continuous development metabolic profiling is still in the development phase: protocols are still needed validated for sample preparation, analysis and data mining. The lecture will highlight some of the most important limitations and thus the associated analytical challenges of the currents state of the art: 1) the need for new advanced methods of high efficiency, e.g. methods for the analysis of polar intracellular metabolites or the analysis of lipophilic substances 2) the need for faster and more robust tools for data treatment 3) the need for data fusion to effectively combine e.g. NMR with MS data or HILIC with RPLC data 4) the slow progress of metabolite identification, 5) the need for efficient data visualization tools in combination with biochemical pathway analysis.

The perspective for the analytical community is and will remain high. It is now understood that at least five or six analytical methods are necessary to map the metabolome: both untargeted methods (RPLC-TOF-MS, HILIC-TOF-MS, GC-MS) and targeted multi-analyte methods (HILIC-MS/MS, IonPairLC-MS/MS). These methods require the highest efficiency and the highest level of validation and quality control. If such measures are not implemented, there is a significant risk that research will follow wrong leads and reach dead-ends.

Examples from the research of our group will illustrate the need for method development, the gain in productivity by the development of advanced analytical methods and the discovery of biomarkers in life sciences, more specifically from the fields of arthritis, in-vitro fertilization and physical exercise biochemistry.