SFB 1315
Mechanisms and Disturbances in Memory Consolidation:
From Synapses to Systems

Tuesday

APR 21, 2020
4:00 pm

ZOOM Lecture
Meeting ID | 7754910236

SFB 1315 LECTURE SERIES 2019-2020

MECHANISMS OF EXPERIENCE-DEPENDENT NEURONAL COMPUTATIONS

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The fundamental function of individual neurons is to produce an axonal output by integrating excitatory and inhibitory synaptic inputs.

My research sheds light on how changes in this input-output-transformation impact behaviorally relevant brain functions, especially in the context of tasks that require learning. Thus, I have been studying the mouse hippocampal area CA1, as this region is known to be involved in spatial learning. I found that broadly tuned synaptic inhibition is essential for producing the spatially localized firing fields of CA1 place cells ('place fields'). Inhibition selectively counteracts out-of-field synaptic excitation, thus suppressing the firing of action potentials outside of the neuron's place field and preserving the sparseness of the spatial code in CA1. Furthermore, I co-discovered a new kind of plasticity, called behavioral timescale synaptic plasticity (BTSP), which is driven by a specific type of dendritic spike, Ca2+ plateau potentials ('plateaus'), and produces place fields in CA1 neurons. BTSP provides a neural mechanism for one-trial learning as a single plateau is sufficient to modify synaptic strength. My most recent results point towards a fundamental role of BTSP in allowing experiences to shape CA1 representations and, thus, identify plateaus as a key signal that instructs CA1 neurons in how to represent an environment.

Taken together, my research provides a mechanistic understanding of how synaptic integration and plasticity shape feature-selective responses of neurons, mediate the formation of experience-dependent representations, and enable neural circuit computations to drive adaptive behaviors.

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