Environmental modifications of hippocampal theta-cycle compressed cell assembly representations

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Hippocampal place cells on a linear track can be used to define a temporally ordered event sequence. These sequences are observed on the order of seconds during track running, and on the order of tens of milliseconds during theta oscillations and sharp-wave ripples (in forward and in reverse). We tested the plasticity of these temporal sequences, in CA1 and CA3 regions of the rat hippocampus, by shrinking the length of the linear track. We varied the track length only once, rather than from trial to trial (Gothard et al. 2006). We observed that the sequence representation changed within a single trial, to reflect the modified environment. The modified representation involved the disappearance of some place-fields, the emergence of other new place-fields, and the shrinkage and shifting of the remaining place-fields. These place-field modifications simultaneously reflect the adaptability and the rigidity of cell assembly representations in the hippocampus.

References