Aging impairs the 'replay' of memories during sleep

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Aging impairs the consolidation of memories during sleep, a process important in converting new memories into long-term ones, according to new animal research in the July 30 issue of *The Journal of Neuroscience*. The findings shed light on normal memory mechanisms and how they are disrupted by aging.

During sleep, the hippocampus, a brain region important in learning and memory, repeatedly "replays" brain activity from recent awake experiences. This replay process is believed to be important for memory consolidation. In the new study, Carol Barnes, PhD, and colleagues at the University of Arizona found reduced replay activity during sleep in old compared to young rats, and rats with the least replay activity performed the worst in tests of spatial memory.

Barnes and colleagues recorded hippocampal activity in 11 young and 11 old rats as they navigated several mazes for food rewards. Later, when the animals were asleep, the researchers recorded their hippocampal activity again. In the young animals, the sequence of neural activity recorded while the animals navigated the mazes was repeated when they slept. However, in most of the old animals, the sequence of neural activity recorded during sleep did not reflect the sequence of brain activity recorded in the maze.

"These findings suggest that some of the memory impairment experienced during aging could involve a reduction in the automatic process of experience replay," said Michael Hasselmo, DPhil, at Boston University, an expert unaffiliated with the study.

Animals with more faithful sleep replay also performed better on memory tests. The researchers tested the same 22 rats on a spatial learning and memory task. Consistent with previous research, the young rats recalled the solution to the spatial task faster and more accurately than the old rats. In the old group, the researchers found that the top performers in the spatial memory task were also the ones that showed the best sleep replay. Irrespective of the animal's age, the researchers found that animals who more faithfully replayed the sequence of neural activity recorded in the maze while asleep also performed better on the spatial memory task.

"This is the first study to suggest that an animal's ability to perform a spatial memory task may be related to the brain's ability to perform memory consolidation during sleep," said study author Barnes.

Identification of the specific memory deficit present in the aging brain may be a first step to preventing age-related memory loss. "This study's findings could inspire the development and testing of pharmacological agents designed to enhance memory replay phenomena," Hasselmo said.

Source: Society for Neuroscience

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