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RESEARCH AREA

The two main profiles of the laboratory are the investigation on the pathophysiology of the brainstem cholinergic neuromodulatory actions and the age dependence of the human astrocyte-neuron communication.

The cholinergic neuromodulation of the brainstem regulates sleep-wakefulness cycles, movement and sensory gating. Loss of cholinergic neurons is related to the pathogenesis of progressive supranuclear palsy. In our research, we plan to focus on actions leading to the local degeneration of the cholinergic neurons and their consequences in behavioral tests.

We previously demonstrated that astrocytes are able to alter synaptic strength via generating NMDA receptor dependent slow inward currents. This mechanism has a strong age dependence in humans. Further research is performed for understanding its molecular background and pathophysiological significance.

TECHNIQUES AVAILABLE IN THE LAB

- Slice electrophysiology, patch clamp experiments on surviving brain slices.
- Opto- and chemogenetics.
- Calcium imaging on brain slices.
- Stereotaxic operations on mice.
- Behavioral tests (activity wheel test, acoustic startle test, Barnes maze test, footprint test).
- Immunohistochemistry.
- Cell reconstruction, morphological analysis.
- We plan to set in vivo fluorescent microscopy and imaging with glutamate sensors in the near future.

SELECTED PUBLICATIONS

Csemer, A., Kovács, A., Maamrah, B., Pocsai, K., Korpás, K., Klekner, Á., Szűcs, P., Nánási, P., **Pál, B.** (2023) Astrocyte- and NMDA receptor-dependent slow inward currents differently contribute to synaptic plasticity in an age-dependent manner in mouse and human neocortex. **Aging Cell** e13939.

Maamrah, B., Pocsai, K., Bayasgalan, T., Csemer, A., **Pál, B.** (2022) KCNQ4 potassium channel subunit deletion leads to exaggerated acoustic startle reflex in mice. **Neuroreport** **34**: 232-237.

Gönczi, M., Csemer, A., Szabó, L., Sztretye, M., Fodor, J., Pocsai, K., Szenthe, K., Keller-Pintér, A., Köhler, Z., Nánási, P., Szentandrassy, N., **Pál, B.**, Csernoch, L. (2022) Astaxanthin Exerts Anabolic Effects via Pleiotropic Modulation of the Excitable Tissue. **Int J Mol Sci** **23**: 917.

Bayasgalan, T., Stupniki, S., Kovács, A., Csemer, A., Szentesi, P., Pocsai, K., Dionisio, L., Spitzmaul, G., **Pál, B.** (2021) Alteration of mesopontine cholinergic function by the lack of KCNQ4 subunit. **Front Cell Neurosci** **26**: 15:707789.

Bayasgalan, T., Csemer, A., Kovács, A., Pocsai, K., **Pál, B.** (2021) Topographical organization of M-current on dorsal and median raphe serotonergic neurons. **Front Cell Neurosci** **25**: 15: 614947.

Baksa, B., Kovács, A., Bayasgalan, T., Szentesi, P., Kőszeghy, Á., Szűcs, P., **Pál, B.** (2019) Characterization of functional subgroups among genetically identified cholinergic neurons in the pedunculopontine nucleus. **Cell Mol Life Sci** **76**: 2799-2815.