Study demonstrates how memory can be preserved -- and forgetting prevented

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As any student who's had to study for multiple exams can tell you, trying to learn two different sets of facts one after another is challenging. As you study for the physics exam, almost inevitably some of the information for the history exam is forgotten. It's been widely believed that this interference between memories develops because the brain simply doesn't have the capacity necessary to process both memories in quick succession. But is this truly the case?

A new study by researchers at Beth Israel Deaconess Medical Center (BIDMC) suggests that specific brain areas actively orchestrate competition between memories, and that by disrupting targeted brain areas through transcranial magnetic stimulation (TMS), you can preserve memory -- and prevent forgetting.

The findings are described in the June 26 Advance On-line issue of Nature Neuroscience.

"For the last 100 years, it has been appreciated that trying to learn facts and skills in quick succession can be a frustrating exercise," explains Edwin Robertson, MD, DPhil, an Associate Professor of Neurology at Harvard Medical School and BIDMC. "Because no sooner has a new memory been acquired than its retention is jeopardized by learning another fact or skill."

Robertson, together with BIDMC neurologist and coauthor Daniel Cohen, MD, studied a group of 120 college-age students who performed

two concurrent memory tests. The first involved a finger-tapping motor skills task, the second a declarative memory task in which participants memorized a series of words. (Half of the group performed the tasks in this order, while a second group learned these same two tasks in reverse order.)

"The study subjects performed these back-to-back exercises in the morning," he explains. "They then returned 12 hours later and re-performed the tests. As predicted, their recall for either the word list or the motor-skill task had decreased when they were re-tested."

In the second part of the study, Robertson and Cohen administered TMS following the initial testing. TMS is a noninvasive technique that uses a magnetic simulator to generate a magnetic field that can create a flow of current in the brain.

"Because brain cells communicate through a process of chemical and electrical signals, applying a mild electrical current to the brain can influence the signals," Robertson explains. In this case, the researchers targeted two specific brain regions, the dorsolateral prefrontal cortex and the primary motor cortex. They discovered that by applying TMS to specific brain areas, they were able to reduce the interference and competition between the motor skill and word-list tasks and both memories remained intact.

"This elegant study provides fundamental new insights into the way our brain copes with the challenge of learning multiple skills and making multiple memories," says Alvaro Pascual-Leone, MD, PhD, Director of the Berenson-Allen Center for Noninvasive Brain Stimulation at BIDMC. "Specific brain structures seem to carefully balance how much we retain and how much we forget. Learning and remembering is a dynamic process and our brain devotes resources to keep the process flexible. By better understanding this process, we may be able to find

novel approaches to help enhance learning and treat patients with memory problems and learning disabilities."

"Our observations suggest that distinct mechanisms support the communication between different types of memory processing," adds Robertson. "This provides a more dynamic and flexible account of memory organization than was previously believed. We've demonstrated that the interference between memories is actively mediated by brain areas and so may serve an important function that has previously been overlooked."

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