Virtual brain gives insights into memory deficits in depression

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Sen Cheng analyzes brain functions with the aid of computer models. Credit: RUB, Marquard

During a depressive episode, the ability of the brain to form new brain cells is reduced. Scientists of the Ruhr-Universität Bochum examined how this affects the memory with a computational model. It was previously known that people in an acute depressive episode were less likely to remember current events. The computational model however suggests that older memories were affected as well. How long the memory deficits reach back depends on how long the depressive episode lasts. The team around the computational neuroscientist Prof Dr. Sen Cheng published their findings in the journal *PLOS ONE* on 7th June 2018.

Computational model simulates a depressive brain

In major depressive disorder, patients may suffer from such severe cognitive impairments that, in some cases, are called pseudodementia. Unlike in the classic form of dementia, in pseudodementia, memory recovers when the depressive episode ends. To understand this process, the scientists from Bochum developed a computational model that captures the characteristic features of the brain of a patient with depression. They tested the ability of the model to store and recall new memories.

As is the case in patients, the simulation alternated between depressive episodes and episodes without any symptoms. During a depressive episode, the brain forms fewer new neurons in the model. Whereas in previous models, memories were represented as static patterns of neural activity, the model developed by Sen Cheng and his colleagues views memories as a sequence of neural activity patterns. "This allows us not only to store events in memory, but also their temporal order," says Sen Cheng.

Impact on brain stronger than thought

The computational model was able to recall memories more accurately if the responsible brain region was able to form many new neurones, just like the scientists expected. However, if the brain region formed fewer new brain cells, it was harder to distinguish similar memories and to recall them separately.

The computational model not only showed deficits in recalling current events, it also struggled with memories that were collected before the depressive episode. The longer the depressive episode lasted, the further the memory problems reached back.

"It was previously assumed that memory deficits only occur during a depressive episode," says Sen Cheng. "If our model is right, major depressive disorder could have consequences that are more far-reaching. Once remote memories have been damaged, they do not recover, even after the depression has subsided."

More information: Jing Fang et al, The reduction of adult neurogenesis in depression impairs the retrieval of new as well as remote episodic

memory, *PLOS ONE* (2018). DOI: 10.1371/journal.pone.0198406

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