Electrical stimulation of brain boosts birth of new cells, may improve memory

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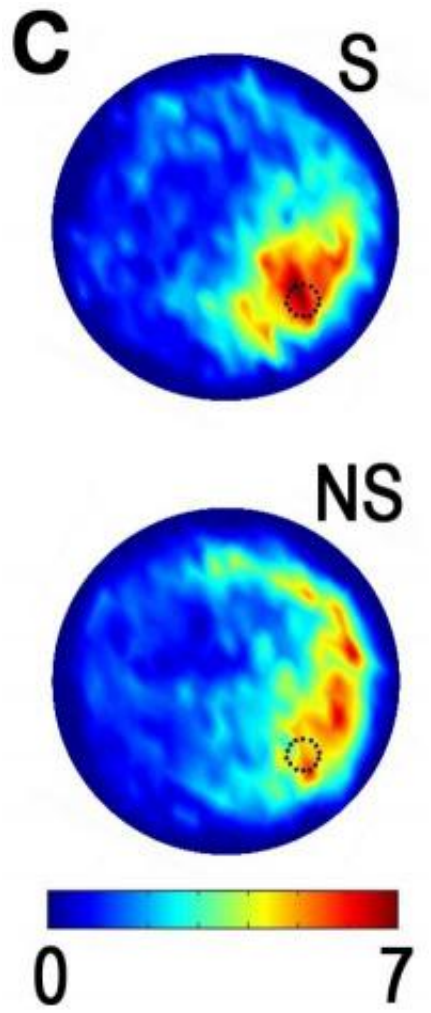

Mice who received deep brain stimulation (DBS) to a region in the brain called the entorhinal cortex showed an enhanced ability to learn how to navigate to a designated target. This image shows DBS mice (S) spent a greater amount of time (indicated in red) swimming near a submerged landing (dotted circle) compared with non-stimulated mice (NS). Credit: Reprinted with permission:

Stone, et al. The Journal of Neuroscience 2011.

Stimulating a specific region of the brain leads to the production of new brain cells that enhance memory, according to an animal study in the September 21 issue of *The Journal of Neuroscience*. The findings show how deep brain stimulation (DBS) — a clinical intervention that delivers electrical pulses to targeted areas of the brain — may work to improve cognition.

"DBS has been quite effective for the treatment of movement disorders, such as Parkinson's disease, and has recently been explored for treatment of a range of neurologic and psychiatric conditions," said Paul Frankland, PhD, of The Hospital for Sick Children (SickKids), senior author of the study. "These new findings have important clinical implications as they inform potential treatments for humans with memory disorders."

Throughout life, new cells are born in parts of the hippocampus, the brain's learning and memory center. In the new study, Frankland and his colleagues found that one hour of electrical stimulation to the entorhinal cortex — a region that directly communicates with the hippocampus — in adult mice led to a two-fold increase in new cells in the hippocampus. Although the burst of new cells lasted for only about one week, the cells produced during this time window developed normally and made connections with other nearby brain cells.

Six weeks later, the researchers evaluated whether the newly integrated cells produced changes in memory. The authors tested how well the animals learned to navigate onto a landing submerged in a small pool of water. Compared with mice that did not receive the therapy, DBS mice spent more time swimming near the landing, suggesting that stimulation

of the entorhinal cortex improved spatial learning.

"To date, the neurobiological basis for the clinical effect of DBS has not been well understood," said Daniel A. Peterson, PhD, of the Rosalind Franklin University of Medicine and Science, an expert on stem cells and brain repair who was unaffiliated with the study. "This study suggests that the stimulation of specific brain circuitry may result in the development of new functional brain cells in particular brain regions."

In a related preliminary study, researchers led by Andres Lozano, MD, PhD, of Toronto Western Hospital, recently published a Phase I clinical trial showing that DBS of the fornix, a brain region that also communicates directly with the hippocampus, slows cognitive decline in some people with dementia and other cognitive impairments. "The pro-cognitive effects of deep brain stimulation in human patients may result from the production of new neurons," Frankland said.

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