

Influencing craving for cigarettes by stimulating the brain

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Targeted brain stimulation increases cigarette cravings, a new study in *Biological Psychiatry* has found, which may ultimately lead to new treatments that reverse these effects. Cues associated with cigarette smoking, such as watching someone else smoke, elicit craving and may provoke relapse when smokers are attempting to quit. There are many methods that smokers use in an attempt to reduce their craving for cigarettes, including efficacious pharmacologic treatments such as nicotine patches, and alternative approaches such as hypnosis and acupuncture. Scientists have long suspected that these diverse approaches might work through a common mechanism -- the reduction of activity in a brain circuit that is responsible for cigarette craving.

This hypothesis is supported by human [functional brain imaging](#) studies, which consistently report the activation of several [brain regions](#) during craving that involve regions in the [cerebral cortex](#) as well as the limbic system, a [brain circuit](#) involved in emotion.

Building on these brain imaging studies, scientists at the Center for Nicotine and Smoking Cessation Research at Duke University Medical Center manipulated this 'craving circuit' activity using transcranial magnetic stimulation (TMS), a non-invasive technique that uses electromagnetic currents to target specific or general areas of the brain. Depending upon the frequency used, it can either stimulate or depress brain activity.

The researchers found that the delivery of repeated TMS to the superior

frontal gyrus at high frequency (10 Hz) increased craving for cigarettes.

"We directly stimulated a frontal brain region using magnetic fields and showed that it exaggerated smokers' craving for cigarettes when they viewed smoking related cues. By gaining a better understanding of how the brain influences craving responses, strategies for blocking these responses can be devised and ultimately more effective smoking cessation treatments may be developed," explained Dr. Jed Rose, one of the study authors.

However, they did not find that low frequency (1 Hz) stimulation reduced craving. Thus, a potential intervention that may have reduced the activation within this circuit did not produce the opposite effect.

Nonetheless, the high frequency stimulation reduced craving when participants were viewing nonsmoking cues. Moreover, the ability of smoking to satisfy craving, a rewarding effect that helps keep smokers "hooked," was partially blocked by high frequency stimulation. These effects need to be explored for potential therapeutic applications.

"This elegant study implicates the superior frontal gyrus in controlling the activity of the craving circuit," commented Dr. John Krystal, Editor of [Biological Psychiatry](#). "Additional research will be needed to determine the potential value of repetitive TMS as a treatment for smoking."

More information: "Repetitive Transcranial Magnetic Stimulation of the Superior Frontal Gyrus Modulates Craving for Cigarettes" ([DOI 10.1016/j.biopsych.2011.05.031](https://doi.org/10.1016/j.biopsych.2011.05.031))

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