Introductory Remarks to Symposium 32

Presynaptic calcium channels: key players in synaptic transmission and plasticity

Tina Pangrsic Vilfan and Tobias Moser, Goettingen

Voltage-gated calcium channels play a critical role in neuronal excitability, synaptic transmission, and excitation-contraction coupling. To support proper calcium signalling in different tissues, their biophysical properties are tailored to the cell-specific requirements via alternative splicing, RNA editing, as well as interaction with distinct auxiliary subunits and further channel modulators that exert their functions on one or the other calcium channel subtype. Channel interaction partners further determine the channel arrangement within the target membranes. At synapses, channels typically cluster in the presynaptic active zones where synaptic vesicles are released. The probability of vesicle release that is triggered by calcium entry through these channels is heterogeneous among synapses of different cells and even within the same cell. Furthermore, at least at some synapses, it may change dynamically over time and as a function of synapse' past activity. The research of the past years has revealed that the positioning of a channel in relation to other channels and synaptic vesicles is instructed via scaffolding proteins and further interaction proteins, including the proteins that directly link the channels to synaptic vesicles or presynaptic organelles. It however remains to be clarified how exactly these various factors regulate channel biophysical properties, abundance, topography, and mobility in distinct synapses to control and adjust the strength of synaptic function and tune it to the specific requirements of the particular synapse.

The symposium will address recent advances in our understanding of the underlying mechanisms revealed by various approaches including single active zone and synaptic bouton calcium imaging, and single channel imaging. The speakers will address the structural determinants of calcium channels and their interaction partners that critically influence their function, for example in sensory encoding. They will further discuss topographical arrangements of channels in different types of synapses, present scaffolding proteins that are involved in regulation of channel mobility and abundance upon homeostatic synaptic potentiation, and shed light on our current understanding of the possibly common mechanisms underlying the functional heterogeneity across synapses in different systems.

Symposium 32, Friday, March 24, 13:00 - 15:00

Symposium 32

Friday, March 24, 2023
13:00 - 15:00, Lecture Hall 10

Chairs: Tina Pangrsic Vilfan and Tobias Moser, Goettingen

13:00 **Opening Remarks**

13:05 Tina Pangrsic Vilfan, Goettingen
MODULATION OF CAV1.3 CHANNELS BY CALCIUM BINDING PROTEINS (S32-1)

13:30 Stephan Sigrist, Berlin
AN ACTIVE ZONE STATE SWITCH CONCENTRATES AND IMMOBILIZES VOLTAGE-GATED CA^{2+} CHANNELS TO BOOST VESICLE RELEASE (S32-2)

13:55 David A. DiGregorio, Paris, France
FUNCTIONAL SYNAPTIC DIVERSITY: FROM MOLECULES TO COMPUTATIONS (S32-3)

14:20 Tobias Moser, Goettingen
CAV1.3 CA^{2+} CHANNELS: KEY PLAYERS IN WIDE DYNAMIC RANGE SOUND ENCODING (S32-4)

14:45 Nare Karagulyan, Goettingen
UNDERSTANDING SYNAPTIC MECHANISMS OF SOUND INTENSITY CODING IN MICE WITH ALTERED CAV1.3 GATING (S32-5)

Symposia