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RESEARCH AREA

Synaptic junctions are major sites of communication in the brain, where chemical messenger molecules transmit information from presynaptic neurons to their postsynaptic partners. The efficacy of synaptic transmission is not constant in time and space. Instead, its plasticity is a fundamental phenomenon underlying information storage and adaptation to environmental stimuli. Although classical neurotransmitters (such as glutamate and GABA) have well characterized principal roles in mediating basal neurotransmission, emerging evidence has revealed that synapses exploit a wide array of additional messenger molecules integrated into sophisticated signaling pathways to accomplish their complex functions. Thus, the major objective of our laboratory is to identify new signaling systems regulating synaptic transmission and its plasticity. We aim to characterize the molecular architecture of these novel pathways and to elucidate their physiological roles. Ultimately, this activity is envisaged to help gain a better understanding of synaptic function and reveal new aspects of impaired synaptic activity in brain disorders.

TECHNIQUES AVAILABLE IN THE LAB

A broad array of molecular neurobiology techniques (DNA, RNA and protein isolation and measurement, PCR, cloning, in vitro mutagenesis, Western blot), as well as cell culture methods are used to characterize signaling molecule candidats by gain-of-function or loss-of-function models. Labeling or genetic manipulation of given neuronal populations is achieved by in utero electroporation. Anatomical and developmental experiments exploit the methods of in situ hybridization, RNAscope, immunohistochemistry, and the imaging is performed by confocal or STORM super-resolution microscopy.

SELECTED PUBLICATIONS

Prokop, S., Ábrányi-Balogh, P., Barti, B., Vámosi, M., Zöldi, M., Barna, L., Urbán, G.M., Tóth, A.D., Dudok, B., Egyed, A., Deng, H., Leggio, G.M., Hunyady, L., van der Stelt, M., Keserű, G.M., **Katona, I.** (2021) PharmacoSTORM nanoscale pharmacology reveals cariprazine binding on Islands of Calleja granule cells. **Nature Communications 12:** 6505.

László, Z., Lele, Z., Zöldi, M., Miczán, V., Mógor, F., Simon, G.M., Mackie, K., Kacskovics, I., Cravatt, B.F. and **Katona, I.** (2020) ABHD4-mediated developmental anoikis safeguards the embryonic brain. **Nature Communications 11:**1.

Frau, R.*, Miczan, V.*, Traccis, F., Aroni, S., Pongor, C.I., Saba, P., Serra, V., Sagheddu, C., Fanni, S., Congiu, M., Devoto, P., Cheer, J.F., **Katona, I.***, Melis, M.* (2019) Prenatal THC exposure produces a hyperdopaminergic phenotype rescued by pregnenolone. **Nature Neuroscience 22:** 1975–1985.

Barna, L., Dudok, B., Miczán, V., Horváth, A., László, Z.I., and **Katona, I.** (2016) Correlated confocal and super-resolution imaging by VividSTORM. **Nature Protocols 11:** 163-183.

Dudok, B., Barna, L., Ledri, M., Szabó, S.I., Szabadits, E., Pintér, B., Woodhams, S.G., Henstridge, C.M., Balla, GY., Nyilas, R., Varga, C., Lee, S.H., Matolcsi, M., Cervenak, J., Kacskovics, I., Watanabe, M., Sagheddu, C., Melis, M., Pistis, M., Soltesz, I. and **Katona, I.** (2015) Cell-specific STORM superresolution imaging reveals nanoscale organization of cannabinoid signaling. **Nature Neuroscience 18:** 75-86.