Astrocytes gate hippocampal sharp-wave ripples

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A growing body of evidence highlights the importance of distinct neuronal populations in hippocampal networks for learning and memory, and how their interactions shape circuit function. A paradigmatic example of such coordination is sharp-wave ripples (SPW-Rs), transient hippocampal network events arising from coordinated activity across nearly all neuronal cell types and essential for memory consolidation. In parallel, accumulating work points to a key role for non-neuronal cells—particularly astrocytes—in the regulation of neuronal activity across brain circuits. Yet, how astrocytes engage with distinct neuronal cell types in vivo and shape network dynamics remains poorly understood. Here, we address this gap by combining astrocyte calcium fiber-photometry and/or optostimulation using melanopsin with large-scale chronic electrophysiological recordings and a recently developed classifier-based framework for neuronal cell-type identification. Strikingly, we reveal a strong negative correlation between astrocytic calcium events and SPW-R occurrence regardless the brain state and evident already within single recording sessions. In addition, the neuronal response to these astrocytic calcium events is cell-type-specific, with a subset of Sst interneurons remaining selectively active during astrocytic calcium events, which could lead to the reduced network excitability and astrocyte-controlled suppression of SPW-s. Ongoing optostimulation experiments seem to confirm a downregulation of SPW-Rs following astrocytic activation, in line with calcium recording experiments, yet neuronal populations exhibit a different response profile. Ongoing experiments and analysis will help elucidate the integration of the astrocytic population within the hippocampal network. Overall, our results identify a functional role for astrocytes in SPW-R dynamics, and advance our understanding of how astrocytes regulate circuit activity and memory.