

Objective:

Traumatic daytime experience may lead to sleep disturbances at night. Sometimes these traumatic experiences replay after falling asleep and subsequently disrupt sleep. In the present study, we hypothesize the activation of neurons that encode fear memory in the hippocampus causes sleep disturbance in animals.

Methods:

To observe the brain activity, we performed *in vivo* calcium imaging in the ventral CA1 of the hippocampus (vCA1) and recorded the electrical field for both vCA1 and basal amygdala (BA) in mice during sleep. Then, we compared the neuronal activity before/after the subjects were fear conditioned. In addition, optogenetic, chemogenetic, and activity-dependent neural tagging techniques were used to tag and manipulate neurons that had activated during fear conditioning.

Results:

The results demonstrated that neurons in vCA1 were robustly activated during sleep when we applied conditioned stimuli. The electrical field was mainly transferred from vCA1 to BA when the subject heard the conditioned stimuli. Moreover, inhibition of the vCA1-BA pathway reduced the sleep disruption following fear conditioning. In addition, stimulation of the neurons that had activated during fear conditioning caused sleep disturbance

Conclusion:

Our results suggest the reactivation of neurons that keep fear memory in vCA1 contributes to sleep disturbance. The vCA1 to BA is one of the main pathways leading to this type of sleep disturbance.

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