

Introductory Remarks to Symposium 21

Pushing and pulling: how the interplay of excitation and inhibition shapes network dynamics

Mattia Chini and Sebastian H. Bitzenhofer, Hamburg

Synaptic excitation and inhibition are temporally and spatially tightly coupled in neuronal networks. Even simple stimuli lead to the concomitant occurrence of excitation and inhibition, controlled by the interplay between pyramidal neurons and interneurons. This ultimately results in a delicate dynamic balance between the amount of excitatory and inhibitory postsynaptic currents (excitation-inhibition ratio). Theoretical work suggests that a balanced excitation-inhibition ratio stabilizes cortical networks and enables flexible processing of information. How the balance of excitation-inhibition ratio emerges during development and how it coordinates network functions are questions of open investigation.

The proposed symposium aims at providing a comprehensive overview of recent key findings on how excitation-inhibition ratio affects information processing and neuronal network dynamics by bringing together theoretical perspectives and experimental data from humans and animal models.

Anna Levina will address how self-organization of synaptic connections in neuronal cultures stabilizes the excitation-inhibition ratio to maintain stable and robust dynamics in neuronal networks. Julijana Gjorgjieva will discuss how spontaneous activity and the organization of synaptic inputs on the dendrites of cortical neurons affect excitation-inhibition balance and neuronal network dynamics in the developing mouse brain. Irina Pochinok will describe experimental and computational work highlighting how the developmental emergence of hippocampal ripples is promoted by a relative increase of inhibition. Richard Gao will present data on model-based inference of excitation-inhibition ratio and other physiological variables from multiscale neural data. Thomas Pfeffer will leverage multi-scale computational modeling and human EEG/MEG data to show how different neuromodulatory systems modulate the balance between excitation and inhibition in cortical circuits.

Symposium 21

*Thursday, March 23, 2023
16:15 - 18:15, Lecture Hall 10*

Chairs: Mattia Chini and Sebastian H. Bitzenhofer,
Hamburg

- 16:15 Anna Levina, Tuebingen
NEURONAL CIRCUITS OVERCOME IMBALANCE IN EXCITATION AND INHIBITION BY ADJUSTING CONNECTION NUMBERS (S21-1)
- 16:40 Julijana Gjorgjieva, Munich
STABILITY AND LEARNING IN EXCITATORY SYNAPSES BY NONLINEAR INHIBITORY PLASTICITY (S21-2)
- 17:05 Irina Pochinok, Hamburg
A DEVELOPMENTAL INCREASE OF INHIBITION PROMOTES THE EMERGENCE OF HIPPOCAMPAL RIPPLES (S21-3)
- 17:20 Richard Gao, Tuebingen
MECHANISTIC MODEL INFERENCE FROM OBSERVED NEURODYNAMICS (S21-4)
- 17:45 Thomas Pfeffer, Barcelona, Spain
NEUROMODULATORY REGULATION OF LARGE-SCALE CORTICAL DYNAMICS AND BEHAVIORAL VARIABILITY IN HEALTHY HUMANS (S21-5)
- 18:10 **Concluding Remarks**