

Changing the Mind of Mice : Inception of Memories During Sleep

Lacroix, Marie ¹

¹ CNRS - ESPCI Paris Tech - Cog'X, France

TO CITE

Lacroix, M. (2019). Changing the Mind of Mice : Inception of Memories During Sleep. In *Proceedings of the Paris Institute for Advanced Study* (Vol. 7). https://paris.pias.science/article/SLEEP_2019_05_changing-the-mind-of-mice-inception-of-memories-during-sleep

PUBLICATION DATE

06/06/2019

ABSTRACT

Sleep and Memory. Paris IAS, 6-7 June 2019 - Session 2 - Enhancement and Inception (Part I: Rodents)

Sleep is now recognized to be crucial for the consolidation of preexisting memory traces. One important model to study memory in rodent is the spatial memory, as hippocampal neurons have been shown to code for spatial location of the animal. This correlate between animal behavior and hippocampal neuronal activity is so strong that those « place cells » assemblies are believed to support the *cognitive map*, which is the mental representation of space in the animal brain. During sleep, those place cells assemblies show reactivations of recent waking experience, and this replay would be instrumental in the process of memory consolidation.

Here we show that neuronal reactivations can be used to induce a new artificial place/reward association during sleep. We designed a protocol where intracranial rewarding stimulations were triggered by a hippocampal place cell during sleep. We were able to induce an explicit memory trace, leading to a goal-directed behavior toward the place field artificially associated to reward.

These results show first that it is possible to create an artificial explicit memory during sleep that is used during subsequent waking period to drive a goal directed behavior. But more importantly, it demonstrates the causal role of place cells on the mental representation of space, and that hippocampal cell assemblies still conveyed the same spatial information during sleep as it did during wakefulness.

Protocol : Creation of place preference memory during sleep

The slide illustrates the experimental protocol for creating place preference memory during sleep in mice. It includes the following elements:

- Inset Video:** A small video window in the top left corner shows a woman, likely the presenter, speaking.
- IEA Logo:** The logo for the Institut des Échelles Avancées (IEA) is displayed in the bottom left corner.
- Diagram 1 (Top Left):** Shows a mouse in a Y-maze with a green arrow indicating a preference for one arm, labeled with a green speech bubble containing "(R)N".
- Diagram 2 (Top Center):** A thought bubble containing "Zzz" indicates the mouse is asleep.
- Diagram 3 (Top Right):** A red speech bubble labeled "reward" points to a diagram of a mouse's head with a red arrow indicating a specific neural pathway.
- Diagram 4 (Bottom Left):** Three heatmaps labeled "Cell 1", "Cell 2", and "Cell 3" show neural activity patterns. A color scale bar labeled "Hz" is provided.
- Diagram 5 (Bottom Right):** A diagram comparing the mouse's behavior "Before learning" and "After learning". The "After learning" state shows a more defined preference for a specific location. Below this, it is noted "Kobayashi et al., 2013".
- Text:** "Stimulation of latB (dorsal posterior bundle)" is written near the mouse head diagram.