

Researchers identified a protein essential in long term memory consolidation

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New research at the University of Haifa identified a specific protein essential for the process of long term memory consolidation. This is the latest of several discoveries that are leading us towards a better understanding of one of the most complex processes in nature – the process of memory creation and consolidation in the human brain. This latest research was published recently in the prestigious journal *Nature Neuroscience*.

The human brain constantly receives sensory stimuli from the outside world: sounds, tastes, visuals, touch and smells. A very small fraction of these stimuli which are recorded in short term memory actually become part of our long term memory. Previous studies in the laboratory for "Molecular Mechanisms of Learning and Memory" at the University of Haifa identified a protein linked to the quality of long term memories. In the current study, the researchers were looking to understand how long term memories are stabilized.

The research team led by Prof. Kobi Rosenblum, Head of the Department of Neurobiology and Ethology at the University of Haifa, and PhD student Alina Elkobi together with Drs. Katya Belelovsky and Liza Barki and in cooperation with Dr. Ingrid Ehrlich from the Friedrich Miescher Institute at the University of Basel, Switzerland, searched for a protein which is present during the process of memory formation and is actually an essential factor in the process.

Using taste learning in mice, the researchers found learning-related

induction of the protein PSD-95 in the brain cortex "taste center" during the process of memory creation. However, when the mice were exposed to known tastes, PSD-95 was not induced in this center of the brain cortex.

In order to prove that PSD-95 is essential for the process of memory creation, the researchers used two different groups of mice who had undergone the same tests for taste learning. Using genetic engineering, the researchers halted the process of PSD-95 production in the nerve cells of the "taste center" in the cortex. The group whose PSD-95 production was stopped had no memory of new tastes the day after being introduced to them while the other group remembered the tastes – demonstrating that a new memory was created when PSD-95 was induced and that the information disappeared from the brain when the protein was not induced.

The study further examined the effect of PSD-95 production on existing memories. Mice that had already been introduced to and remembered certain tastes were genetically engineered to stop producing the protein and they still remembered the tastes – demonstrating that while PSD-95 induction is essential for memory creation, its absence does not affect memory retention.

"The process of long term memory creation in the human brain is one of the incredible processes which is so clearly different than "artificial brains" like those in a computer. While an "artificial brain" absorbs information and immediately saves it in its memory, the human brain continues to process information long after it is received, and the quality of memories depends on how the information is processed. One of the first processes to be affected in neurodegenerative diseases like Alzheimer's and Parkinson's is that of memory acquisition and processing. In this research we identified one specific protein, among the many proteins active in brain synapses, whose production is essential for

the brain to process and remember information it receives. The more we understand about the processes and elements involved in this complicated process, the sooner we will be able to develop medications which will delay the progression of cognitive degenerative diseases and enable patients to continue normative functioning," explains Prof. Rosenblum.

Source: University of Haifa

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