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Imaging study illustrates how memories change in the brain over time

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A new brain imaging study illustrates what happens to memories as time goes by. The study, in the January 28 issue of *The Journal of Neuroscience*, shows that distinct brain structures are involved in recalling recent and older events.

The findings support earlier studies of memory-impaired patients with damage limited to the hippocampus. These patients show deficits in learning new information and in recalling events that occurred just prior to their injuries. However, they are able to recall older events, which are thought to involve other regions of the brain, particularly the cortex.

"It has long been known that older memories are more resistant to hippocampal damage than newer memories, and this was thought to reflect the fact that the hippocampus becomes less involved in remembering as a memory gets older," said Russell Poldrack, PhD, an expert on the cognitive and neural mechanisms of memory at the University of California, Los Angeles, who was not involved in the study. "However, there has been a recent debate over whether the hippocampus ever really stops being involved, even for older memories," Poldrack said.

To address this debate, Christine Smith, PhD, and Larry Squire, PhD, at the University of California, San Diego and the San Diego VA Medical Center, imaged study participants as they answered 160 questions about news events that occurred over the past 30 years. The hippocampus and related brain structures were most active when recalling recent events.

Hippocampal activity gradually declined as participants recalled events that were 1-12 years old and remained low when they recalled events that were 13-30 years old.

In contrast, Smith and Squire found the opposite pattern of activity in frontal, temporal, and parietal cortices. In these brain regions — which are located at the surface of the brain — activity increased with the age of the news event recalled. "Our findings support the idea that these cortical regions are the ultimate repositories for long-term memory," Smith said. The researchers found that brain activity was unrelated to the richness of memories or to the recollection of personal events related to the tested news events.

"This is the best evidence to date supporting a long-held view about how memories become permanent," said Howard Eichenbaum, PhD, an expert on memory at Boston University who was unaffiliated with the study.

The Journal of Neuroscience: www.jneurosci.org/

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