

Projection-identified large-scale recording reveals pathway-specific information outflow from the subiculum

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The hippocampus processes multimodal information, including place, time, speed, reward, and memory. However, how such information is distributed to multiple downstream areas remains poorly understood. The subiculum is the major hippocampal output structure that receives the hippocampal CA1 output and projects to multiple cortical/subcortical areas. Despite its anatomical importance, the nature of information distribution from the subiculum is unknown. We investigated this issue by optogenetically identifying the projection targets of subicular neurons during large-scale extracellular recordings in freely behaving rats. We introduced channelrhodopsin-2 and a 256-channel silicon probe into the subiculum, and implanted four optical fibers above subicular projection targets. Then, axonal projections of the recorded subicular neurons were determined by detecting antidromic spikes generated by blue-light irradiation to the projection targets. During multiple behavioral tasks and sleep, the subicular projection neurons were entrained to neural oscillations differentially and conveyed distinct information depending on the projection targets. These results suggest the prominent role of the subiculum in distributing hippocampal information to multiple downstream targets in a pathway-specific manner.