Insights into dynamics of mitochondrial network in primary fibroblasts derived from patients diagnosed with sporadic form of Alzheimer's disease

P-07-030

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Mitochondria are recognized as highly dynamic and interconnected organelles, which are characterized by repeated cycle of fusion and fission, turnover (biogenesis and mitophagy), as well as movement along the cytoskeleton. Tight control and proper functioning of these interdependent processes are essential for maintenance of vital functions of the cell. Recent studies revealed, that abnormal mitochondrial dynamics may contribute to pathological conditions and play a crucial role in many diseases. Moreover, wide events connected to impaired mitochondrial dynamics are one of the most early and prominent features in various neurodegenerative diseases. Detailed mechanisms of these deterioration are still lacking and have a far-reaching significance in studies of health and disorders.

In our investigation we analyzed three following aspects of mitochondrial physiology: mitochondrial turnover, transport and dynamics of mitochondrial network. Our study were conducted on primary fibroblasts derived from patients diagnosed with sporadic form of Alzheimer's disease (AD). Previous results showed diminished mitochondrial turnover, changes of the level of proteins involved in mitophagy and decreased level of factors engaged in biogenesis in AD cells. Furthermore mitochondria in AD cells were functionally older and created diverse mitochondrial network. Recent data indicate that mitochondrial network in AD is less fragmented, contain longer branch length and has an increased quantity of junctions. Additionally, the analysis of the dynamic of mitochondrial network architecture revealed some alterations in the number of fusion and fission events that occur during mitochondrial trafficking. We observe also changes in the track duration, track displacement, and track straightness.

To summarize, our results indicate that mitochondrial dynamics in fibroblasts derived from Alzheimer's disease patients is distinct than in control cells.