OMICS Group Conferences
Accelerating Scientific Discovery

2nd International Conference and Exhibition on
Metabolomics & Systems Biology

April 8-10, 2013 Hilton Chicago/Northbrook, USA

Metabolic profiling of human colorectal cancer: A top-down approach to translational cancer research

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Abstract

Tumor cells exhibit distinct metabolic phenotypes that are essential for them to sustain higher proliferative rates and resist some cell death signals, altering the flux along key metabolic pathways, such as glycolysis and glutaminolysis. When used as a translational research tool, metabolomics enables the discrimination of distinct metabolic profiles and metabolite markers noninvasively *in vivo* that correlate to pathological stages and different responses to treatment modalities. Cancer metabolomics research aims at evaluating and predicting pathophysiological changes of cancer patients by investigating metabolic signatures in body fluids or tissues, which are influenced by genetics, epigenetics, environmental exposures, diet, and behavior. A particular advantage of metabolomics is that it represents a top-down tactic in that all of the molecules detected are interrogated, providing a global picture of dynamic metabolic changes involving key markers and pathways that were not already associated with carcinogenesis.

We describe here our studies with mass spectrometry based metabolomic profiling of serum, urine and tissue samples from colorectal cancer (CRC) patients. The metabolic profile of CRC involves several significantly altered pathways, including increased glycolysis and an impaired TCA cycle, glutaminolysis, down-regulated urea cycle, dysregulated tryptophan, nucleotides, carnitine, and choline metabolism, and a significantly altered gut microbial-host co-metabolism. Our experimental results highlight the potential for the metabolomic approach to have a multitude of uses in oncology, including the early detection and diagnosis of cancer and as both a predictive and prognostic marker of therapeutic effect.

Biography

Wei Jia is Professor and Co-Director of the Center for Translational Biomedical Research, the University of North Carolina at Greensboro. He also serves as Director of the Metabolomics Core Lab at the David H Murdock Research Institute, Kannapolis, North Carolina. Jia was previously Professor and Vice Dean, School of Pharmacy, Shanghai Jiao Tong University in China, and has worked nearly a decade on biochemical profiling of botanical preparations and metabolomics. Professor Jia's current research focuses on mass spectrometry (MS)-based metabolomics profiling technologies to investigate metabolic phenotypes and metabolic transformation in cancer and metabolic disorders.