MedicalXpress

# Researchers develop technique to visualize 'your brain on drugs'

April 26 2010

Researchers at the U.S. Department of Energy's Brookhaven National Laboratory have developed an imaging protocol that allows them to visualize the activity of the brain's reward circuitry in both normal individuals and those addicted to drugs. The technique could lead to better insight into why people take recreational drugs as well as help determine which treatment strategies might be most effective.

Drug addiction is a complex process that involves numerous biological and environmental factors, but a central element is how the drugs affect the activity of dopamine, the chemical that regulates pleasure and reward in the brain.

To get a real-time sense of dopamine activity, Joanna Fowler and her colleague Gene-Jack Wang at Brookhaven, along with Nora Volkow, Director of the National Institute on Drug Abuse, combined positron emission tomography (PET), a medical imaging technology useful for identifying brain diseases, with special radioactive tracers that bind to dopamine receptors. The PET scan highlights the movement of the tracers in the brain, and can be used to reconstruct real-time 3D images of the dopamine system in action.

The scientists tested this procedure on several drug-addicted volunteers as well as age-matched healthy control subjects and found that people with addictions in general have 15-20 percent fewer dopamine receptors than normal and thus cannot bind to a lot of the dopamine released in response to the drugs or natural reinforcers like food.

"These addicted individuals all had a blunted dopamine response," noted Fowler, a senior scientist in Brookhaven's medical department. "This reinforces the idea that drug addicts experience diminished feelings of pleasure, which drives their continual drug use."

Fowler added that the study looked at multiple recreational drugs and found similar results. "So, while various drugs operate by unique mechanisms, they all share a commonality in that the dopamine receptors in the brains of addicted individuals show an under-stimulated reward system."

In an interesting correlation, Fowler noted that Gene-Jack Wang also used the dopamine PET scans on obese individuals and found highly similar patterns of low dopamine receptors-validating that at least in some cases, obesity can also be considered a disease of addiction.

A potential valuable application of observing dopamine activity in real-time, Fowler noted, involves not looking at addicted individuals while they use drugs, but rather when they don't.

"We can examine individuals as they use different coping strategies to try to suppress their desires for drugs or food," she said, "and see in the scans which approach work best."

"We still have a lot of research to do before we fully understand why people take drugs," Fowler continued, "but with this new PET scan application, we might help more people stop."

The highlights of this study will be presented in Fowler's talk, "Imaging Brain Chemistry in Diseases of Addiction," at the American Society for Biochemistry and Molecular Biology's annual meeting.