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Brain response to information about the future suggests that ignorance isn't bliss

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New research demonstrates that single neurons in the reward center of the brain process not only primitive rewards but also more abstract, cognitive rewards related to the quest for information about the future. The study, published by Cell Press in the July 16 issue of the journal *Neuron*, enhances our understanding of learning and suggests that current theories of reward should be revised to include the effect of information seeking.

"The desire to know what the future holds is a powerful motivator in everyday life, but we know little about how this desire is created by neurons in the brain," says lead study author Dr. Ethan S. Bromberg-Martin from the National Institutes of Health in Bethesda, Maryland. Dr. Bromberg-Martin and coauthor, Dr. Okihide Hikosaka, investigated whether dopamine-releasing neurons associated with processing basic primitive rewards, such as food and water, are also involved in processing more abstract rewards.

The researchers focused on a form of cognitive reward that involves anticipation of a substantial future gain. Specifically, people (and animals) do not like to be held in suspense and prefer to receive advance information about the rewards they will receive in the future. In this study, a simple decision task allowed rhesus monkeys to choose whether to view informative pictures that would tell them the size of upcoming water rewards. The researchers recorded the activity of dopamine reward neurons while the monkeys performed the task.

The monkeys showed a strong preference for information about upcoming rewards and preferred to receive the information as soon as possible, even though the information had no effect on the final reward outcome. Importantly, the dopamine neurons that signaled the monkey's expectation of water rewards also signaled the expectation of advance information in a manner that was correlated with the strength of the animal's preference. "The monkeys and dopamine neurons treated information about rewards as if it was a reward itself," explains Dr. Bromberg-Martin.

The authors conclude that the same dopamine neurons that signal primitive rewards like food and water also signal the cognitive reward of advance information. Importantly, this finding has important implications for modern theories of reinforcement learning. "Our data shows the need for a new class of models that assign information a positive value," says Dr. Bromberg-Martin. "Dopamine neurons might treat information as desirable because it can help us learn how to predict and control our environment."

Source: Cell Press (news : web)

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