ZOLTÁN NUSSER

Institute of Experimental Medicine
Cellular Neurophysiology Research Group

Address: Szigony u. 43., H-1083 Budapest, Hungary

RESEARCH AREA

The most fundamental function of nerve cells is the integration of their synaptic inputs to generate their propagating output signal, the action potential. The major aims of Dr Nusser's laboratory are to understand how identified presynaptic nerve cells release neurotransmitters; how the released transmitter molecules activate their postsynaptic receptors; and how the generated postsynaptic potentials are integrated to generate an action potential. The Laboratory of Cellular Neurophysiology focuses on the following major project areas using a variety of molecular, neuroanatomical, in vitro electrophysiological, in vitro and in vivo imaging and in silico modeling approaches: 1. Revealing the molecular, structural and functional heterogeneity of cortical excitatory and inhibitory synapses. Determine the molecular specializations underlying the functional and structural diversity of synapses, such as the probability and short-term plasticity of transmitter release, and the extent of postsynaptic receptor activation. 2. Creating a molecular map of the neuronal surface by determining the location and density of various voltage- and ligand-gated ion channel subunits in defined subcellular compartments of identified nerve cells. 3. Understanding the mechanisms underlying hippocampal network activity during behaviour.

TECHNIQUES AVAILABLE IN THE LAB

Molecular, neuroanatomical, in vitro electrophysiological, in vitro and in vivo two-photon imaging and in silico modeling approaches.

SELECTED PUBLICATIONS

Aldahabi, M., Balint, F., Holderith, N., Lorincz, A., Reva, M., and **Nusser, Z.** (2022) Different priming states of synaptic vesicles underlie distinct release probabilities at hippocampal excitatory synapses. **Neuron 110:** 4144-4161.

Karlocai, M.R., Heredi, J., Benedek, T., Holderith, N., Lorincz, A. and **Nusser, Z.** (2021) Variability in the Munc13-1 content of excitatory release sites. **eLife 0:**e67468

Holderith, N., Heredi, J., Kis, V., and **Nusser, Z.** (2020) A high-resolution method for quantitative molecular analysis of functionally characterized synapses. **Cell Rep 32:** 107968.

Rebola, N., Reva, M., Kirizs, T., Szoboszlay, M., Lorincz, A., Moneron, G., **Nusser, Z.** and DiGregorio, D.A. (2019) Distinct nanoscale calcium channel and synaptic vesicle topographies contribute to the diversity of synaptic function. **Neuron 104:** 693-710.

Éltes, T., Kirizs, T., **Nusser, Z.** & Holderith, N. (2017) Target cell type-dependent differences in Ca^{2+} channel function underlie distinct release probabilities at hippocampal glutamatergic terminals. **J Neurosci 37:** 1910-1924.

Szoboszlay M., Lorincz, A., Lanore, F., Vervaeke, K., Silver, R. A. & **Nusser, Z.** (2016) Functional properties of dendritic gap junctions in cerebellar Golgi cells. **Neuron 90:** 1043-1056.