The Protein for Quick Decision-Makers

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(PhysOrg.com) -- Everyday, people are required to make decisions quickly and flexibly. In a flash, they must weigh up the advantages, disadvantages and possible consequences of their behaviour and coordinate it with the relevant external circumstances. This learning process involves the messenger substance dopamine.

Decisions that are perceived as positive and are followed by a reward trigger the increased release of dopamine and are recorded by the brain as beneficial. German researchers at the Max Planck Institute for Human Development have now discovered an enzyme variant that promotes fast and flexible decision-making behaviour.

It is known from previous studies that the COMT enzyme (cathecolamin-O-methyltransferase) breaks down dopamine and can, therefore, influence learning and thought processes. It is also known that there are two variants of the COMT enzyme (COMT Met and COMT Val) that influence dopamine levels to varying degrees. Lea Krugel and her colleagues from the Max Planck Institute for Human Development in Berlin investigated the question as to whether and how the influencing of the dopamine level by COMT-Met and COMT-Val in turn affects reward-dependent decision processes.

Individuals with the COMT-Val genotype learn faster from unexpected outcomes and are more flexible decision makers.

To this end, the scientists tested 26 young adults who exhibited either only the Met variant or the Val variant of the COMT enzyme (Met/Met

or Val/Val genotype). The study participants received a monetary bonus for their performance in reward-based decision tests which examined how quickly and flexibly they learned from the consequences of their actions. Decisions involving different options are often influenced by the expected reward. A significant difference between the result achieved and the expected outcome generates an important signal for the alteration of decision behaviour.

It emerged from the study that the participants with the Val version of the genotype were the more flexible decision makers and could better learn from the differences between outcomes and expectations. With the help of functional magnetic resonance imaging (fMRT), Lea Krugel and her colleagues were able to demonstrate that this advantage was accompanied by greater nerve cell activity in certain regions of the brain in which the messenger substance dopamine is known to play a particularly prominent role. Hence, the scientists observed greater activity in the region of the brain known as the striatum and more intensive interaction between the striatum and frontal lobe (prefrontal cortex) in the participants with the Val version of the COMT enzyme.

Based on this, the scientists not only demonstrated a possible advantage for individuals with the Val version of enzyme, which is the more common variant throughout the world than the Met version, their results also provide new clues as to how the messenger substance dopamine helps people to make use of past decisions for future ones in the context of ongoing decision-making processes.

More information: Lea K. Krugel, Guido Biele, Peter N. C. Mohr, Shu-Chen Li, Hauke R. Heekeren, Genetic Variation in Dopaminergic Neuromodulation Influences the Ability to Rapidly and Flexibly Adapt Decisions. *Proceedings of the National Academy of Sciences (PNAS),* October 12, 2009