Mitochondrial calcium ion transport

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Introduction

Reactome is open-source, open access, manually curated and peer-reviewed pathway database. Pathway annotations are authored by expert biologists, in collaboration with Reactome editorial staff and cross-referenced to many bioinformatics databases. A system of evidence tracking ensures that all assertions are backed up by the primary literature. Reactome is used by clinicians, geneticists, genomics researchers, and molecular biologists to interpret the results of high-throughput experimental studies, by bioinformaticians seeking to develop novel algorithms for mining knowledge from genomic studies, and by systems biologists building predictive models of normal and disease variant pathways.

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Literature references


Reactome database release: 79

This document contains 2 pathways and 5 reactions (see Table of Contents)
Divalent calcium ions (Ca²⁺) are transported from the cytosol into the mitochondrial matrix and back out of the matrix into the cytosol (reviewed in Santo-Domingo et al. 2010, De Stefani et al. 2016). In the matrix, Ca²⁺ binds and allosterically regulates pyruvate dehydrogenase, isocitrate dehydrogenase, 2-oxoglutarate dehydrogenase, and possibly other enzymes (Rizzuto et al. 2012). Matrix calcium is also observed to regulate release of caspase cofactors and calcium flux through channels on neighboring membranes. The pathway into the mitochondrion involves VDAC1, VDAC2, and VDAC3 in the outer membrane and the mitochondrial calcium uniporter (MCU) complex in the inner membrane. VDACs in the open conformation are anion channels. However in the closed conformation they transport Ca²⁺ from the cytosol to the intermembrane space. When calcium concentrations in the cytosol and intermembrane space are high, the MCU complex opens and transports Ca²⁺ from the intermembrane space to the mitochondrial matrix using the driving force of the membrane potential (reviewed in Drago et al. 2011, Marchi et al. 2014, De Stefani et al. 2015).

Efflux of Ca²⁺ from the matrix to the intermembrane space is catalyzed by the Na⁺/Ca²⁺ antiporter SLC8B1 (NCLX) located in the inner membrane. LETM1 is also observed to export calcium from the matrix to the intermembrane space by acting as an H⁺/Ca²⁺ antiporter, although somewhat contradictory results have been found in knockdowns of LETM1. Calcium in the intermembrane space may be transported to the cytosol by the Na⁺/Ca²⁺ antiporter SLC8A3 (NCX3), however the mitochondrial localization of SLC8A3 is controversial and SLC8A3 has a limited distribution among tissues.

**Literature references**


**Editions**

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VDAC1,2,3 translocate calcium from the cytosol to the mitochondrial intermembrane space

Location: Mitochondrial calcium ion transport

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