New research shows why too much memory may be a bad thing

March 29 2007

New research from Columbia University Medical Center may explain why people who are able to easily and accurately recall historical dates or long-ago events, may have a harder time with word recall or remembering the day's current events. They may have too much memory – making it harder to filter out information and increasing the time it takes for new short-term memories to be processed and stored.

Published in the *Proceedings of the National Academy of Sciences* (March 13, 2007 issue), the research reinforces the old adage that too much of anything – even something good for you – can actually be detrimental. In this case, the good thing is the growth of new neurons, a process called neurogenesis, in the hippocampus, the region of the brain responsible for learning and memory.

Results of the study, conducted with mice, found that the absence of neurogenesis in the hippocampus improves working memory, a specific form of short-term memory that relates to the ability to store task-specific information for a limited timeframe, e.g., where your car is parked in a huge mall lot or remembering a phone number for few seconds before writing it down. Because working memory is highly sensitive to interference from information previously stored in memory, forgetting such information may therefore be necessary for performing everyday working memory tasks, such as balancing your check book or decision making.

"We were surprised to find that halting neurogenesis caused an

improvement of working memory, which suggests that too much memory is not always a good thing, and that forgetting is important for normal cognition and behavior," said Gaël Malleret, Ph.D., a research scientist at the Center for Neurobiology and Behavior at Columbia University Medical Center and the paper's co-first author. "Altogether, our findings suggest that new neurons in the hippocampus have different, and in some cases, opposite roles in distinct types of memory storage, and that excess neurogenesis can be detrimental to some memory processes."

"We believe these findings have important implications for diverse disciplines ranging from medicine to artificial intelligence," said Dr. Malleret. "In medicine, these findings have significant implications for possible therapeutic interventions to improve memory – a careful balance of neurogenesis would need to be struck to improve memory without overwhelming it with too much activity."

Many scientists had believed that neurogenesis in the hippocampus, and specifically, the dentate gyrus region, was wholly beneficial to memory. Previous research by Dr. Malleret with co-first author Michael D. Saxe, Ph.D., who was at Columbia when the research took place and is now at the Salk Institute in San Diego, Calif., found that reducing neurogenesis causes long-term memory deficits.

Based on this research, Drs. Malleret and Saxe hypothesized that the growth of too many new neurons could actually be more harmful than helpful to working memory. To examine this hypothesis, they designed working memory tests for two independent groups of mice in which neurogenesis in the hippocampus regions was suppressed. Results of the tests, in which mice had to locate food within specific areas of a maze, showed that mice in which neurogenesis had been halted made more correct choices and found the food faster.

"In our world, we are constantly bombarded by new information so we are constantly filtering –and if we did not do this, we would be overwhelmed," said Dr. Malleret. "Our research indicates that those with better working memory may have fewer new neurons being developed in their hippocampus, which helps them forget old and useless information sooner and enable them to take in new information faster."

Source: Columbia University Medical Center