CDB SEMINAR

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Thursday, May 13, 2010

16:00~17:00 C1F CDB Auditorium

Differential Metabolomics for Assessment of N-Acetyl-L-Cysteine Pretreatment in Strenuous Exercise: A Quantitative Model of Oxidative Stress Inhibition for Fatigue Reduction

Summary

Despite several decades of active research, the success of large-scale clinical trials involving antioxidants remains equivocal given the complex biological interactions of reactive oxygen/nitrogen species in human health. Herein, we outline a differential metabolomics strategy by capillary electrophoresis-electrospray ionization-mass spectrometry (CE-ESI-MS) to assess the efficacy of nutritional intervention to attenuate oxidative stress induced by strenuous exercise. A healthy volunteer was recruited to perform a submaximal prolonged ergometer cycling trial until volitional exhaustion with frequent blood collection over a 6 h time interval, which included pre-, during, and postexercise periods while at rest. A follow-up study was subsequently performed by the same subject after high-dose oral intake of N-acetyl-l-cysteine (NAC) prior to performing the same exercise protocol under standardized conditions.

Time-dependent changes in global metabolism of filtered red blood cell lysates by CE-ESI-MS were measured to reveal a significant attenuation of cellular oxidation associated with high-dose oral NAC intake relative to a control. Untargeted metabolite profiling allowed for the identification and quantification of several putative early- and late-stage biomarkers that reflected oxidative stress inhibition due to nutritional intervention. Our work demonstrates the proof-of-principle that NAC pretreatment is effective at dampening acute episodes of oxidative stress by reversible perturbations in global metabolism that can provide deeper insight into the mechanisms of thiol-specific protein inhibition relevant to its successful translation as a prophylaxis in clinical medicine.

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