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Brain Wired to Reward Learning

Feel-good Chemical Dopamine Released in Response to Correct Choices

Making the right choice may come with its own built-in reward from your brain.

A new study suggests that the brain releases the feel-good chemical dopamine in response to learning. When we make the right choice, the surge of dopamine helps us appreciate what we've done so we eventually "learn" to do it again.

Researchers also found that raising the level of dopamine in the brain may help us learn better.

Several theories of learning are based on the idea that the brain uses success and failure to improve future decision-making. These theories highlight the role that anticipating a reward plays in learning.

Researchers say this study helps explain the biological mechanism behind the way the brain uses reward anticipation to improve future decisions.

Learning Is Rewarding

In the study, published in the journal *Nature*, researchers treated adult volunteers with drugs to either increase or decrease levels of dopamine circulating in the brain. Dopamine is a naturally occurring chemical in the brain involved in its reward system.

Participants were then asked to perform a reward-based learning task. They were presented with pairs of symbols on a computer screen. Each symbol was linked to different probabilities of monetary gain or loss, and researchers assessed how well participants were able to maximize their monetary gain.

The results showed that participants with higher levels of dopamine performed better on the learning task and became more adept at choosing the symbol with the best chances of reward.

Researcher Mathias Pessiglione and colleagues at the Wellcome Department of Imaging Neuroscience, say the finding suggests the brain's dopamine system helps us learn by rewarding educated decisions.

Apple Juice May Boost Memory

Antioxidants in Apples May Help Memory and Fight Alzheimer's Disease

An apple (or two) a day may help keep Alzheimer's away -- and fight the effects of aging on the brain.

A new study shows drinking apple juice may improve memory by preventing the decline of an essential neurotransmitter known as acetylcholine.

Neurotransmitters are chemicals released by nerve cells to transmit messages to other nerve cells. They are critical for good memory and brain health.

Previous studies have shown that increasing the amount of acetylcholine in the brain can slow the mental decline found in people with Alzheimer's disease.

"The findings of the present study show that consumption of antioxidant-rich foods such as apples and apple juice can help reduce problems associated with memory loss," says researcher Thomas Shea, PhD, director of the Center for Cellular Neurobiology & Neurodegeneration Research at the University of Massachusetts Lowell, in a news release.

Prior research has shown that supplementing animal diets with other antioxidant-rich fruits and vegetables, such as blueberries, spinach, and strawberries, can help slow age-related mental decline better than using dietary supplements containing purified forms of antioxidants.

Apples for Alzheimer's?

In the study, researchers compared normal adult mice, normal "aged" mice, and special mice that were a genetic model for human Alzheimer's.

The mice were given either a normal diet, or a diet lacking in essential nutrients, for one month. Some of the mice on the nutrient-poor diet were also given apple juice concentrate mixed in their water.

The results showed that normal adult mice and the genetically-engineered mice on normal diets had the same acetylcholine levels.

In fact, the normal adults had the same acetylcholine levels regardless of diet.

However, the genetically engineered mice on the nutrient-poor diet had lower acetylcholine levels. But this drop was prevented in those given apple juice.

In the aged mice on a normal diet, acetylcholine levels were lower than in the normal adult mice; and their levels were even lower if placed on the nutrient-poor diet. But, again, this decline was prevented by the addition of apple juice to drink.

The mice were also put through maze memory tests. "It was surprising how the animals on the apple-enhanced diets actually did a superior job on the maze tests than those not on the supplemented diet," says Shea.

The amount of apple juice the mice drank was comparable to drinking about two 8-ounce glasses of apple juice or eating two to three apples a day for humans.

Human studies looking at apple consumption are coming in the future.

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