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## THE ROLE OF ASTROCYTES IN COMPLEX COGNITIVE PROCESSING

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**Background:** The importance of glial cells in the brain is rising due to emerging data supporting dynamic neuron-glia interactions, in which astrocyte signaling complements and modulates the communication between pre- and post-synaptic neurons.

**Aims:** The main research objective of this project was to assess how astrocyte signaling and calcium-dependent mechanisms underlying cognitive processing in the brain.

**Method:** We tested the dnSNARE model that lack astrocyte signaling via exocytosis and the IP3R2KO model that lacks calcium-dependent signaling in astrocytes. To assess the influence of these mechanisms to cognitive function, we used complementary state-of-the-art techniques such as in vivo electrophysiology, innovative behavior, structural and molecular analysis, to characterize, monitor and rescue cognitive functions.

**Results:** Our results show that neuronal synchrony between the dorsal hippocampus and the prefrontal cortex is dependent on astrocyte signaling. This synchrony supports correct cognitive computation and may be rescued by supplementation of D-serine, a known modulator of glutamatergic excitatory transmission, which is released by astrocytes. In turn, astrocytic calcium-dependent mechanisms are relevant for cognitive computation in different life stages.

**Conclusions:** This grant allowed us to explore the potential of astrocyte modulation in brain cells and circuits to allow correct cognitive computation. The results obtained in this project have widened our understanding of astrocyte-specific mechanisms that might mediate cognitive decline and/or enhancement.

**Keywords:** Astrocyte, Learning and memory, Hippocampus, Prefrontal cortex, Electrophysiology

### Publications:

Guerra-Gomes S, Viana JF, Correia JS, Caetano I, Sardinha VM, Sousa N, Pinto L, Oliveira JF (2018). The role of astrocytic calcium signaling in the aged prefrontal cortex. *Front. Cell. Neurosci.* 12.

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