Neuroscientists identify physiological link between trial and error and learning

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Learning through trial and error often requires subjects to establish new physiological links by using information about trial outcome to strengthen correct responses or modify incorrect responses. New findings, which appear in the latest issue of the journal *Neuron*, establish a physiological measure linking trial outcome and learning.

"Our results open a new door to understanding the important role of trial outcome in the learning process," said Wendy Suzuki, a professor at New York University's Center for Neural Science and a co-author of the study.

The study's other co-authors included researchers from France's National Center for Scientific Research, the Harvard Medical School, and the University of California, Davis. The study was supported by a grant from the National Institutes of Health.

For the past half century, scientists have examined the role of the brain's medial temporal lobe in learning. Previous scholarship has determined that a critical function of the medial temporal lobe is to successfully acquire new information about facts and events ("declarative learning") by making new associations between initially unrelated items ("associative learning").

The researchers on the study published in Neuron sought to understand if there is a link between how the brain functions in associative learning and in processing information about trial outcome. Specifically, they

were interested in cell activity in a portion of medial temporal lobe called the hippocampus. Earlier research had found that hippocampal neurons are involved in associative learning, such as matching names with faces.

To investigate this process, the researchers had primates play a computer memory game in which the subjects matched particular object-place combinations with motor responses. When they associated the correct object-place association with the correct response, the primates were rewarded with their favorite fruit juice. During these sessions, the researchers recorded the activity of the primates' hippocampal neurons.

The results showed that a surprisingly large proportion of recorded hippocampal cells—50 percent—differentiated between correct and error responses. This finding was striking since previous learning or memory studies in the hippocampus showed lower proportions of active cells in task-related activities. Moreover, their findings showed many of these cells also came to respond more strongly to particular object-place combinations as learning improved. This suggests that the cells' ability to make distinctions between correct and incorrect trial outcomes may influence new learning by changing a cell's sensitivity to the stimuli being learned.

Source: New York University (news : web)