Scientists shed light on age-related memory loss and possible treatments

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Scientists from the Florida campus of The Scripps Research Institute have shown in animal models that the loss of memory that comes with aging is not necessarily a permanent thing.

In a new study published this week in an advance, online edition of the journal Proceedings of the National Academy of Sciences, Ron Davis, chair of the Department of Neuroscience at Scripps Florida, and Ayako Tonoki-Yamaguchi, a research associate in Davis's lab, took a close look at memory and memory traces in the brains of both young and old fruit flies.

What they found is that like other organisms—from mice to humans—there is a defect that occurs in memory with aging. In the case of the fruit fly, the ability to form memories lasting a few hours (intermediate-term memory) is lost due to age-related impairment of the function of certain neurons. Intriguingly, the scientists found that stimulating those same neurons can reverse these age-related memory defects.

"This study shows that once the appropriate neurons are identified in people, in principle at least one could potentially develop drugs to hit those neurons and rescue those memories affected by the aging process," Davis said. "In addition, the biochemistry underlying memory formation in fruit flies is remarkably conserved with that in humans so that everything we learn about memory formation in flies is likely applicable to human memory and the disorders of human memory."

While no one really understands what is altered in the brain during the aging process, in the current study the scientists were able to use functional cellular imaging to monitor the changes in the fly's neuron activity before and after learning to view those changes.

"We are able to peer down into the fly brain and see changes in the brain," Davis said. "We found changes that appear to reflect how intermediate-term memory is encoded in these neurons."

Olfactory memory, which was used by the scientists, is the most widely studied form of memory in fruit flies—basically pairing an odor with a mild electric shock. These tactics produce short-term memories that persist for around half an hour, intermediate-term memory that lasts a few hours, and long-term memory that persists for days.

The team found that in aged animals, the signs of encoded memory were absent after a few hours. In that way, the scientists also learned exactly which neurons in the fly are altered by aging to produce intermediate-term memory impairment. This advance, Davis notes, should greatly help scientists understand how aging alters neuronal function.

Intriguingly, the scientists took the work a step further and stimulated these neurons to see if the memory could be rescued. To do this, the scientists placed either cold-activated or heat-activated ion channels in the neurons known to become defective with aging and then used cold, or heat, to stimulate them. In both cases, the intermediate-term memory was successfully rescued.

More information: "Aging Impairs Intermediate-Term Behavioral Memory by Disrupting the Neuron Memory Trace," *Proceedings of the National Academy of Sciences.*

Provided by The Scripps Research Institute