



Why Metabolites Matter

The human body is constantly at work running countless chemical reactions to synthesize, alter, or degrade small molecule metabolites. The presence or absence of certain metabolites can inform researchers and clinicians about the status of these reactions and the health of the cells, tissues, and organisms producing them.

Modern technologies that enable high throughput nucleic acid and protein analyses ushered in the “-omics” era in scientific research. Metabolites can also undergo this rigorous form of analysis using mass spectrometry techniques, which provide a snapshot of the small molecules being made in a sample under specific conditions. Metabolomics is therefore the large-scale study of metabolites within cells, bodily fluids, tissues, and even whole organisms.

HOW ARE METABOLITES MEASURED?

A classic approach to studying metabolites uses simple biochemical tests that look at one molecule per reaction. These experiments are often used to diagnose and monitor disease. In contrast, metabolomics methods can identify and measure thousands of metabolites at a time in a given sample. A wide range of samples can be tested for metabolites, including human biospecimens such as sweat, plasma, fecal solids, and tissue biopsies. These samples are analyzed using a combination of biological, analytical chemistry, and computer science methods.

Researchers isolate and analyze biological samples with various mass spectrometry methods to identify metabolites. Because the number of metabolites in a single sample is enormous, systems biology approaches assist researchers in analyzing these large data sets by using statistical models to form a metabolic profile for

the specimen being tested. Key differences in metabolites from different biological pathways may be used as biomarkers—metabolites that are directly affected by the condition being tested.

WHAT CAN METABOLOMICS TELL US ABOUT HEALTH AND DISEASE?

Many metabolic pathways have been extensively studied and mapped. These pathways are dynamic, and genetics, drug treatment, disease, and the environment all influence metabolite production. Therefore, metabolomics data directly reflect the biochemical activity of cells and tissues, giving researchers a view of an organism's phenotype; metabolite changes indicate differences in protein function.

Researchers and clinicians often rely on biomarkers to indicate specific health or disease states. Biomarker abundance can be tracked to monitor metabolic disturbances, such as changes in the gut microbiome or the effects of diabetes or cancer. Disease progression and the effects of drug treatment can also be assessed by comparing specific biomarkers in metabolite profiles throughout the course of a study. Metabolomics studies are valuable in pre-clinical research for validating experimental findings, such as biomarker responses to treatment conditions.

Metabolomics methods can be applied in numerous research fields to analyze functional changes in many specimen types, making the technology a huge player in the -omics field. By combining metabolomics with other omics analyses, researchers can gain a holistic view of living organisms.

To learn more about metabolomics, visit en.humanmetabolome.com