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INTERNSHIP OFFER, Oheim lab, academic year 2020-21

MASTER PROJECT: Are astroglial Ca^{2+} microdomains of mitochondrial origin?

About half of the cells in the human brain are not neurons. Our aim is to understand their contribution and particularly that of cortical astrocytes and Bergmann glia of the cerebellum to brain metabolism and signaling. We focus on how ion channels, transporters and organelles of the glial perisynaptic processes ensheathing neuronal synapses contribute to shaping and modulating synaptic transmission, and we combine electrophysiology and advanced microscopy and optogenetic tools.

Unlike neurons, astrocytes display a bushy morphology branching into a plethora of fine processes. Local, short-lived transients of elevated free cytosolic calcium concentration ('Ca^{2+} microdomains') are observed in these nanoscopic processes [Ar20], neither requiring somatic Ca^{2+} transients nor neuronal action potential firing. However, the origin and function of these 'spontaneous' events have remained elusive. A recent study suggested that small, isolated, peripherial mitochondria [De15] that are present in astrocytes [Ja15] could not only supply local energy and buffer Ca^{2+} [Oh18] but that they also released Ca^{2+} to generate microdomain Ca^{2+} signals through spontaneously occurring mitochondrial permeability transition pore (mPTP) openings [Ar17]. In this project, we want to test this hypothesis using a combination of genetically encoded Ca^{2+} indicators, microscopic imaging techniques, and pharmacological tools.

Students should have a strong interest in experimental neuroscience, biophysics, or cell biology. The ideal candidate has already practical lab skills for, a background in quantitative biology, and a deep desire to understand the principles underlying the functioning of the nervous system. Cell culture, microscopic imaging and programming skills are beneficial.
For applications we request: (*i*) a statement of motivation, (*ii*) a *curriculum vitae*, (iii) the names and emails of 2 academic references.

Further reading

[Ar17] Agarval *et al.* (2017) Neuron. https://doi.org/10.1016/j.neuron.2016.12.034
[Ar20] Arizono *et al.* (2020) Nat Commun. https://doi.org/10.1038/s41467-020-15648-4
[De15] Derouiche *et al.* (2015) Neurochem Res. https://doi.org/10.1007/s11064-015-1563-8
[Ja15] Jackson & Robinson (2015) J Neurosci. https://doi.org/10.1523/JNEUROSCI.2049-15.2015
[Oh18] Oheim *et al.* (2018) Brain Res Bull. https://doi.org/10.1016/j.brainresbull.2017.04.011

Contact

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