Study Finds Dopamine Is Released in Response to Both Pleasure and Stress

The release of the “feel-good” hormone dopamine in the brain is actually triggered by both pleasurable and stressful experiences.

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Addiction to certain drugs is often blamed on the surge of dopamine they funnel into the brain. However, new study findings published in the journal Current Biology show that dopamine—thought to be synonymous with the obsessive pursuit of pleasure via drugs, food or sex—also floods the brain during periods of stress, reports a press release from Vanderbilt University. The findings are causing scientists to rethink treatment for certain mental illnesses and addiction.

For the inquiry, researchers from Vanderbilt University and the University of California, Davis studied diverse neurobehavioral processes linked to dopamine release, including emotion, behavior and learning, using machine learning, computational modeling and a method that used light to control the actions of genetically modified brain cells.

“A common theme of all drugs of abuse is that they increase dopamine release in the brain, which helped feed the notion of dopamine as a reward molecule,” explained Danny Winder, PhD, director of the Vanderbilt Center for Addiction Research, who was not involved with the study. “This work clearly demonstrates a much more sophisticated role for this neurotransmitter, and it means we need to rethink models of addiction that depend on the dopamine/drug reward mentality.”

Erin S. Calipari, PhD, an assistant professor of pharmacology at the university’s School of Medicine Basic Sciences and the study’s principal investigator, agreed that the findings offer game-changing insights about dopamine’s effects on the brain and behavior. “Dopamine is not a reward molecule at all. It instead helps encode information about all types of important and relevant events and drive adaptive behavior—regardless of whether it is positive or negative,” she concluded.

“This work replaces our current understanding with a formalized theory and calls for revision of textbook facts regarding dopamine in the central nervous system,” Calipari added.

Many mental health illnesses, such as addiction, anxiety and depression and schizophrenia ,as well as Parkinson’s disease—a progressive disorder of the central nervous system that affects

movement—are characterized by a dysregulation, or lack, of dopamine.

“We plan to research how this framework fits into our understanding of drug addiction and how drugs alter dopamine signaling to disrupt behavior within this novel framework,” explained Calipari. “Many therapeutic approaches that aim to treat addiction target dopamine. However, altering dopamine without having a full understanding of what dopamine actually does may lead to many unforeseen side effects and, more importantly, failed treatment strategies.”

These findings will affect many fields outside neuroscience and strongly impact human lives and health outcomes, she added.

To learn more about dopamine and Parkinson’s disease, read “Inside Muhammad’s Ali’s Final Fight With Parkinson’s Disease.”

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