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ADDICTION AND DOPAMINE BEHAVIOR

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The human brain is the epicenter of the Central Nervous System, controlling hormone regulation, movement, and involuntary functions. One neurotransmitter, dopamine, is important in both decision making and behavioral choices, among other behavioral functions. Dr. Paul Soto, Assistant Professor in Educational Psychology and Leadership, researches the extent of behavioral flexibility and the importance of dopamine in addictive behavior.

Addiction and addictive behavior is substantially controlled by dopamine, acting upon D1- and D2-like receptors. D1-like receptors, the most abundant of class dopamine receptors, regulate behavioral responses, influencing the actions of D2-like receptors. Dr. Soto initially trains mice to perform the simple task of a lever press to receive a food reward. "We are currently investigating the effects of D2 antagonist administration in mice to determine how they allocate their time and responses," he explains. After this initial training, D2 antagonists are administered to the mice in order to assess the effects of the D2 antagonists on behavior.

Dopamine, known as the "pleasure" receptor, is also involved in predicting rewards. After sufficient exposure to the procedures,



Paul Soto is currently an Assistant Professor in the Department of Educational Psychology and Leadership. His work focuses on neurological and behavior disorders and diseases such as Alzheimer's, Autism, and addiction.

behavioral performances stabilize and the effect of dopamine receptor antagonism on behavior can be assessed. "Our interests are in disentangling the involvement of particular dopamine receptor subtypes in reinforcement related processes," emphasizes Dr. Soto. Decision making and choice behavior are fundamental processes that dopamine is involved in controlling.

Dr. Soto also focuses on willingness to work for food. Again, the response in the mouse is conditioned, and the mouse is subjected to repeated increases in work requirements in order to receive a food reward. In mice lacking D2 receptors, responding "maintained by food reward decreases much more quickly as work requirements increase than does responding in wild-type control mice," Dr. Soto clarifies. Mice lacking D3 or D4 receptors do not show robust deficiencies, suggesting a primary role of D2 receptors in mediating the reinforcing effectiveness of food.

Combined, these results allow Dr. Soto to expand on previous studies on the differences in the willingness to work for food from D2 receptor deficient mice, and how the different dopamine receptor subtypes contribute to choice and willingness to work for food. This work provides insight into the normal functions sub-served by dopamine and thereby helps us understand how dopamine is involved in maladaptive behavior such as drug abuse. Deriving and applying research on behavioral functions of dopamine, particularly research on drug self-administration, "has been critical for altering the view that abuse of drugs is a moral failing and changing that view to the predominant view that drug abuse is a brain disease," Dr. Soto affirms. Further insight into the mechanisms of dopamine and behavioral health is necessary to how the brain reacts to varied environmental and chemical deficits, including drug self-administration.

Through the years, researchers have cultivated the overall view on the link between dopamine receptors and behavioral disorders. This view, though still developing, has grown from a perception of a "reward transmitter" to one of complex decision making based on exposure and expectation. Behavioral processes are complex and involve a multitude of transmitters and receptors, evidence that dopamine is necessary and responsible for numerous behavioral deficiencies and the link to safe and effective pharmacological treatments for drug abuse and addiction.