Project 1.8 The Role of NONO Protein in Neuronal Activity-Dependent Gene Expression, Structural Plasticity, and Animal Behavior

Supervisor: Adriana Magalska, PhD Dsc.
Laboratory: Laboratory of Spatial Epigenetics
www: https://nencki.edu.pl/laboratories/laboratory-of-spatial-epigenetics/

Background:

We are looking for passionate and creative individuals who view science as a lifelong passion and not just a career. Our ideal candidates are curious about the world, eager to learn, and enthusiastic about asking and answering questions related to our project. If you find joy in scientific discovery and are motivated by the thrill of uncovering new knowledge, we encourage you to apply.

Activation-dependent transcription in neurons is crucial for responding to environmental signals, impacting many physiological and pathological processes. The products of activity-induced genes support memory and learning through neuronal plasticity. Despite extensive research, the regulation of activity-dependent gene transcription and its role in behavioral adaptations remain unclear.

NONO protein, a candidate for bridging DNA, RNA, and protein, plays a significant role in gene expression regulation. It is implicated in various transcription processes, RNA splicing, export, and local translation. NONO is vital for brain development, with mutations causing X-linked intellectual disability syndrome. In mice, NONO knockout leads to neurological and behavioral deficits, but it is unclear whether these issues stem from abnormal brain development or faulty neuronal plasticity.

Aim:

This project aims to characterize NONO protein's role in regulating gene expression following neuronal activation. Preliminary data indicate that NONO reorganizes upon neuronal stimulation, forming condensates that colocalize with activated RNA polymerase II. We hypothesize that NONO assembles transcriptional domains essential for proper neuronal gene expression regulation.

Using Caenorhabditis elegans as a model organism, we will employ a holistic approach, combining cell imaging and functional analysis of NONO binding partners at the DNA, RNA, and protein levels. We will investigate the consequences of NONO depletion on dendritic spine and synapse structural changes, neuronal cell electrophysiology, and animal behavior to better understand NONO's role in synaptic plasticity.

Requirements:

We are seeking a highly motivated individual with a scientific interest in neuroscience, cell biology, cell nucleus, and microscopy. Ideal candidates will possess the following qualifications:

- higher education in biology or biotechnology,
- experience in laboratory teamwork and hands-on experience in cell culture, cellular and molecular biology (especially cloning), and C. elegans handling,
- very good command of English, both spoken and written (knowledge of Polish is not a requirement),
- knowledge of microscopy and microscope image processing will be an additional advantage,
- intermediate computer skills and ability to work with biological databases (knowledge of sequence analysis and statistics is not a requirement but will be welcome),
- ability to thoroughly and critically study professional literature,
- ability to formulate scientific hypotheses,
- creative approach to solving problems,
- good organizational skills,
- if you are excited about contributing to interesting research in neuroscience and cell biology, and you find joy in scientific exploration, we encourage you to apply and join our team.