MOTOR CRC 1451

Motor Control Science Club, January 22, 2025, 11:00 AM CEST

The lecture is open to everybody

Mitophagy regulation in axons

Prof. Angelika Harbauer |
Max Planck Institute for Biological Intelligence,
Martinsried & Technical University of Munich,
Institute of Neuronal Cell Biology

Host:
Prof. Irina Dudanova |
Center for Anatomy,
University Hospital Cologne

Neurons with their elaborate and extended morphology must employ homeostatic mechanisms that allow neuronal mitochondria to exist far away from the cell body while still retaining a functional proteome. This process, called “Mitostasis”, is most likely a finely tuned concert of mitochondrial transport, local protein synthesis and local degradation by proteasomal and autophagic mechanisms. Modulation of these processes may prove beneficial in the treatment of neurodegenerative diseases.
However, the processes that allow local translation of mRNAs encoding for mitochondrial proteins are only partially understood. Using the transcript of PTEN-induced kinase 1 (PINK1) as a model substrate, we have discovered that this RNA associates with mitochondria specifically in neurons and uses mitochondria as a means of transport into axons and dendrites. This is a neuron specific mechanism driven by selective expression of an mRNA anchoring complex at the outer mitochondrial membrane which we termed mitochondrial hitch-hiking.
To get an unbiased insight into the amount of mitochondrial RNA hitch-hiking, we performed RNAseq of mitochondria isolated from retinal ganglion cell axons and motorneuron axons. This revealed a cell-type specific adaption of the amount of RNA hitch-hiking not only of the mRNA encoding Pink1, but of an entire class of proteins involved in mitophagy, synaptic and cytoskeletal processes, that may be driven by the local availability (or absence) of these transcripts. This suggests fundamental difference in axonal biology between glutamatergic and cholinergic axons.

Live @
Department of Neurology, Building 30
Universitätsklinikum Köln
Kerpener Str. 62
50937 Köln
https://lageplan.uni-koeln.de/#!30

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