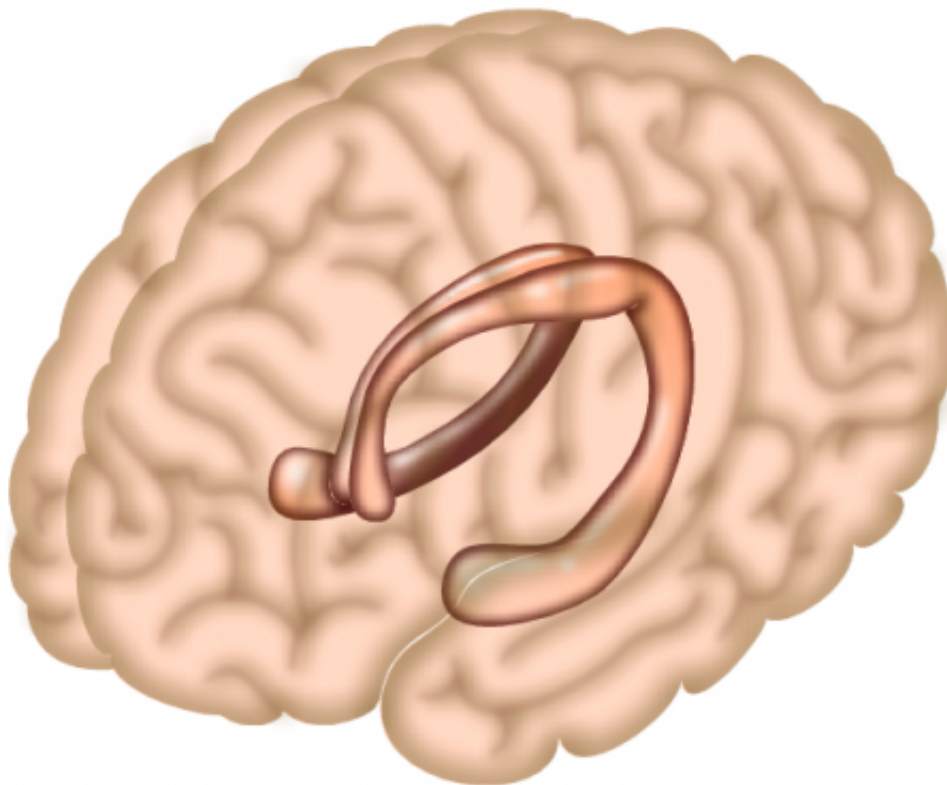


Brain stimulation reverses age-related memory loss

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The hippocampus is a region of the brain largely responsible for memory formation. Credit: Salk Institute

Stimulating a precise location of the brain's memory center with electromagnetic pulses improves the memory of older adults with age-

related memory loss to the level of young adults, reports a new Northwestern Medicine study.

"Older people's [memory](#) got better up to the level that we could no longer tell them apart from [younger people](#)," said lead investigator Joel Voss, associate professor at Northwestern University Feinberg School of Medicine. "They got substantially better."

The study used Transcranial Magnetic Stimulation (TMS) to target the hippocampus—the brain region that atrophies as people grow older, which is responsible for memory decline.

The study will be published April 17 in *Neurology*.

"It's the [part of the brain](#) that links two unrelated things together into a memory, like the place you left your keys or your new neighbor's name," Voss said. "Older adults often complain about having trouble with this."

This type of memory worsens as we age. Nearly all people experience a decline in their memory ability as they age.

The new study of 16 people—ages 64 to 80 with normal age-related memory problems—shows it's possible to alter memory ability in older adults using this type of brain stimulation, Voss said. "There is no previous evidence that the specific memory impairments and brain dysfunction seen in older adults can be rescued using brain stimulation or any other method."

Voss's team located the hippocampus—which is smaller in older adults—individually for each participant with an fMRI. An fMRI (functional MRI) measures how active a part of the brain is at a given time.

Then, they located an area of the parietal lobe that communicates with the hippocampus for stimulation delivery. This spot was behind and slightly above a person's left ear, but everyone had a slightly different spot.

It isn't possible to directly stimulate the hippocampus with TMS, which is noninvasive, because it's too deep in the brain for the magnetic fields to penetrate. So, Voss and colleagues identified a superficial brain region close to the surface of the skull with high connectivity to the hippocampus.

"We stimulated where [brain activity](#) is synchronized to the hippocampus, suggesting that these regions talk to each other," said first author Aneesha Nilakantan, a neuroscience graduate student working in Voss' lab.

At baseline, younger and older adults were given memory tasks in which they learned arbitrary relations between paired things, such as this object goes on this spot on the computer screen. Younger adults score about 55 percent correct and older adults less than 40 percent correct.

The research team then applied high-frequency repetitive magnetic stimulation to the spot for five consecutive days for 20 minutes a day. Stimulating this area improved the function of regions important for memory that are disrupted by aging, evident by more neural activity visible on an fMRI.

Then, 24 hours after the final stimulation, the subjects were given a new memory test in which they had to learn new arbitrary relations between paired things. After the brain stimulation, [older adults](#) scored at the level of young [adults](#) on the memory tasks.

The study also used a fake placebo stimulation condition, which did not

improve memory.

Voss and colleagues will next test this approach on participants with mild cognitive impairment, the early stage of Alzheimer's disease. They will be stimulating the brain for longer periods of time.

Voss isn't certain how long the effects could last. He suggests the enhanced memory effects could last longer with more stimulation. For instance, when depression is treated with TMS for five weeks, those patients get an antidepressant effect that lasts for many months, he noted. In a future study, Voss will be stimulating the [brain](#) in persons with age-related memory loss for more weeks to test this.

Provided by Northwestern University

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