Module 8:
Molecular basis of synaptic plasticity

iDN
Institute of Developmental Biology and Neurobiology

Module description

Synapses constitute the main connection element between neurons. Synapse structure and function define the neuronal network activity and underlie the processes of learning and memory. The diversity and plasticity of synaptic connections are based on their molecular composition. In this module, we will overview the main structural principles and molecular components of excitatory and inhibitory synapses in the context of their function and contribution to synaptic plasticity. The lectures will be accompanied by literature seminars to discuss current findings in this vibrant field.

In the practical part of Module A, we will use neuronal preparations that allow accessing the fine structure of individual synapses. Here, we will provide an opportunity to gain hands-on experience of working with various types of synapses in preparations form fruit fly and mouse. Using a combination of optical and electrophysiological methods, you will directly evaluate structural and functional aspects of synaptic transmission and perform the registration, manipulation and analysis of synaptic responses. In the practical Module B, you will choose and run a personal project (4 weeks) involving a more detailed analysis of synaptic activity to address specific questions related to current projects in the lab. Here, the primary focus is the role of voltage-gated calcium channels and adhesion molecules in formation, maintenance and plasticity of synaptic connections.

Requirements

Bachelor degree in Biology,
Molecular Biology
or related disciplines

Eligible participants

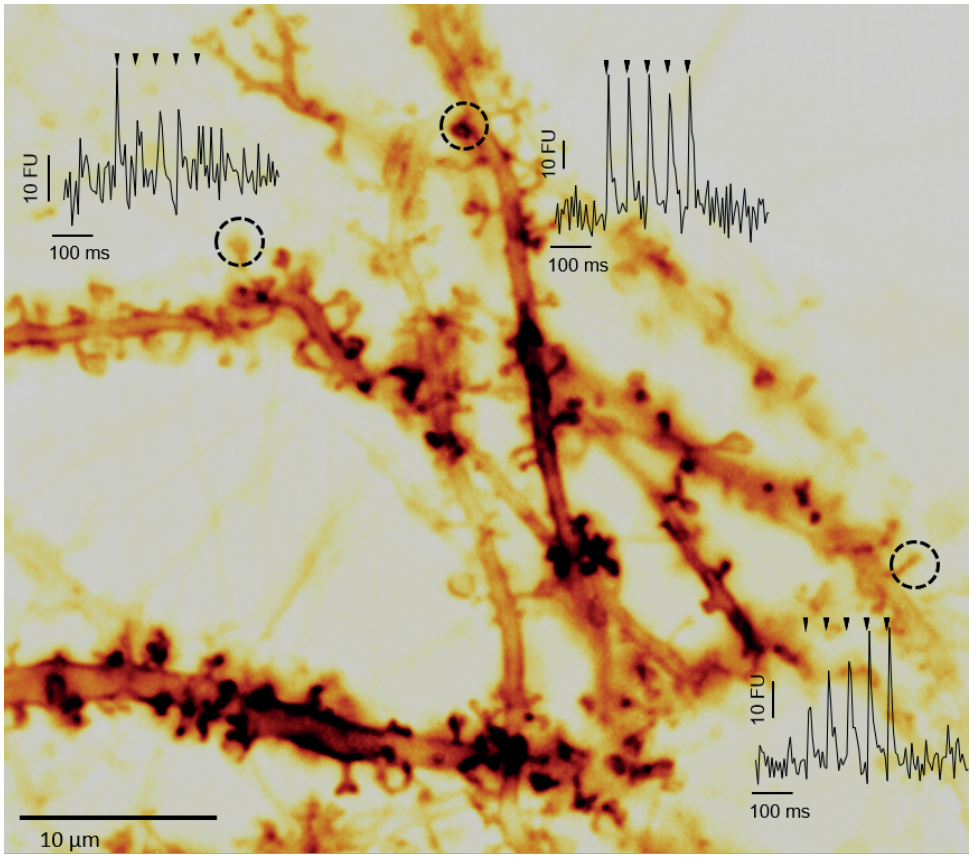
Master students of the
1st and 2nd semester

Availability

Winter semester,
max. 12 students

Responsible Persons

Prof. Dr. Martin Heine
Dr. Artur Bikbaev



Mouse hippocampal neurons (21 DIV) expressing a Glutamate Sensor within the cell membrane. The shown dendritic segments are decorated with postsynaptic spines, which show variable responses to a 20 Hz train of action potentials (illustrated for three examples)