

Genetic variation contributes to individual differences in pleasure

8 August 2019



Credit: APS

Differences in how our brains respond when we're anticipating a financial reward are due, in part, to genetic differences, according to research with identical and fraternal twins published in *Psychological Science*, a journal of the Association for Psychological Science. The findings suggest that how we experience pleasure and reward is at least partly heritable.

The brain's reward system plays a central role in decision making and emotion, and research suggests that impaired reward processing and the inability to feel pleasure are features of various neuropsychiatric disorders, including schizophrenia, major depressive disorder, and bipolar disorder.

"Being able to quantify the relative influences of genetic and [environmental factors](#) on activation of the reward circuit could deepen our understanding on the genesis of the reward system, and further clarify potential causes of the lack of pleasure, or anhedonia, found in mental disorders," says lead researcher Raymond Chan.

To investigate the relative contributions of genetic and environmental factors, Chan and colleagues recruited pairs of identical and [fraternal twins](#) from the Twin Registry of the Chinese Academy of Sciences Institute of Psychology. Both identical twin pairs and fraternal twin pairs are thought to share the same environment; while identical twin pairs share the same genes, fraternal twins share only about 50% of the same genes. Comparing how traits vary across identical and fraternal twin pairs is thought to shed light on the degree to which genes explain that variation.

In this study, the researchers focused on a structure buried in the middle of the brain called the [nucleus accumbens](#). The nucleus accumbens is part of the ventral striatum, an area that facilitates aspects of decision making, motivation, and reward processing. Chan and colleagues wanted to examine whether nucleus accumbens activation in anticipation of a [financial reward](#) differed between identical twin pairs and fraternal twin pairs.

The participants—43 pairs of same-sex identical twins and 44 pairs of same-sex fraternal twins—completed a computer task while their brain activity was measured via functional MRI. On each trial, the participants pressed a button as soon as they saw a target and an on-screen cue told them what type of trial it would be: a triangle meant they would gain 5 points for hitting the target and a square meant they would lose 5 points for missing it. A circle indicated that they wouldn't gain or lose any points, regardless of their performance. In total, they completed two runs of the task, each of which contained 10 gain trials, 10 loss trials, and 10 neutral trials.

The participants also completed Chinese versions of validated measures for physical anhedonia, social anhedonia, and experience of pleasure.

On trials when the participants expected an award, activation of the nucleus accumbens appeared to

moderately heritable, as were scores for physical anhedonia and pleasure. Furthermore, nucleus accumbens activation and physical anhedonia scores appeared to be influenced by shared genes; physical anhedonia and pleasure also appeared to share some of the same genes.

Activation of the nucleus accumbens on loss trials did not appear to be heritable, however.

The fact that activation of the reward system and self-reported pleasure seem to share genetic influence provides further support for the role of the [nucleus accumbens](#) in pleasure, the researchers note.

"We plan to clarify how the genetic and environmental factors shape the reward system—in other words, we would like to link gene expression and specific environmental factors to the reward circuit," says Chan.

Continued research examining the heritability of brain and behavioral reward responses "could help researchers identify shared regions of the genome and explore interventions for amotivation and [anhedonia](#), both of which are associated with poor prognosis and are resistant to treatments that are currently available," Chan and colleagues conclude.

More information: Zhi Li et al, Inheritance of Neural Substrates for Motivation and Pleasure, *Psychological Science* (2019). [DOI: 10.1177/0956797619859340](#)

Provided by Association for Psychological Science

APA citation: Genetic variation contributes to individual differences in pleasure (2019, August 8) retrieved 18 November 2019 from <https://medicalxpress.com/news/2019-08-genetic-variation-contributes-individual-differences.html>

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