Research reveals brain pathway that signals when we have made a mistake and facilitates better future decision-making

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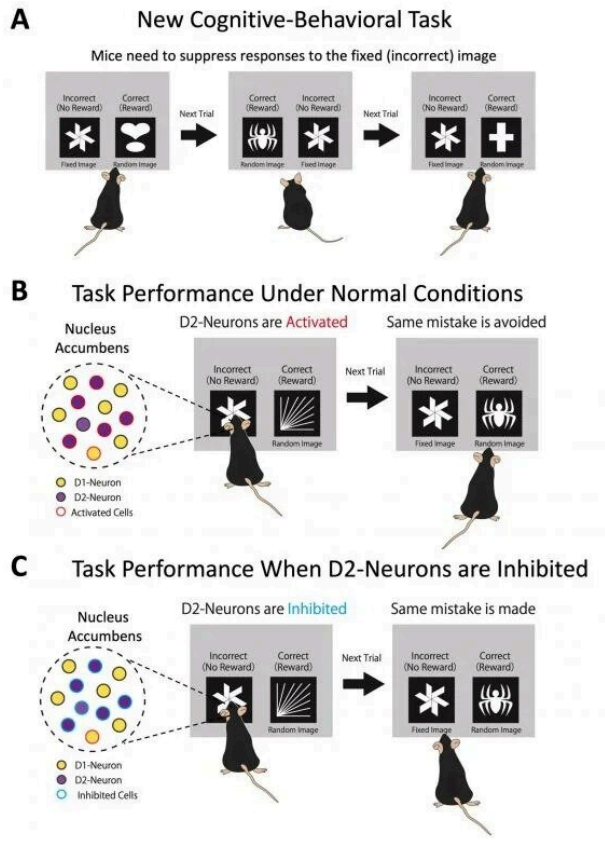

Signaling of mistakes by D2-Neurons improves future decision-making. Credit: Tadaaki Nishioka, Tom Macpherson, Takatoshi Hikida

The Nobel prize winning physicist Niels Bohr once said, "An expert is a (person) that has made all the mistakes that can be made in a narrow field." This idea, that to master a skill we must learn from our mistakes and avoid making them in future, has long been recognized; however, the brain mechanisms and pathways that control this ability have been poorly understood.

In a recent study published in the journal *Nature Communications*, researchers from Osaka University, led by postdoctoral fellow Dr. Tadaaki Nishioka under the supervision of Professors Takatoshi Hikida and Tom Macpherson, revealed a specific brain pathway that allows us to identify and learn from our mistakes to guide better decision-making in future.

The team began by designing a new cognitive-behavioral task in which mice could only receive a sugar reward if they successfully learned how to prevent making decision-making mistakes. Then, using a cutting-edge brain imaging technique the team identified a specific group of cells (known as D2-neurons) in the nucleus accumbens, an area of the brain implicated in decision-making, that signaled when mice had made a mistake.

Finally, using a genetic technique called "optogenetics," which allows cells to be temporarily "switched-off," the team demonstrated that if signaling by D2-neurons was blocked during the part of the task when mice would ordinarily realize that they had made a mistake (i.e., when they discover the outcome of their decision), then mice were more likely to make the same mistake again in future.

"Our work is an important step towards understanding how the brain controls our daily choices and behavior." said Tom Macpherson, a senior author on the project. "The identification of these cells as 'mistake signalers' may also help to guide new treatments for mental health

conditions associated with impaired decision-making ability."

More information: Tadaaki Nishioka et al, Error-related signaling in nucleus accumbens D2 receptor-expressing neurons guides inhibition-based choice behavior in mice, *Nature Communications* (2023). DOI: 10.1038/s41467-023-38025-3

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