Calcium dependent activation of mitochondrial ROS production in neurons and astrocytes

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Mitochondria is an organelle involved in various vitally essential processes in the cell. Besides main function -ATP production, mitochondria play a key role of in calcium signaling, reactive oxygen species production and cell death regulation. Although all these processes are described in detail, the mechanism of their interaction during the propagation of an intracellular signal remain unclear. Using live cell imaging in primary co-culture of neurons and astrocytes we studied the interaction of ROS and mitochondrial calcium uptake. We have found that addition of ATP or L-Glu triggered the calcium signal in astrocytes and neurons that initiate calcium uptake by mitochondria. Elevation of mitochondrial calcium stimulated an increase in the rate of ROS in mitochondria of neurons ($p = 0.035$) and astrocytes ($p < 0.01$). Ca2+-ionophore ionomycin is also induced activation of ROS production in mitochondria. Ca2+-induced increase of ROS production was dependent on the presence of uncoupler FCCP or inhibitor of mitochondrial complex I rotenone. Thus, mitochondrial calcium uptake in neurons and astrocytes in response to physiological stimulus can induce ROS production in mitochondria which is dependent of calcium on mitochondrial respiration. Activation of mitochondrial ROS production can play important role in physiology and development of pathology.

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