



# GUEST LECTURES

## Prof. Dr. Christian Henneberger

Institute of Cellular Neurosciences, University of Bonn, Germany

>> „Structural constraints of neuron-astrocyte interactions at glutamatergic synapses“ <<

**Hosted by: Hadi Mirzapourdelavar**

20.06.2022

2:00 – 3:30 p.m.

Zoom

### Zoom Login

<https://ovgu.zoom.us/j/61028626617?pwd=eWJLSkVvWnd2Tlo1WUIMUWZSdExGQT09#success>

Meeting ID: 61028626617

Password: MED-DO-40

Organizer contact info:

Jana Haselhorst  
[contact@synage.de](mailto:contact@synage.de)  
[www.synage.de](http://www.synage.de)



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## RTG 2413

### Abstract

Neuronal communication at excitatory synapses is shaped by astrocytes and their perisynaptic processes through mechanisms such as local astrocytic neurotransmitter uptake and release of signalling molecules. However, the coverage of individual synapses by perisynaptic astrocytic processes varies strongly between synapses and the rules and mechanisms that govern perisynaptic astrocyte morphology and function is only partly understood. Therefore, we explored the patterns of astrocyte coverage of individual excitatory synapses in the CA1 stratum radiatum of the hippocampus using superresolution microscopy, glutamate imaging and electrophysiology. Unexpectedly, we discovered that larger spines are, relative to their size, less strongly covered by astrocytes and their glutamate transporters and that glutamate uptake at these synapses is less efficient. Investigating the endogenous mechanisms controlling perisynaptic astrocyte morphology, we uncovered that long-term potentiation of synaptic transmission induces a withdrawal of astrocytic processes from potentiated synapses on a time scale of minutes. Importantly, this acute withdrawal increased the spread of synaptically released glutamate in the tissue, which promoted synaptic crosstalk via N-methyl-D-aspartate receptors. Our results reveal new rules and mechanisms that control local perisynaptic astrocyte processes, local glutamate uptake and the spatial fidelity of excitatory synaptic transmission.

1. Herde MK, Bohmbach K, Domingos C, Vana N, Komorowska-Müller JA, Passlick S, Schwarz I, Jackson CJ, Dietrich D, Schwarz MK, Henneberger C (2020) Local efficacy of glutamate uptake decreases with synapse size. *Cell Rep.* 32:108182.
2. Henneberger C\*, Bard L, Panatier A, Reynolds J, Kopach O, Medvedev NI, Minge D, Herde MK, Anders S, Kraev I, Heller JP, Rama S, Zheng K, Jensen TP, Sanchez-Romero I, Jackson CJ, Janovjak H, Ottersen OP, Nagelhus EA, Oliet SHR, Stewart MG\*, Nägerl UV\*, Rusakov DA\* (2020) LTP induction boosts glutamate spillover by driving withdrawal of perisynaptic astroglia. *Neuron* 108:919-936. (\* correspondence)

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