How odours are turned into long-term memories

December 22 2017

Credit: RUB, Kramer

The neuroscientists Dr. Christina Strauch and Prof Dr. Denise Manahan-Vaughan from the Ruhr-Universität Bochum have investigated which brain area is responsible for storing odours as long-term memories.

Some odours can trigger memories of experiences from years back. The current study shows that the piriform cortex, a part of the olfactory brain, is involved in the process of saving those memories; the mechanism, however, only works in interaction with other brain areas. The findings have been published in the journal *Cerebral Cortex*.

"It is known that the piriform cortex is able to temporarily store olfactory memories. We wanted to know, if that applies to long-term memories as well," says Christina Strauch.

Artificial sensation through stimulation

Synaptic plasticity is responsible for the storing of memories in the memory structures of the brain: During that process the communication between neurons is altered by means of a process called synaptic plasticity, so that a memory is created. Strauch and Manahan-Vaughan examined if the piriform cortex of rats is capable of expressing synaptic plasticity and if this change lasts for more than four hours; indicating that long-term memory may have been established.

The scientists used electrical impulses in the brain to emulate processes that trigger the encoding of an olfactory sensation as a memory. They used different stimulation protocols which varied in the frequency and intensity of the pulses. It is known that these protocols can induce long-term effects in another brain area that is responsible for long term memories: the hippocampus. Strikingly, the same protocols did not induce long-term information storage in the form of synaptic plasticity in the piriform cortex.

Signal from a higher brain area needed

The scientists wondered whether the piriform cortex needs to be

instructed to create a long-term memory. They then stimulated a higher brain area called the orbitofrontal cortex, which is responsible for the discrimination of sensory experiences. This time the stimulation of the brain area generated the desired change in the piriform cortex. "Our study shows that the piriform cortex is indeed able to serve as an archive for long-term memories. But it needs instruction from the orbitofrontal cortex – a higher brain area – indicating that an event is to be stored as a long-term memory," says Strauch.

More information: Christina Strauch et al. In the Piriform Cortex, the Primary Impetus for Information Encoding through Synaptic Plasticity Is Provided by Descending Rather than Ascending Olfactory Inputs, *Cerebral Cortex* (2017). DOI: 10.1093/cercor/bhx315

Provided by Ruhr-Universitaet-Bochum