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RESEARCH AREA

Key to the long-term survival of the nervous system is its resilience towards unwanted environmental effects coupled to plasticity and regeneration following adverse events. Nerve injuries, traumatic spinal cord and brain injury, neurodegenerative diseases, viral infections, and certain chemotherapeutic agents all compromise the integrity of the nervous system. Injury, for example, results in short-term cell death and degeneration of neurites in the vicinity of the injury, which in turn may lead to inflammation and neurodegeneration that can last for years, damaging other cells. Debris and dead cells that form after injury are cleared by glial cells, which make up half of the nervous system. Without removal of debris by microglia, which represent the major phagocyte population in the brain, secondary damage may be much more sustained and severe than with normal phagocytic activity. Therefore, it is important to understand the regulation of glial phagocytosis after nerve injuries. Our working group studies glial phagocytic processes and membrane-limited degradation pathways involved in lysosomal degradation of extracellular cargoes such as axonal debris and internal cell constituents such as regulatory proteins, in the nervous system of Drosophila melanogaster or fruit fly. The ensheathing and wrapping glia of Drosophila have similar phagocytic function to microglia and use a similar phagocytic receptor as mammalian glia. The genetic toolkit and neural complexity of Drosophila allows us to obtain results that are relevant in vivo, more rapidly in contrast to those obtained in cell cultures and that are potentially translatable to mammals.

TECHNIQUES AVAILABLE IN THE LAB

The following techniques can be mastered in our laboratory without the need for exclusiveness. It is typical that experiments usually suggest new lines of research that calls for introduction of new techniques. Techniques: • fluorescent confocal and structured illumination microscopy • image analysis of images obtained from microscopy • recombinant DNA techniques • Drosophila genetics, transgenesis • RNA and protein biochemistry • Examination of Drosophila behaviour - such as sleep, locomotor activity • lifespan experiments • transcriptomics and proteomics sample preparation.

SELECTED PUBLICATIONS

Szabó, Á.*, Papin, C. *, Cornu, D., Chélot, E., Lipinszki ,Z., Udvardy, A., Redeker, V., Mayor, U., Rouyer, F. (2018) Ubiquitylation Dynamics of the Clock Cell Proteome and TIMELESS during a Circadian Cycle. **Cell Reports 23:** 2273-2282.

Alexopoulou, Z., Lang, J., Perrett, R.M., Elschami, M., Hurry, M.E., Kim, H.T., Mazaraki, D., **Szabó, Á.**, Kessler, B.M., Goldberg, A.L., Ansorge, O., Fulga, T.A., Tofaris, G.K. (2016) Deubiquitinase Usp8 regulates α-synuclein clearance and modifies its toxicity in Lewy body disease. **PNAS 113:** E4688-97.

Szabó, Á., Tofaris, G.K. (2019) Monitoring α-Synuclein Proteotoxicity in Drosophila Models. **Methods Mol Biol 1948:** 199-208.

Bhattacharjee, A. *, **Szabó, Á.***, Csizmadia, T., Laczkó-Dobos, H., Juhász , G. (2019) Understanding the importance of autophagy in human diseases using Drosophila. **J Genet Genomics 46:** 157-169.