

Molecular imaging shows chronic marijuana smoking affects brain chemistry

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Definitive proof of an adverse effect of chronic marijuana use revealed at SNM's 58th Annual Meeting could lead to potential drug treatments and aid other research involved in cannabinoid receptors, a neurotransmission system receiving a lot of attention. Scientists used molecular imaging to visualize changes in the brains of heavy marijuana smokers versus non-smokers and found that abuse of the drug led to a decreased number of cannabinoid CB1 receptors, which are involved in not just pleasure, appetite and pain tolerance but a host of other psychological and physiological functions of the body.

"Addictions are a major medical and socioeconomic problem," says Jussi Hirvonen, MD, PhD, lead author of the collaborative study between the National Institute of Mental Health and National Institute on Drug Abuse, Bethesda, Md. "Unfortunately, we do not fully understand the neurobiological mechanisms involved in addiction. With this study, we were able to show for the first time that people who abuse [cannabis](#) have abnormalities of the cannabinoid receptors in the brain. This information may prove critical for the development of novel treatments for cannabis abuse. Furthermore, this research shows that the decreased receptors in people who abuse cannabis return to normal when they stop smoking the drug."

According to the National Institute on Drug Abuse, marijuana is the number-one illicit drug of choice in America. The psychoactive chemical in marijuana, or cannabis, is delta-9-tetrahydrocannabinol (THC), which binds to numerous cannabinoid receptors in the brain and

throughout the body when smoked or ingested, producing a distinctive high. Cannabinoid receptors in the brain influence a range of mental states and actions, including pleasure, concentration, perception of time and memory, sensory perception, and coordination of movement. There are also cannabinoid receptors throughout the body involved in a wide range of functions of the digestive, cardiovascular, respiratory and other systems of the body. Currently two subtypes of cannabinoid receptors are known, CB1 and CB2, the former being involved mostly in functions of the central nervous system and the latter more in functions of the immune system and in stem cells of the circulatory system.

For this study, researchers recruited 30 chronic daily cannabis smokers who were then monitored at a closed inpatient facility for approximately four weeks. The subjects were imaged using positron emission tomography (PET), which provides information about physiological processes in the body. Subjects were injected with a radioligand, 18F-FMPEP-d2, which is a combination of a radioactive fluorine isotope and a neurotransmitter analog that binds with CB1 brain receptors.

Results of the study show that receptor number was decreased about 20 percent in brains of cannabis smokers when compared to healthy control subjects with limited exposure to cannabis during their lifetime. These changes were found to have a correlation with the number of years subjects had smoked. Of the original 30 cannabis smokers, 14 of the subjects underwent a second PET scan after about a month of abstinence. There was a marked increase in receptor activity in those areas that had been decreased at the outset of the study, an indication that while chronic cannabis smoking causes downregulation of CB1 receptors, the damage is reversible with abstinence.

Information gleaned from this and future studies may help other research exploring the role of PET imaging of CB1 [receptors](#)—not just for drug use, but also for a range of human diseases, including metabolic

disease and cancer.

More information: Scientific Paper 10: J. Hirvonen, R. Goodwin, C. Li1, G. Terry, S. Zoghbi, C Morse, V. Pike, N. Volkow, M. Huestis, R. Innis, National Institute of Mental Health, Bethesda, MD; National Institute on Drug Abuse, Baltimore, MD; "Reversible and regionally selective downregulation of brain cannabinoid CB1 receptors in chronic daily cannabis smokers," SNM's 58th Annual Meeting, June 4-8, 2011, San Antonio, TX.

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