Underlying processes of working memory are more complex than previously thought

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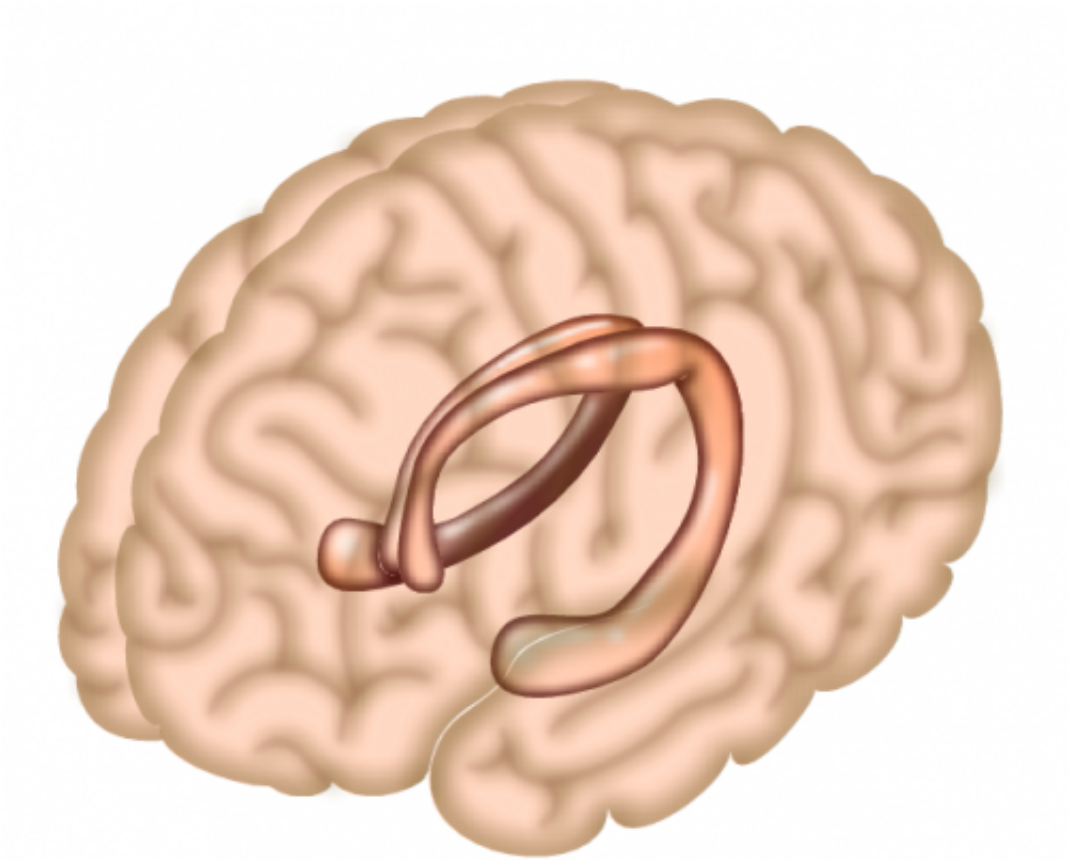

The hippocampus is a region of the brain largely responsible for memory formation. Credit: Salk Institute

In order to retain a piece of information for a short time, working memory is required. The underlying processes are considerably more

complex than hitherto assumed, as researchers from the Ruhr-Universität Bochum and Bonn University report in the journal *Cell Reports*. Two brain states must alternate rhythmically in order for a piece of information to be successfully maintained.

Working memory: maintaining new information for a short time

When we want to remember a new piece of information for a short time, for example a phone number, working memory is called upon. Different brain regions are involved in this process, including the hippocampus, which is known for its crucial role in long-term memory. The team headed by Prof Dr Nikolai Axmacher from the Institute of Cognitive Neuroscience in Bochum and Marcin Leszczynski, researcher in Bochum and at the Department of Epileptology at Bonn University, studied rhythmic activity patterns in the hippocampus while the subjects memorised sequences of numbers or faces.

Two activity states at semi-second intervals

To this end, the team worked with epilepsy patients who had electrodes implanted into the hippocampus for the purpose of surgical planning. Those electrodes enabled the researchers to measure the activity of the region embedded deeply in the brain. While the patients memorised sequences of faces or numbers, the researchers observed two activity states in the hippocampus, which alternated twice per second: an excited and a less excited state.

Seemingly simple tasks require highly complex processes

If the rhythmic pattern did not occur in the hippocampus, the patients

tended to make mistakes during the task. Based on the activity patterns, the researchers were also able to estimate how many numbers or faces the test subjects could reliably memorise. "The results show that the brain performs highly complex processes even during seemingly simple tasks," says Prof Nikolai Axmacher. "Our subjective feeling if something is simple or complex is not a reliable marker for how the brain actually solves a task."

More information: M. Leszczyński, J. Fell, N. Axmacher (2015): Rhythmic working memory activation in the human hippocampus, *Cell Reports*, DOI: 10.1016/j.celrep.2015.09.081

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