Frank Reidy Research Center for Bioelectrics

Seminar Series

Mitochondrial bioenergetics in a non-obese model of type 2 diabetes mellitus: Experimental and Computational Analysis

Speaker: Nicola Lai, Ph.D.
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When: 9:00 AM, Tueesday, Sept. 27, 2016

Where: 1st floor conference room, IRP II

Abstract:

Skeletal muscle metabolic functions, which are vital for maintaining health and quality of life, decline with type 2 diabetes mellitus (T2DM) and is accompanied by mitochondrial dysfunction and insulin resistance. The causes leading to skeletal muscle insulin resistance point to an accumulation of lipids that appear to impair insulin-signaling pathway. However, it is not clear whether the lipid accumulation is caused by mitochondria dysfunction rather than an enhanced fatty acid transport and/or overload. In this talk, a systems biology approach to study skeletal muscle energy metabolism in a non-obese model of T2DM will be discussed. To evaluate bioenergetic function in both populations of skeletal muscle mitochondria, oxidative phosphorylation and biochemical assays were used to dissecting and analyzing mitochondrial electron transport chain components. To quantify the regulation of bioenergetic processes and fuel utilization as well as identifying the factors limiting oxidative phosphorylation, mathematical models were used combining biochemical, biophysical and physiological processes. Our new findings do not support a primary role of mitochondria in the pathogenesis of skeletal muscle insulin resistance.

Biosketch:

Nicola Lai received his PhD degree in chemical engineering from the University of Pisa, Italy. From 2002 to 2005, he was a Researcher at the Center for Advanced Studies, Research and Development (CRS4) in Sardinia, Italy. After his postdoctoral studies at Case Western Reserves University (CWRU), Cleveland, Ohio, he became a Research Assistant Professor in the department of Biomedical Engineering at CWRU. In this position, he was the recipient of the Career Development Award, supported by NIAMS-NIH, for his project on Systems Biology Investigation of Muscle Exercise Metabolism in Diabetes. His research interests include the regulation of cellular energy transfer and metabolism in skeletal muscle at both mitochondrial and tissue/organ levels in healthy and disease during conditions that challenge homeostasis (e.g., exercise) and throughout the course of adaptations to a chronic stress (e.g., training). He applies an integrated systems physiology approach that combines computational modeling with biochemical and physiological experiments. Cellular mechanisms responsible for metabolic dysfunction in disease states can be quantitatively analyzed to target therapeutic intervention with an effect on key metabolic homeostatic pathways. Currently, he is an Associate Professor in the Department of Electrical Engineering and Biomedical Engineering Institute at Old Dominion University.

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