

Introductory Remarks to Symposium 14

Tuning ion channels, myelin, and synapses for rapid axonal signaling

Stefan Hallermann, Leipzig

Communication between neurons relies on the propagation of action potentials along axons and the subsequent transmission at synapses. The resulting delay in neuronal communication ultimately limits the speed of information processing. High evolutionary pressure for rapid execution of complex behavioral tasks led to the development of exquisitely fast and temporally precise signaling mechanisms within and around the axon membrane. This symposium will address how the axonal and synaptic mechanisms are tuned for high-speed performance. First, Peter Jonas (Institute of Science and Technology, Austria) will focus on axonal sodium channels. The density and function of sodium channels are fundamental parameters determining the speed and reliability but also the metabolic costs of action potential propagation in unmyelinated axons. For repetitive action potential generation, potassium channels are equally essential. Lu-Yang Wang (University of Toronto, Canada) will discuss a novel form of short-term plasticity of potassium channels that ensures high-frequency action potential generation and enhances the fidelity of neurotransmission. In addition to optimal sodium and potassium channel performance, glial-cell derived myelin sheaths evolved. Myelinated axons conduct action potentials in saltatory manner and faster. Maarten Kole (Netherlands Institute for Neuroscience, Netherlands) will highlight the impact of the architecture of axonal myelin on action potential propagation. Finally, to transmit signals to other neurons en passant boutons and axon terminals release neurotransmitter. Takeshi Sakaba (Doshisha University, Japan) will focus on the mechanisms of vesicular transmitter release at a synapse in the auditory pathway, which is tuned for rapid synaptic transmission.

In summary, the symposium brings together experts in the research field addressing new insights into the critical parameters determining the speed of axonal signaling.

Symposium 14

Thursday, March 23, 2017
14:30 – 16:30, Lecture Hall 9

Chair: Stefan Hallermann, Leipzig

- 14:30 **Opening Remarks**
- 14:35 Peter Jonas, Klosterneuburg, Austria
NA⁺ CHANNELS IN GABAERGIC INTER-NEURON AXONS: SPEED VERSUS ENERGY EFFICIENCY (S14-1)
- 15:00 Lu-Yang Wang, Toronto, Canada
ACTIVITY-DEPENDENT FACILITATION OF PRE-SYNAPTIC POTASSIUM CURRENTS AND SHORT-TERM PLASTICITY AT A CENTRAL SYNAPSE (S14-2)
- 15:25 Maarten Kole, Amsterdam, The Netherlands
A BIOPHYSICAL FOUNDATION FOR RAPID SALTATORY CONDUCTION IN MYELINATED AXONS (S14-3)
- 15:50 Takeshi Sakaba, Kyoto, Japan
MECHANISM OF TRANSMITTER RELEASE AT THE CALYX OF HELD SYNAPSE (S14-4)
- 16:15 Niklas Byczkowicz, Leipzig
HYPERPOLARIZATION-ACTIVATED CURRENTS FACILITATE HIGH-FREQUENCY ACTION POTENTIAL FIRING IN CEREBELLAR MOSSY FIBERS (S14-5)
- 16:25 **Concluding Remarks**