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## RESEARCH AREA

Human brain is composed of 100 billion neurons forming trillions of highly organized chemical synapses. The remarkably complex connectivity of neurons is believed to underlie our mental abilities. Still, the computational power of a neuronal circuit is not only influenced by the complex connectivity, but also depends on the functional diversity of synapses. It is generally believed that molecular heterogeneity of the pre- and postsynaptic cells can explain the diversity of synaptic strength. However, emerging evidence suggests that neurons equipped with the same set of molecules may form synapses with variable strength by altering the intrasynaptic density and / or intrasynaptic distribution pattern (i.e., nanotopology) of the same molecule. Unfortunately, little is known about the intrasynaptic distribution of synaptic proteins at the nanoscale level, as it requires high-resolution localization methods. To understand the molecular basis of synaptic heterogeneity we study the intrasynaptic distribution of relevant synaptic proteins in identified synapses of known efficacy in mouse hippocampus using highly sensitive and high-resolution electron microscopy and super-resolution microscopy.

## TECHNIQUES AVAILABLE IN THE LAB

Pre- and postembedding immunogold and fluorescent immunohistochemistry, STED super-resolution microscopy, preparation of ultrathin sections, transmission electron microscopy, postembedding array tomography, SDS-digested freeze-fracture replica labelling, quantitative image analysis.

## SELECTED PUBLICATIONS

- Rebola, N., Reva, M., Kirizs, T., Szoboszlay, M., **Lőrincz, A.**, Moneron, G., Nusser, Z., DiGregorio, D.A. (2019) Distinct Nanoscale Calcium Channel and Synaptic Vesicle Topographies Contribute to the Diversity of Synaptic Function. **Neuron 104**: 693-710.
- Szoboszlay, M.\*, **Lőrincz, A.\***, Lanore, F.\*, Vervaeke, K., Silver, R.A., Nusser, Z. (2016) Functional Properties of Dendritic Gap Junctions in Cerebellar Golgi Cells. **Neuron 90**: 1043-56.
- Holderith, N., **Lorincz, A.**, Katona, G., Rózsa, B., Kulik, A., Watanabe, M., Nusser, Z. (2012) Release probability of hippocampal glutamatergic terminals scales with the size of the active zone. **Nat Neurosci 15**: 988-97.
- Lorincz, A.** and Nusser, Z. (2010) Molecular identity of dendritic voltage-gated sodium channels. **Science 328**: 906-9.
- Lorincz, A.** and Nusser, Z. (2008) Cell-type dependent molecular composition of the axon initial segment. **J Neurosci 28**: 14329-40.