

# New discovery on animal memory opens doors to research on memory impairment diseases

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Rats demonstrated a form of human memory as they sought chocolate in a series of experiments at Indiana University. Credit: Ellen van Deelen, photo

If you ask a rat whether it knows how it came to acquire a certain coveted piece of chocolate, Indiana University neuroscientists conclude, the answer is a resounding, "Yes." A study newly published in the journal *Current Biology* offers the first evidence of source memory in a

nonhuman animal.

The findings have "fascinating implications," said principal investigator Jonathon Crystal, both in evolutionary terms and for future research into the biological underpinnings of memory, as well as the treatment of diseases marked by [memory failure](#) such as Alzheimer's, Parkinson's and Huntington's, or disorders such as schizophrenia, [PTSD](#) and depression.

The study further opens up the possibility of creating animal models of [memory disorders](#).

"Researchers can now study in animals what was once thought an exclusively human domain," said Crystal, professor in the Department of Psychological and [Brain Sciences](#) in the College of Arts and Sciences. "If you can export types of behaviors such as source memory failures to transgenic animal models, you have the ability to produce preclinical models for the treatment of diseases such as Alzheimer's."

Of the various forms of memory identified by scientists, some have long been considered distinctively human. Among these is source memory. When someone retells a joke to the person who told it to him, it is an everyday example of source memory failure. The person telling the joke forgot the source of the information—how he acquired it—though not the information he was told. People combine source information to construct memories of discrete events and to distinguish one event or episode from another.

Nonhuman animals, by contrast, have been thought to have limited forms of memory, acquired through conditioning and repetition, habits rather than conscious memories. The kind of memory failures most devastating to those directly affected by Alzheimer's have typically been considered beyond the scope of nonhuman minds.

The study owes much to another quality these rodents share with humans: They love [chocolate](#). "There's no amount of chocolate you can give to a rat which will stop it from eating more chocolate," Crystal said.

Using chocolate as bait in an eight-arm radial maze, the study was made up of a series of five experiments that together provide converging evidence. In the first two, in order to obtain the chocolate, the rats needed to remember the source by which they acquired it, whether they were placed near the trough containing the chocolate or had to run on their own to get there. Using different mazes helped rule out the possibility that overlearned cues from a particular maze led to the positive results.

A third experiment showed that the rats' source memory, the means by which it retrieved the chocolate, lasted for a week rather than the one day that other, more ordinary forms of memory last. This provided converging evidence, said Crystal, that the rats were relying on source memory insofar as source memories decay more slowly than other memory systems.

In the fourth experiment, the rats could obtain the chocolate when the researcher placed them at the trough. The rats remembered this rule, too. Finally, in the fifth experiment, researchers temporarily disabled the rats' hippocampus, the brain region thought to be crucial for accurate source memory. If the task requires source memory, inactivating that area would impair the ability to remember source information, which it did.

"What we're trying to do is to develop behavioral approaches with rodents that tap into those types of memory systems," Crystal said. "This study is the demonstration, the proof of the concept that source memory exists in animals. But the mechanism that supports it is open. We're now interested in working out the sub-areas of the hippocampus that are involved in episodic memory, testing hypotheses about different regions

being involved in short-term and long-term episodic memory, working out the neuroanatomical pathways."

**More information:** The study "Source Memory in the Rat" was published in *Current Biology* and is online at [dx.doi.org/10.1016/j.cub.2013.01.023](https://doi.org/10.1016/j.cub.2013.01.023)

Provided by Indiana University

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