Insulin stimulates mitochondrial fusion and function in cardiomyocytes via the AktmTOR-NFkB-Opa-1 signaling pathway

Parra, Valentina

Verdejo, Hugo E.

Iglewski, Myriam

Del Campo, Andrea

Troncoso, Rodrigo

Jones, Deborah

Zhu, Yi

Kuzmicic, Jovan

Pennanen, Christian

Lopez-Crisosto, Camila

Jaña, Fabián

Ferreira, Jorge

Noguera, Eduard

Chiong, Mario

Bernlohr, David A.

Klip, Am

Insulin regulates heart metabolism through the regulation of insulin-stimulated glucose uptake. Studies have indicated that insulin can also regulate mitochondrial function. Relevant to this idea, mitochondrial function is impaired in diabetic individuals. Furthermore, the expression of Opa-1 and mitofusins, proteins of the mitochondrial fusion machinery, is dramatically altered in obese and insulin-resistant patients. Given the role of insulin in the control of cardiac energetics, the goal of this study was to investigate whether insulin affects mitochondrial dynamics in cardiomyocytes. Confocal microscopy and the mitochondrial dye MitoTracker Green were used to obtain three-dimensional images of the mitochondrial network in cardiomyocytes and L6 skeletal muscle cells in culture.

Three hours of insulin treatment increased Opa-1 protein levels, promoted mitochondrial fusion, increased mitochondrial membrane potential, and elevated both intracellular ATP levels and oxygen consumption in