

# Physical fitness improves spatial memory, increases size of brain structure

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When it comes to the hippocampus, a brain structure vital to certain types of memory, size matters. Numerous studies have shown that bigger is usually better. Now researchers have found that elderly adults who are more physically fit tend to have bigger hippocampi and better spatial memory than those who are less fit.

The study, in the journal *Hippocampus*, shows that hippocampus size in physically fit adults accounts for about 40 percent of their advantage in spatial memory.

The hippocampus, a curved structure deep inside the medial temporal lobe of the brain, is essential to memory formation. Remove it - as was done in the well-known case of surgical patient Henry Gustav Molaison - and a person's ability to store most new experiences in memory is destroyed.

The hippocampus also is a key player in spatial navigation and other types of relational memory.

Certain activities are believed to modify hippocampus size in humans. For example, a study of London taxi drivers found that the posterior portion of the hippocampus was larger in experienced taxi drivers than in other subjects. And a study of German medical students found that the same region of the hippocampus increased in size as they studied for their final exams.

Studies also have found that the hippocampus shrinks with age, a process that coincides with small but significant cognitive declines. The rate at which this occurs, however, differs among individuals.

Earlier studies found that exercise increases hippocampus size and spatial memory in rodents, but the new study is the first to demonstrate that exercise can affect hippocampus size and memory in humans.

The researchers, from the University of Illinois and the University of Pittsburgh, measured the cardiorespiratory fitness of 165 adults (109 of them female) between 59 and 81 years of age. Using magnetic resonance imaging, the researchers conducted a volumetric analysis of the subjects' left and right hippocampi. They also tested the participants' spatial reasoning.

They found a significant association between an individual's fitness and his or her performance on certain spatial memory tests. There was also a strong correlation between fitness and hippocampus size.

"The higher fit people have a bigger hippocampus, and the people that have more tissue in the hippocampus have a better spatial memory," said U. of I. psychology professor Art Kramer, who led the study with Pittsburgh psychology professor Kirk Erickson.

"Even ignoring the hippocampus data, we see there is this significant and substantial relationship between how fit you are and how good your memory is, or at least a certain kind of memory, a certain kind of memory that we need all the time," Kramer said.

"This is really a clinically significant finding because it supports the notion that your lifestyle choices and behaviors may influence brain shrinkage in old age," Erickson said. "Basically, if you stay fit, you retain key regions of your brain involved in learning and memory."

An impairment of spatial memory "is one of a number of reasons why older people end up losing their independence," Kramer said. "Here is yet more evidence that becoming fit has implications for how well you're going to live your life."

Source: University of Illinois at Urbana-Champaign

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