Medical Xpress

Researchers identify one of the necessary processes in the formation of long-term memory

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A new study that was carried out at the University of Haifa has identified another component in the chain of actions that take place in the neurons in the process of forming memories. This discovery joins a line of findings from previous studies that together provide a better understanding of the most complex processes in nature - the process of memory formation and storage in the human brain. The new study has been published in the prestigious *Journal of Neuroscience*.

The human brain is continuously inundated with sensory information on the world: new sounds, tastes, sights and smells and the formation of memory to these inputs is ultimately vital for animal survival. Very little of this information becomes short-term memory. And only a small part of the information that becomes short-term memory ultimately becomes long-term and stabilized memory. Earlier studies that were carried out at the Molecular Mechanisms of Learning and Memory laboratory headed by Prof. Kobi Rosenblum at the University of Haifa found that the an elevation in the expression of the protein PSD-95 is necessary for the formation of long-term memory. The present study aimed to find out whether another molecular process - the addition of a phosphor molecule to the NMDA receptor protein (phosphorylation) - is necessary too.

Earlier studies have proven that changes in the NMDA receptor can adjust the neuronal network in the brain, and that during a learning process this receptor undergoes increased phosphorylation. Until now, it had not been proved that the increase in phosphorylation of the NMDA is necessary for the process and that the process would not occur without it.

In order to prove this, the scientists - headed by Prof. Rosenblum, Head of the Department of Neurobiology and Ethology at the University of Haifa, and Dr. Liza Barki-Harrington, along with Dr. Alina Elkobi and research student Tali Tzabary - chose to focus on the formation of new taste memory in rats as a model for sensory memory. According to the researchers, examining taste-learning processes has advantages in this type of research, since it enables tracking when the process begins, what its specific location is in the brain and the molecular processes that occur during the process.

The first stage of the study aimed to verify the findings of the previous studies and showed that the new taste learning does indeed involve a process of increased phosphorylation in the NMDA receptors in the area specific to learning taste in the brain. In order to do so, mature rats were trained to drink water at set times and after a few days some were given saccharine-sweetened water. The saccharine has no caloric value and therefore has no metabolic impact on the body and cannot affect the body's processes. As expected, the rats that received the newly sweet-tasting water and that began a process of learning, showed an increase in phosphorylation in comparison to those rats that continued drinking regular water.

The second stage of the study was aimed at showing that the phosphorylation process is essential. For this, the scientists injected a new group of rats with a substance that inhibits phosphorylation of the NMDA in the area of taste learning in the brain when drinking the saccharine. Tests that were carried out afterwards showed that these rats were not able to learn the new taste, which proves that the phosphorylation process is necessary for learning taste. The researchers found that obstruction of the process brings about a change in the location of the receptor in relation to the NMDA and thereby is likely to be responsible for inhibiting the formation of long-term memory.

"Our goal is to identify piece after piece of the complex puzzle that is the formation of long-term memory. Once we know how to describe the chain of actions that take place in the brain, we may be able to know where and how to interfere," Dr. Barki-Harrington said.

"The glutamate neural synapses - via the receptors of the NMDA - and dophamin, play a central role in a number of neural pathologies, including processes of addiction and of schizophrenia. There is good reason to assume that one afflicted with schizophrenia has a sub- or over-functioning of this system, and its loss of balance is one of the causes of the illness. A better understanding of this balance - or loss of balance - in the normal processes will enable future discovery of new objectives for developing medications, which we hope will improve patients' lives significantly," Prof. Rosenblum stated.

Source: University of Haifa (news : web)