Open Ph.D. projects

1.

Announcer: Hajnalka Laczkó-Dobos

Doctoral School: University of Szeged, Faculty of Science and Informatics, Doctoral School of Biology

Title of the research topic: Lysosome heterogeneity

Description of the research topic: Lysosomes are membrane-bound organelles within our cells, and these are responsible for degradation and recycling of different cargos (macromolecules, damaged organelles, bacteria, viruses). The cargoes can be delivered to the lysosomes by different routes: by autophagy (from the cytoplasm) or via endocytosis or phagocytosis (from the plasma membrane and outside of cells). Lysosomes show a large variation in their size and shape compared to the relative uniformity of other cellular organelles. Despite the critical role of lysosomes, regulation of their activity and the functional consequences of their astonishing heterogeneity arising specifically in animal and human cells are mostly unknown. By having different types of lysosomes, cells can efficiently break down a wide range of materials. In this project we will establish how the localization, size, pH, and degradation capacity of lysosomes influence individual fusion events, and how these parameters change because of autophagic vesicle fusions. To answer our questions, we use biochemical, molecular biological, genetic, omics, and microscopic approaches. The study of lysosomal heterogeneity is of great biomedical importance, since it is known that malfunction of lysosomal degradation can lead to numerous neurodegenerative diseases for example. Our results may contribute to the development of strategies to preserve cognitive abilities.

2.

Announcer: Gábor Juhász

Doctoral School: University of Szeged, Faculty of Science and Informatics, Doctoral School of Biology

Title of the research topic: Analysis of lysosomal vesicle transport and degradation

Description of the research topic: Eukaryotic cells break down and recycle their own material in lysosomes via autophagy. This catabolic pathway ensures the turnover of cellular organelles and macromolecules and slows down the aging process, and it is required for the organism's survival during starvation. In recent years, important roles for autophagy were identified in various pathologies including cancer, neurodegenerative diseases, and infections. Despite the 2016 Nobel Prize we still know relatively little about the precise role of this process, and the underlying molecular mechanisms are incompletely understood. During endocytosis/phagocytosis, the cell takes up material from its environment (such as bacteria, growth factors), which may also be degraded in lysosomes. The aim of the PhD project is to

investigate these degradation routes using molecular genetics, biochemistry, cell and developmental biology in Drosophila and mammalian cells. The specific research topics will be developed in consultation with the applicants.

3.

Announcer: Áron Szabó
Doctoral School: University of Szeged, Faculty of Science and Informatics, Doctoral School of Biology
Title of the research topic: Glia-neuron interactions in Drosophila
Description of the research topic: Glia support neuronal function in various ways and there is ample crosstalk between the two cell types that can influence the fate and survival of either partner. We are interested in membrane trafficking pathways in glia, especially phagocytosis, early damage signalling and their involvement in neuronal death, axon degeneration and regeneration. We also study how neuroinflammation is fuelled by glial immunity leading to demise of neurons and the role of purinergic pathways in neuron-glia signalling. We use Drosophila as a versatile and genetically tractable model that offers unsurpassed access to cell types and their genetic manipulation in the nervous system. Simple injury paradigms such as wing transection for the peripheral tissues and antennal ablation or traumatic brain injury for the CNS are used to inflict reproducible injuries. A combination of advanced genetics, fluorescence and electron microscopy, cell type-specific proteomics/ transcriptomics and behavioural tests is applied to tackle the questions arising from the investigation of the above-mentioned topics