Small RNAs found to play important roles in memory formation

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Drosophila melanogaster

Scientists from the Florida campus of The Scripps Research Institute (TSRI) have found that a type of genetic material called "microRNA" plays surprisingly different roles in the formation of memory in animal models. In some cases, these RNAs increase memory, while others decrease it.

"Our systematic screen offers an important first step toward the comprehensive identification of all miRNAs and their potential targets that serve in gene networks important for normal learning and memory," said Ron Davis, chair of TSRI's Department of Neuroscience who led

the study. "This is a valuable resource for future studies."

The study was published in the June 2015 edition of the journal *Genetics*.

Unlike some types of RNA, microRNAs (miRNAs) do not code for proteins but instead regulate various biological processes by modulating the level of gene expression. A number of studies have shown that miRNAs are critical for normal development and cellular growth and may contribute to the complexity of neurodegenerative diseases.

In the new study, 134 different miRNAs were tested for roles in learning and memory in the central nervous system of Drosophila melanogaster, the common fruit fly, which is a recognized animal model for memory studies.

The researchers tested the potential involvement of miRNAs in intermediate-term memory by silencing them individually and identified at least five different miRNAs involved in memory formation or retention.

"Among the five miRNAs identified in this study, we found one that is necessary for memory formation," said Research Associate Germain U. Busto, a first author of the study with Research Associate Tugba Guven-Ozkan. "Interestingly, its human counterpart is altered in several neurodegenerative diseases, including Alzheimer's and Huntington's. It's possible that this might be a potential model to study and solve some specific aspects of those disorders."

Surprisingly, the researchers found some miRNAs decreased memory formation, while others increased it. The identified miRNAs affected either neuronal physiology underlying memory formation or the development of the nervous system.

"These microRNAs are highly regulated during brain development and for adult brain function," said Guven-Ozkan. "When misregulated, they may exacerbate brain diseases like autism, and Alzheimer's and Huntington's diseases. We'd like to pinpoint learning and memory pathways to understand how they may lead to human disease."

More information: "microRNAs That Promote or Inhibit Memory Formation in Drosophila melanogaster." *Genetics* June 2015 200:569-580; DOI: 10.1534/genetics.114.169623

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