

Research Capabilities:

- Stable isotope labeling for metabolic tracking
- Ion-trap mass spectrometers for characterizing and allowing comparison of metabolite profiles
- ICR-LTQ mass spectrometer and nuclear magnetic resonance for identifying and characterizing metabolite structures
- Fully automated agile microbial culturing system:
 - Pulsed isotopic labeling
 - Automated sampling for separating extra-cellular and cellular fractions
 - Simultaneous sampling for metabolome, proteome and transcriptome analysis

Studying metabolomics can:

- Address metabolite regulation of genes and protein function
- Serve as a discovery tool: metabolites, pathways or unexpected effects
- Validate gene expression studies and determine functional relevance
- Provide phenotypic signatures
- Monitor organisms' responses to the environment.

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Summary:

Biologists have long recognized that the central dogma of living organisms begins with genetic material. The idea that a gene generates a message that is then used to create a protein underlies the foundation upon which all other cell function is based. Small molecules called metabolites provide a pathway for finding a more complete understanding of cell function. Understanding cellular function ultimately requires a systems-level analysis of not only metabolomes but also the genomes, proteomes, and transcriptomes.

What are metabolites?

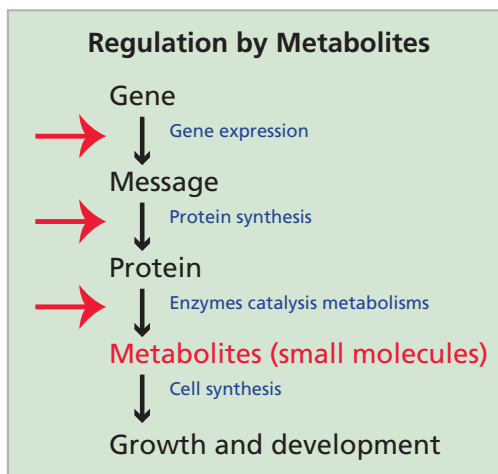
Metabolites, the intermediates and products of metabolism, including energy storage and management molecules, secondary metabolites, and various signaling molecules, are precursors to macromolecules such as proteins and complex carbohydrates. They are also found as regulators of gene expression and thus control which proteins are made in a cell. Los Alamos National Laboratory researchers are studying metabolomics to help us learn what kind of metabolism a cell uses, how it manages energy, even how these pathways change if the organism is infected with a pathogen. Studying the metabolomics of the pathogen itself may help indicate what makes the organism pathogenic.



LC-ICR-LTQ mass spectrometer for high resolution mass measurement

Status:

Los Alamos is seeking partners interested in joint collaborations in metabolomics research and to develop intellectual property in this area. The Laboratory has a unique user facility, the National Stable Isotope Resource (NSIR), available for such collaborative endeavors.



Metabolite levels can change even when proteins do not, and overall there are fewer metabolites, creating a less difficult analysis problem than studying proteins alone. Metabolites can also be used in conjunction with knockout mutations to provide insights into the roles of genes of unknown functions.