

Post-learning paradoxical sleep deprivation impairs reorganization of limbic and cortical networks associated with consolidation of remote contextual fear memory in mice

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Abstract

Study Objectives

Paradoxical sleep (PS) has been shown to play an important role in memory, in particular in emotional memory processes. However, the involvement of this particular sleep stage in the systemic consolidation of remote (30 days old) memory has never been tested. We examined whether post-learning PS could play a role in the consolidation of remote fearful memory and in the brain network reorganization that depends on it.

Methods

Mice were PS-deprived during 6 hours after contextual fear conditioning using an automated method, and their memory was tested either 1 day or 30 days after learning. Brain activity during retrieval was assessed using the immediate early gene *Egr1* (*Zif 268*) as a neuronal marker of activity.

Results

We found that PS deprivation impaired the recall of remote (30 days)—but not recent (1 day)—memory. We also showed that the superficial layers of the anterior cingulate cortex were significantly less activated during the retrieval of remote memory after PS deprivation. In contrast, after such deprivation, retrieval of remote memory significantly activated several areas involved in emotional processing such as the CA1 area of the ventral hippocampus, the basolateral amygdala and the superficial layers of the ventral orbitofrontal cortex. By performing graph-theoretical analyses, our result also suggests that post-learning PS deprivation could impact the reorganization of the functional connections between limbic areas in order to reduce the level of global activity in this network.

Conclusions

These findings suggest an important role for PS in the systemic consolidation of remote memory.

[graph theoretical analysis](#), [immediate early gene](#), [prefrontal cortex](#), [post-traumatic stress disorder \(PTSD\)](#), [systemic consolidation](#)

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rem sleep

brain

memory

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graphical displays

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