MedicalXpress

Study uses new technology to peek deep into the brain

January 18 2011

Changes within deep regions of the brain can now be visualized at the cellular level, based on research on mice, which was funded by the National Institutes of Health. Published Sunday in *Nature Medicine*, the study used a groundbreaking technique to explore cellular-level changes over a period of weeks within deep brain regions, providing a level of detail not possible with previously available methods. The study was supported by the National Institute on Drug Abuse (NIDA), the National Cancer Institute, and the National Institute of Neurological Disorders and Stroke.

Researchers at Stanford University used time-lapse fluorescence microendoscopy, a technique that uses miniature probes to directly visualize specific cells over a period of time, to explore structural changes that occur in neurons as a result of tumor formation and increased stimulation in the mouse brain. This could lead to greater information on how the brain adapts to changing situations, including repeated drug exposure.

"Continued drug use leads to changes in neuronal circuits that are evident well after a person stops taking an addictive substance," said Dr. Nora D. Volkow, director of NIDA. "This study demonstrates an innovative technique that allows for a glimpse of these cellular changes within the brain regions implicated in drug reward, providing an important tool in our understanding and treatment of addiction."

Investigators focused on two brain regions within the study, the

hippocampus and striatum. The striatum, a brain region important for motor function and habit formation, is also a major target for abused drugs. Some researchers believe that a shift in activity within the striatum is at least partly responsible for the progression from voluntary drug-taking to addiction. This new technique could allow a better understanding of how these processes occur at the cellular level, leading to insights into mechanisms underlying addictive behaviors.

"The results should now allow neuroscientists to track longitudinally in the living brain the effects of drugs of abuse at the levels of neural circuitry, the individual neuron, and neuronal dendrites," said Dr. Mark Schnitzer, corresponding author for the article. "For example, our imaging methods work well in the dorsal striatum, which we have followed with microscopic resolution over weeks in the live brain. This should permit researchers interested in the reward system to address a range of issues that were previously out of reach."

More information: The study can be found online at dx.doi.org/10.1038/nm.2292

Provided by National Institutes of Health

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