Genetic Variation Contributes to Individual Differences in Pleasure

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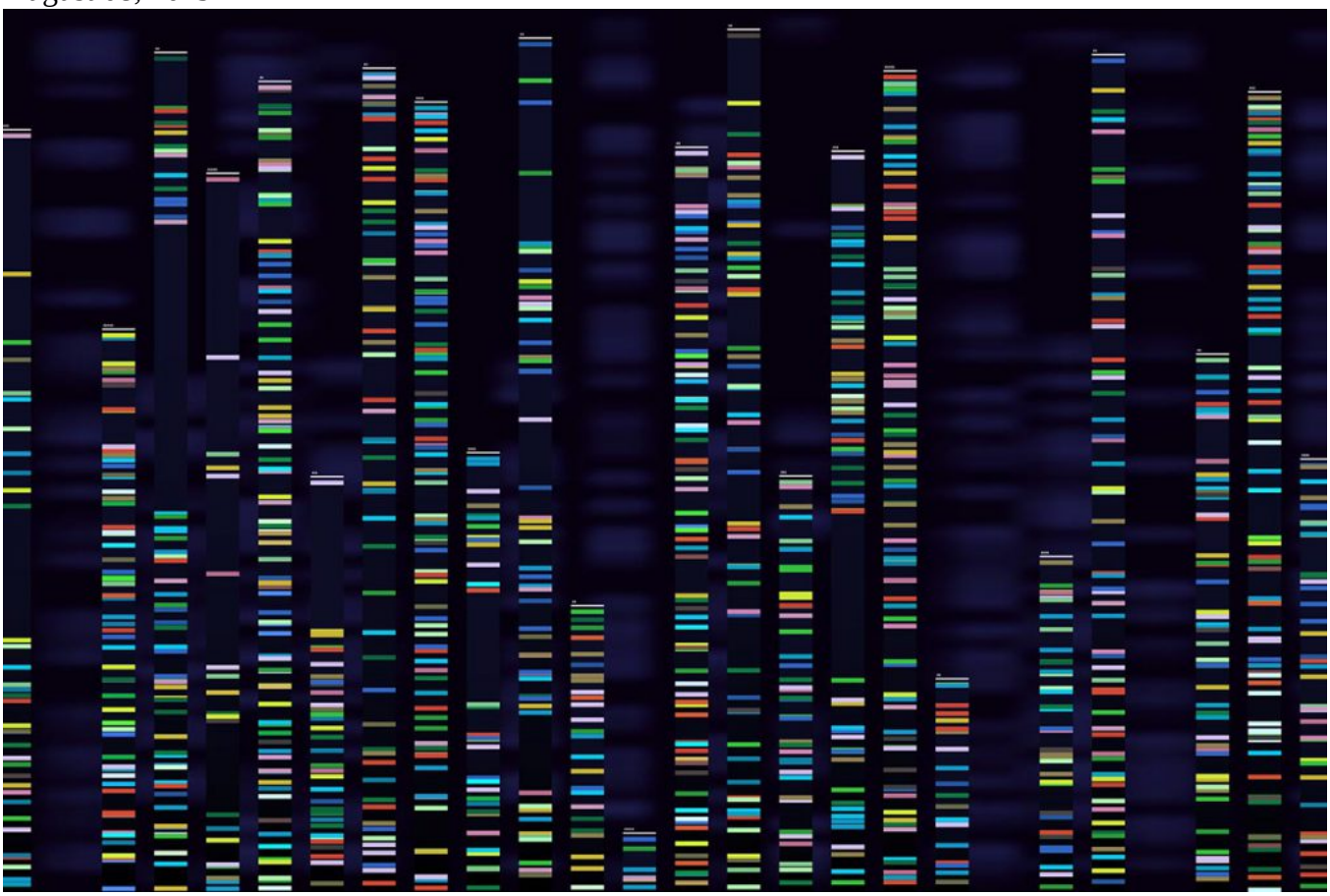

Differences in how ourbrains respond when we're anticipating a financial reward are due, in part, togenetic differences, according to research with identical and fraternal twinspublished in *Psychological Science*, ajournal of the Association for Psychological Science. The findings suggest thathow we experience pleasure and reward is at least partly heritable.

The brain's reward systemplays a central role in decision making and emotion, and research suggests thatimpaired reward processing and the inability to feel pleasure are features of variousneuropsychiatric 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 relativecontributions of genetic and environmental factors, Chan and

colleaguesrecruited pairs of identical and fraternal twins from the Twin Registry of theChinese Academy of Sciences Institute of Psychology. Both identical twin pairs andfraternal twin pairs are thought to share the same environment; while identicaltwin pairs share the same genes, fraternal twins share only about 50% of thesame genes. Comparing how traits vary across identical and fraternal twin pairsis 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 alsocompleted Chinese versions of validated measures for physical anhedonia, socialanhedonia, 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 nucleusaccumbens on loss trials did not appear to be heritable, however.

The fact that activation ofthe reward system and self-reported pleasure seem to share genetic influenceprovides further support for the role of the nucleus accumbens in pleasure, theresearchers note.

"We plan to clarify *how* the genetic and environmentalfactors shape the reward system – in other words, we would like to link geneexpression and specific environmental factors to the reward circuit," says Chan.

Continued research examiningthe heritability of brain and behavioral reward responses "could helpresearchers identify shared regions of the genome and explore interventionsfore amotivation and anhedonia, both of which are associated with poorprognosis and are resistant to treatments that are currently available," Chanand colleagues conclude.

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