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Why one way of learning is better than another

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A new study from the Montreal Neurological Institute and Hospital (The Neuro) of McGill University reveals that different patterns of training and learning lead to different types of memory formation. The significance of the study, published in the *Journal of Neuroscience*, is that it identifies the molecular differences between spaced training (distributed over time) and massed training (at very short intervals), shedding light on brain function and guiding learning and training principles.

In every organism studied, results have shown that memory formation is highly sensitive not only to the total amount of training, but also to the pattern of trials used during training. In particular, trials distributed over time are superior at generating long-term memories than trials presented at very short intervals.

"It is a well known psychological principle that learning is better when training trials are spaced out than when given all together," says Dr. Wayne Sossin, neuroscientist at The Neuro and lead investigator of the study. "However, there are very few, if any studies that identify, at the molecular level, differences between the two types of training."

"In this study, using Aplysia, a type of mollusk often used as a model of learning in which the difference between spaced and massed training has been well established, we identify an event, the activation of the enzyme called Protein kinase C Apl II (PKC Apl II), which is very different under the two training paradigms and could explain the differences in

learning.

The process of strengthening communication between nerve cells (neurons), called synaptic facilitation, represents learning and is the basis of change in learning in Aplysia. This process is controlled by the release of a neurotransmitter called serotonin. Four to five spaced applications of serotonin generate long-term changes in the strength of the synapse - the junction between two neurons - but in this study lead to less activation of PKC Apl II. This leads to stronger connections between neurons and therefore increased learning and memory. In contrast, if the application of serotonin is continuous, as would be the case in massed learning/training, the researchers found that there was much more activation of PKC Apl II, suggesting that activation of this enzyme may block the mechanisms for generating long-term memory, while retaining mechanisms for short-term memory.

This study shows that the enzyme PKC Apl II is regulated differently by spaced versus massed applications of serotonin and that the difference in activation of PKC Apl II can explain some of the distinction between spaced and massed training.

Source: McGill University (news : web)