

Can sleep protect us from forgetting old memories?

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From lowering your risk of obesity and cardiovascular disease to improving your concentration and overall daily performance, sleep has been proven to play a critical role in our health. In a new study, researchers at University of California San Diego School of Medicine report that sleep may also help people to learn continuously through their

lifetime.

Writing in the August 4, 2020 online issue of *eLife*, researchers used computational models capable of simulating different brain states, such as [sleep](#) and awake, to examine how sleep consolidates newly encoded memories and prevents damage to old memories.

"The brain is very busy when we sleep, repeating what we have learned during the day. Sleep helps reorganize memories and presents them in the most efficient way. Our findings suggest that memories are dynamic, not static. In other words, memories, even old memories, are not final. Sleep constantly updates them," said Maksim Bazhenov, Ph.D., lead author of the study and professor of medicine at UC San Diego. "We predict that during the [sleep cycle](#), both old and [new memories](#) are spontaneously replayed, which prevents forgetting and increases recall performance."

Bazhenov said that [memory](#) replay during sleep plays a protective role against forgetting by allowing the same populations of neurons to store multiple interfering memories. "We learn many new things on a daily basis and those memories compete with old memories. To accommodate all memories, we need sleep."

For example, imagine learning how to navigate to a parking lot by going left at one stop sign and right at one traffic light. The next day, you have to learn how to get to a different [parking lot](#) using different directions. Bazhenov said sleep consolidates those memories to allow recollection of both.

"When you play tennis, you have a certain muscle memory. If you then learn how to play golf, you have to learn how to move the same muscles in a different way. Sleep makes sure that learning golf does not erase how to play tennis and makes it possible for different memories to

coexist in the brain," said Bazhenov.

The authors suggest that the restorative value of sleep may be what is lacking in current state-of-the-art computer systems that power self-driving cars and recognize images with performances that far exceed humans. However, these [artificial intelligence systems](#) lack the ability to learn continuously and will forget old knowledge when new information is learned. "We may need to add a sleep-like state to computer and robotic systems to prevent forgetting after new learning and to make them able to learn continuously," said Bazhenov.

Bazhenov said the study results could lead to developing new stimulation techniques during sleep to improve memory and learning. This may be particularly important in older adults or persons suffering from learning disabilities.

"While sleep is certainly involved in many important [brain](#) and body functions, it may be critical for making possible what we call human intelligence—the ability to learn continuously from experience, to create new knowledge and to adapt as the world changes around us," said Bazhenov.

More information: Oscar C González et al, Can sleep protect memories from catastrophic forgetting?, *eLife* (2020). [DOI: 10.7554/eLife.51005](#)

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