BBC NEWS

SCIENCE & ENVIRONMENT

25 July 2013 Last updated at 15:28 ET

Scientists can implant false memories into mice

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False memories have been implanted into mice, scientists say.

A team was able to make the mice wrongly associate a benign environment with a previous unpleasant experience from different surroundings.

The researchers conditioned a network of neurons to respond to light, making the mice recall the unpleasant environment.

Reporting in Science, they say it could one day shed light into how false memories occur in humans.

The brains of genetically engineered mice were implanted with optic fibres in order to deliver pulses of light to their brain. Known as optogenetics, this technique is able to make individual neurons respond to light.

Unreliable memory

Just like in mice, our memories are stored in collections of cells, and when events are recalled we reconstruct parts of these cells - almost like re-assembling small pieces of a puzzle.

It has been well documented that human memory is highly unreliable, first highlighted by a study on eyewitness testimonies in the 70s. Simple changes in how a question was asked could influence the memory a witness had of an event such as a car crash.

When this was brought to public attention, eyewitness testimonies alone were no longer used as evidence in court. Many people wrongly convicted on memory statements were later exonerated by DNA evidence.

Xu Liu of the Massachusetts Institute of Technology and one the lead authors of the study, said that when mice recalled a false memory, it was indistinguishable from the real memory in the way it drove a fear response in the memory forming cells of a mouse's brain.

The mouse is the closest animal scientists can easily use to analyse the brain, as though simpler, its structure and basic circuitry is very similar to the human brain.

Studying neurons in a mouse's brain could therefore help scientists further understand how similar structures in the human brain work.

"In the English language there are only 26 letters, but the combinations of letters make unlimited words and sentences, this is also true for memories," Dr Liu told BBC News.

Evolving memories

"There are so many brain cells and for each individual memory, different combinations of small populations of cells are activated."

These differing combinations of cells could partly explain why memories are not static like a photograph, but constantly evolving, he added.

"If you want to grab a specific memory you have to get down into the cell level. Every time we think we remember something, we could also be making changes to that memory - sometimes we realise sometimes we don't," Dr Liu explained.

"Our memory changes every single time it's being 'recorded'. That's why we can incorporate new information into old memories and this is how a false memory can form without us realising it."

Susumu Tonegawa of the Massachusetts Institute of Technology said his teams' work provided the first animal model in which false and genuine memories could be investigated in the cells which store memories, called engram-bearing cells.

"Humans are highly imaginative animals. Just like our mice, an aversive or appetitive event could be associated with a past experience one may happen to have in mind at that moment, hence a false memory is formed."

Silencing fear

Neil Burgess from University College London, who was not involved with the work, told BBC News the study was an "impressive example" of creating a fearful response in an environment where nothing fearful happened.

"One day this type of knowledge may help scientists to understand how to remove or reduce the fearful associations experienced by people with conditions like post traumatic stress disorder."

But he added that it's only an advance in "basic neuroscience" and that these methods could not be directly applied to humans for many years.

"But basic science always helps in the end, and it may be possible, one day, to use similar techniques to silence neurons causing the association to fear."

'Diseases of thought'

Mark Mayford of the Scripps Research Institute in San Diego, US, said: "The question is, how does the brain change with experience? That's the heart of everything the brain does.

He explained that work like this could one day further help us to understand the structure of our thoughts and the cells involved.

"Then one can begin to look at those brain circuits, see how they change, and hopefully find the areas or mechanisms that change with learning."

"The implications are potentially interventions for diseases of thought such as schizophrenia. You cannot approach schizophrenia unless you know how a perception is put together."

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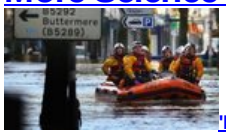

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