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Neural mechanisms of social memory in the hippocampus



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Abstract

For social animals, it is crucial to remember and recognize different conspecific individuals and exhibit appropriate social behaviors. Using the social discrimination behavioral assay, we previously demonstrated that ventral CA1 pyramidal neurons in the hippocampus store social memory (social memory engram). Even if the memory seems lost after long separation periods, optogenetic activation of the engram can fully restore that social memory. Furthermore, vCA1 social memory neurons are preferentially reactivated during sharp-wave ripples (SPW-Rs). Spike sequences of these social replays reflect the temporal orders of neuronal activities within theta cycles during social interactions.

Additionally, even a minor disruption in social memory can easily impair appropriate social behavior, even in humans. Patients with autism spectrum disorder (ASD) have difficulty either with social memory itself or with exhibiting normal social communication driven by social memory. We recently showed that the dysfunction of the autism-associated Shank3 gene, specifically in vCA1 induced by in vivo genome editing, causes social memory impairment. Furthermore, in ASD model Shank3 knockout mice, the proportion of social memory neurons is reduced, and neuronal ensemble spike sequences during SPW-Rs are disrupted, correlating with impaired discriminatory social behavior.

References

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