DANDRITE

Double Topical Seminar

Date: Thursday 1 May 2025
Time: 11:00 - 12:00
Venue: Nucleus auditorium (1871-120)
Address: Universitetsbyen 81

Host: Poul Nissen
OPEN TO ALL INTERESTED

Local control of membrane trafficking drives axon initial segment plasticity

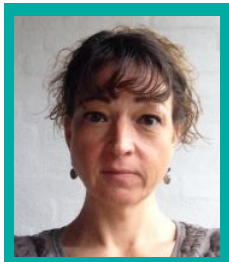
Activity-dependent plasticity of the axon initial segment (AIS) allows neurons to adapt action potential output to changes in network activity and is emerging as a crucial regulator of network activity homeostasis. Action potential initiation at the AIS highly depends on the local density and distribution of voltage-gated sodium channels, but the molecular mechanisms regulating their plasticity remain largely unknown. Using endogenous tagging approaches, we find that the rapid shortening of the AIS during plasticity is associated with a reduction of Nav1.2 channels in this compartment. This reduction depends on clathrin-mediated endocytosis and occurs preferentially in the distal part of the AIS. Moreover, activity-driven AIS shortening increases the threshold for action potential generation. This study reveals how rapid activity-dependent AIS reorganization fine tunes neuronal excitability.

Amélie Freal
Assistant professor
Neuroscience Institute
Amsterdam University Medical Center

Seminar from 11:00 - 11:30

A toolbox of compartment-localized rhodopsins for optogenetic control of the axon initial segment

Optogenetic probes are powerful biological tools, which enable non-invasive, light-based experiments in nerve cells. The optogenetic toolbox is rapidly expanding and includes probes that provide control over a variety of cellular activities in addition to probes reporting various signaling events. While optogenetic probes are often localized evenly throughout the cell, subcellular control is required to uncover effects of local signaling events. Here, we developed optogenetic probes specific for the axon initial segment (AIS), the proximal axonal site responsible for the initiation of action potentials. By fusing combinations of AIS localization sequences to optogenetic probes, we developed multiple probes, each displaying a unique AIS localization pattern thereby allowing for optogenetic control of the AIS and even subcompartments within it.



Hanne Borger Rasmussen
Associate professor
Dept. Biomedical Sciences
University of Copenhagen

Seminar from 11:30 - 12:00

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