Introductory Remarks to Symposium 10

How single neuron properties determine network dynamics

Andreas Draguhn and Hannah Monyer, Heidelberg

Behavior and cognition depend critically on cooperative activity of neurons. The concept of `neuronal ensembles´ suggests that reproducible spatiotemporal activity patterns of selected neurons form elementary representations in sensory, motor, mnemonic or higher associative systems. During past years, considerable progress has been made in unravelling the cellular and network-level mechanisms underlying the formation and re-activation of ensembles. The focus of these analyses has been on synaptic interactions and plasticity, connectivity patterns and dynamic network states, esp. coherent oscillations. More recently, new molecular tools have allowed selectively manipulating network patterns in living animals and, hence, analyzing their causal role in selected behavioral and cognitive tasks.

However, several major questions remain open, especially regarding the selective activation of defined cells. How does a neuron `know´ that it should be activated in a given situation, and when precisely it should spike within the highly organized temporal pattern of activity? How is background activity of non-participating neurons reliably suppressed? How are ensembles stably activated during different network states (e.g. different oscillation patterns)?

This symposium will focus on one peculiar group of mechanisms contributing to the highly organized behavior of neuronal networks – intrinsic neuronal properties. Convergent experimental and theoretical results indicate that membrane properties are extremely important (though understudied) determinants of collective neuronal behavior within networks. Prominent examples are frequency-dependent changes in membrane conductance (resonance), non-linear integration of synaptic inputs (dendritic electrogenesis), kinetic properties of ion channels (spike waveform) and the integration of irregular voltage fluctuations (noise). The present symposium will join leading experts in this field who will present new concepts and results at the interface between cellular and systems neuroscience.

Symposium 10

Thursday, March 23, 2017
11:30 - 13:30, Lecture Hall 10

Chairs: Andreas Draguhn and Hannah Monyer, Heidelberg

11:30 **Opening Remarks**

11:40 Raoul M. Memmesheimer, Frankfurt/Main
HIPPOCAMPAL NONLINEAR DENDRITES, MEMORY AND HIGH FREQUENCY OSCILLATIONS (S10-4)

12:00 Susanne Schreiber, Berlin
TOO HOT TO FUNCTION PROPERLY? ON THE TEMPERATURE DEPENDENCE OF NETWORK SYNCHRONIZATION (S10-2)

12:20 Jeffrey C. Magee, Ashburn, USA
AN ADAPTIVE BEHAVIOR REQUIRES A MIXED NETWORK REPRESENTATION GENERATED BY ACTIVE DENDRITIC INTEGRATION (S10-3)

12:40 Tatjana Tchumatchenko, Frankfurt/Main
SHAPING NETWORK DYNAMICS VIA SINGLE-NEURON ACTIVATION FUNCTIONS (S10-1)

13:00 Chryssanthi Tsitoura, Aachen
INFRASLOW INTRINSIC RHYTHMOGENESIS IN A SUBSET OF MITRAL CELLS ENTRAINS OSCILLATORY MICROCIRCUITS IN THE ACCESSORY OLFACTORY BULB OF MICE (S10-5)

13:10 Jens Wilting, Göttingen
INFERRING COLLECTIVE NETWORK DYNAMICS FROM THE ACTIVITY OF FEW NEURONS (S10-6)

13:20 **Concluding Remarks**