Project 1.3 The role of lipid modifications of proteins in functional neuronal plasticity, learning and memory

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Background:

One of the most fundamental features of the brain is its ability to process and store information in organized neural networks. The brain may adapt in response to various conditions by modifying synapses morphology and efficacy of synaptic transmission. Understanding of the mechanisms of synaptic plasticity and neuronal network code lies in the center of contemporary neurobiology, neuropharmacology and medicine. Every synapse contains thousands of proteins which shuttle between the site of synthesis and the site where they play their functions such as neuronal membrane. We think that reversible post translational protein modifications such as covalent addition of palmitic acid (S-palmitoylation) plays a crucial role in synaptic plasticity and learning.

Aim:

The aim of this project is to describe the role of S-palmitoylation in synaptic plasticity and learning. We are searching the factors that trigger S-palmitoylation and analyze the time-course of this process in response to various patterns of neuronal network activity. We will use in vivo and in vitro models and record electrical signals from individual proteins, synapses and neuronal networks in palmitoylated and non-palmitoylated states. We plan to employ various biochemical techniques enabling us to detect modified synaptic proteins. Next, we will genetically manipulate the S-palmitoylation level in neuronal cultures and cell lines and perform behavioral tests to verify memory in transgenic animals with modified activity of palmitoyl transferases.

Requirements:

- strong interest in neuroscience,
- documented experience in work with at least two research techniques planned in the project (electrophysiological techniques, behavioral techniques, imaging techniques, cell cultures, molecular biology or mass spectrometry),
- the programming skills (Matlab, R, Python) will be considered as a significant advantage.