How curiosity stimulates the brain to improve learning and memory

By Daisy Yuhas, Scientific America, adapted by Newsela staff on 09.29.19
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Image 1. Curiosity motivates us to find out more and helps our brains remember what we discover. Photo by: Getty Images

Do we live in a holographic universe? How green is your coffee? Could drinking too much water actually kill you?

Before you look up the answers on Google, you might consider how your knowledge-hungry brain is preparing for the answers. A 2014 study from the University of California, Davis, suggests that when we feel curious, changes in the brain ready us to learn about the subject at hand. Not only that, but the brain also prepares to absorb separate, unrelated information.

The research team, which included neuroscientist Charan Ranganath, asked 19 participants to review more than 100 questions. The participants rated each question in terms of how curious they were about the answer. Next, each subject revisited 112 of the questions — half of which they found interesting, whereas the rest they found uninteresting — while the researchers scanned their brain activity.

Piquing Curiosity

During the scanning session, participants viewed a question, waited 14 seconds and then viewed a photograph of a face totally unrelated to that question. They were then shown the answer. The researchers tested participants to see how well they could recall and retain both the trivia answers and the faces they had seen.

The researchers discovered that greater interest in a question led to not only better memory for the answer but also for the unrelated face that had come before it. A follow-up test one day later found the same results: People could better remember a face if it came after an intriguing question. Somehow, curiosity could prepare the brain for learning and long-term memory more broadly.

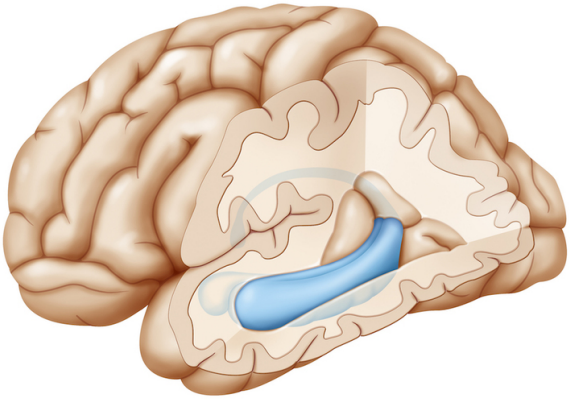
The findings are somewhat similar to the work of UC Irvine neuroscientist James McGaugh. He found that emotional arousal could improve certain memories, but as Ranganath and his team revealed, curiosity involves very different parts of the brain.

Scanning Brain Activity

To understand exactly what happens in the brain, the researchers turned to the brain scans. They discovered that brain activity during the waiting period before an answer appeared was linked to better memory. Several changes occur during this waiting period.

First, brain activity ramps up in two regions in the middle of the brain. These regions transmit a chemical called dopamine, which helps regulate the sensation of pleasure and reward. This suggests that before the answer appears, the brain's eager interest already engages the reward system. "This anticipation was really important," said Ranganath's co-author, UC Davis neuroscientist Matthias Gruber. The more curious a subject was, the more this part of their brain expected something good.

In addition, the researchers found that curious minds showed increased activity in a part of the brain called the hippocampus, which is involved in the creation of memories. In fact, seeing how much the hippocampus and reward pathways interacted helped predict someone's ability to remember the faces. The brain's reward system seemed to prepare the hippocampus for learning.



These findings tell us many things. For one, Ranganath suspected the findings could help explain memory and learning difficulty in people with conditions that involve low dopamine.

Hungry For Knowledge

Encouraging curiosity could also help educators, advertisers and storytellers find ways to help students or audiences better remember their messages. "This research advances our understanding of the brain structures that are involved in learning processes," said Goldsmiths, University of London psychologist Sophie von Stumm. She is unconnected to the study. Von Stumm hopes other researchers will do similar research to clarify the kinds of information curious people can retain. She also wants to know whether results differ for subjects who are generally curious as opposed to temporarily interested in something specific.

Ranganath's findings also hint at the nature of curiosity itself. Neuroscientist Marieke Jepma at the University of Colorado, Boulder, also did not participate in this study. However, she had previously found that curiosity can be an unpleasant experience, and the brain's reward circuitry might not kick in until there is a resolution. She suspected that her findings and Ranganath's results were two sides of the same coin. To explain this, she referred to the experience of reading a mystery book. "Being uncertain about the identity of the murderer may be a pleasant reward-anticipating feeling when you know this will be revealed," she said. "But this will turn into frustration if the last chapter is missing."

Ranganath agreed that the hunger for knowledge is not always an enjoyable experience. "It's like an itch that you have to scratch," he said. "It's not really pleasant."

Quiz

1 Read the selection from the section "Piquing Curiosity."

> *The researchers discovered that greater interest in a question led to not only better memory for the answer but also for the unrelated face that had come before it. A follow-up test one day later found the same results: People could better remember a face if it came after an intriguing question.*

Which phrase from the selection provides context clues for the meaning of "intriguing"?

(A) researchers discovered

(B) greater interest

(C) unrelated face

(D) better remember

2 Read the selection from the section "Hungry For Knowledge."

> *However, she had previously found that curiosity can be an unpleasant experience, and the brain's reward circuitry might not kick in until there is a resolution. She suspected that her findings and Ranganath's results were two sides of the same coin.*

What does Jepma mean by "two sides of the same coin"?

(A) costly ways to arrive at the same conclusion

(B) unpleasant relationships with other scientists

(C) different but related outcomes of a situation

(D) opposite views that cannot find agreement

3 Why did Ranganath and his team show participants faces before the answers to the questions they asked?

(A) They wanted to see if the faces would distract from their curiosity.

(B) They wanted to see if the faces would increase their emotional responses.

(C) They wanted to see how well the brain would remember something unrelated.

(D) They wanted to see how well participants dealt with frustration.

4 How does the hippocampus affect memory in the brain?

(A) It helps regulate the sense of pleasure and reward.

(B) It increases emotional arousal related to certain memories.

(C) It halts the flow of dopamine to allow the brain to create memories.

(D) It interacts with the reward center to prepare for learning.