Nerve protein tomosyn linked to learning and memory

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Can the nerve signaling inhibitor tomosyn help retain long-term memory? A new study by two University of Illinois at Chicago biologists points to the link.

Findings by Janet Richmond and David Featherstone, both professors of biological sciences at UIC, are reported in the Oct. 31 online early edition of the Proceedings of the National Academy of Sciences.

"This is the first really comprehensive effort to look at the role of tomosyn in fly learning," said Richmond, who until now studied the protein in an even simpler organism, the lowly nematode, or roundworm.

Several studies have shown that learning behavior in fruit flies requires many of the same proteins used in higher animals, including mammals.

The UIC biologists found that tomosyn plays an important role in regulating the amount of neurotransmitter in the synapse, the junction where messages are relayed between nerve cells. Tomosyn can limit this signaling; eliminating tomosyn strengthens the signaling.

"When synapses get stronger, we learn. When they get weaker, we forget," said Featherstone. "We discovered that tomosyn is a mechanism that can control whether synapses get stronger or weaker, and this seems to be important for memory formation."

Tomosyn interacts with a group of proteins known by the acronym

SNARE, and that interaction is in turn regulated by an enzyme called PKA, which has been shown to be important for learning.

Knowing this, Richmond and Featherstone ran experiments on fruit flies to see whether tomosyn might play a role in learning and memory.

Their experiments involved the fly's ability to learn to associate a particular odor with an electrical shock. Flies remember the association and will avoid the odor for hours afterwards. But by knocking out tomosyn, "the flies were unable to retain that memory," said Richmond.

The UIC biologists demonstrated how tomosyn can affect both synaptic signaling and learning and memory.

Richmond and Featherstone hope their findings will provide valuable clues that pharmacologists might use in creating new drug therapies for various forms of human memory loss. Richmond said tomosyn is a good protein to experiment with.

"Tomosyn regulates the way synapses work, but it's not essential for life," she said. "We hope that by understanding how it functions in memory formation, our research will provide useful insights that may help us better address the issue of severe memory loss."

Provided by University of Illinois at Chicago