

UNIVERSITY OF CALIFORNIA, RIVERSIDE



## What Role Does Sleep Play in Memory and Learning?

**UC Riverside's Maxim Bazhenov has received a Department of Defense grant to address the question**

By [Iqbal Pittalwala](#) On JUNE 4, 2013

RIVERSIDE, Calif. — A team of researchers led by a neuroscientist at the University of California, Riverside has been awarded a nearly \$7.5 million grant from the Department of Defense to investigate the role of sleep in memory and learning.

"Sleep occupies roughly a third to a half of each day in the majority of mammalian species," said [Maxim Bazhenov](#), a professor of [cell biology and neuroscience](#) and the principal investigator of the five-year grant. "The role of sleep in human and animal life remains a mystery. While sleep is likely to be involved in many processes critical for human and animal well-being, recent evidence suggests that it plays a fundamental role in memory and learning."

Bazhenov's laboratory will collaborate with laboratories at UC San Diego, the University of Arizona and Harvard Medical School in the research that aims to explore the role of sleep in memory and learning and to develop biologically realistic computer models of a brain.

These models will learn complex patterns, consolidate the resulting memory traces over time in a process that is similar to human sleep, and retrieve the patterns given a cue.

"These models will do what the human and animal brain does when it collects memories of many events during the day, then sorts them out at night, and decides what is important and what is not, and finally can retrieve the persistent memories as necessary," Bazhenov said. "Our study will demonstrate that the neural substrate for memory consolidation based on memory replay — a nighttime process of replaying the experiences of the day and storing the highlights — does actually exist in humans. Previously, it was reported only in animals."

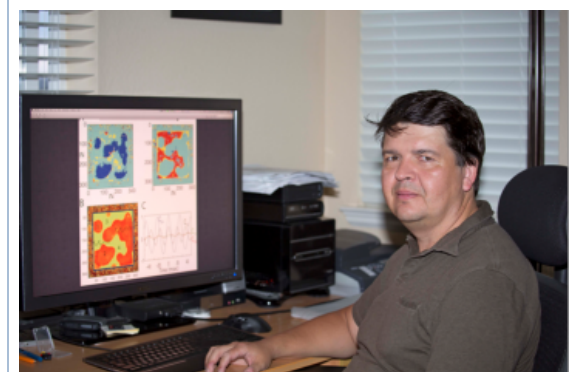
The researchers also plan to use computer models and experiments to develop non-invasive techniques of sensory and pharmacological interventions in modulating memory replay during sleep.

"Presumably, enhancements of the memory replay during sleep, for example, by promoting specific sleep rhythms that are required for replay, will increase memory and learning performance," Bazhenov said. "On the other hand, suppression of the memory replay may decrease memory performance."

He explained that during deep sleep, the [cerebral cortex](#) is decoupled from sensory inputs, and can be devoted to consolidating previously acquired [labile](#) memories into stable memories.

"In other words the cortex decides what was important and what was not during a recent experience, such as the previous day, and removes traces of 'non-important' memories and makes permanent 'important' memories," he said. "Our multidisciplinary research is focused on understanding the fundamental principles of the network dynamics of the brain that are involved in these processes of memory consolidation. Our primary goal is to understand how the interaction among brain areas during different stages of sleep leads to consolidation of memory for recent learning."

The start date of the grant is July 1, 2013. UC Riverside will receive approximately 27 percent (or about \$2 million) of the total grant amount.



*Maxim Bazhenov is a professor of cell biology and neuroscience at UC Riverside.*

PHOTO COURTESY OF BAZHENOV LAB, UC RIVERSIDE.

UCR is one of [15 academic institutions recently given grants by the Department of Defense](#) to perform multidisciplinary basic research. The awards, totaling \$105 million, are the result of the fiscal year 2013 competition conducted by the Army Research Office and the Office of Naval Research under the Department of Defense Multidisciplinary University Research Initiative (MURI) Program.

The highly competitive MURI program supports research by teams of investigators that intersect several traditional science and engineering disciplines in order to accelerate research progress.

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