Chemical signals in the brain help guide risky decisions

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A gambler's decision to stay or fold in a game of cards could be influenced by a chemical in the brain, suggests new research from the University of British Columbia.

The rise and fall of dopamine plays a key role in decisions involving risk and reward, from a baseball player trying to steal a base to an investor buying or selling a stock. Previous studies have shown that dopamine signals increase when risky choices pay off.

"Our brains are constantly updating how we calculate risk and reward based on previous experiences, keeping an internal score of wins and losses," says Stan Floresco, co-author and professor in UBC's Dept. of Psychology. "Dopamine appears to play an important role in these processes, influencing our everyday choices."

The study saw rats choose between safe and risky rewards - similar to what investors face on Wall Street. Pressing one lever gave the rodents a small, but guaranteed reward, not unlike a bond. The other lever yielded a large reward or nothing, similar to a high-risk stock.

Researchers altered the rats' decision-making process by shutting down or turning on the dopamine signals in their brains. When the rats played risky and lost, researchers turned on dopamine signals when normally they would have decreased. Subsequently, the rats made riskier decisions. Conversely, when the rats played risky and won, researchers turned dopamine signals off. Here, the rats began to play more

conservatively.

"By temporarily knocking these chemical signals out, it demonstrates how significant they are in altering our decisions, even if it's against our better judgment," says Floresco.

Background

Abnormal dopamine levels are associated with several psychiatric disorders, including schizophrenia, depression and drug addiction.

Current treatments for these disorders involve drugs that heighten or lower dopamine levels, but not immediately following a risk and reward decision, like the rats experienced. Therefore, the potential clinical application of the approaches used in the study is unclear.

"The timing of the stimulation is important," explains Floresco. "By understanding how these signals work to influence our behaviour, these findings can provide insight into what happens when these signals go awry, as may occur in numerous psychiatric disorders."

More information: The study, Overriding Phasic Dopamine Signals Redirects Action Selection during Risk/Reward Decision Making, is published in *Neuron*.

Provided by University of British Columbia