

# How odours are turned into long-term memories

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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](https://doi.org/10.1093/cercor/bhx315)

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