

# Can brain lesions contribute to criminal behavior?

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New research published in the *Proceedings of the National Academy of Sciences* indicates that lesions to brain areas in individuals exhibiting criminal behavior all fall within a particular brain network involved in moral decision-making. Previous studies have shown that the brains of some criminals exhibit abnormalities, but in most cases, it is unclear whether these abnormalities are the cause of, effect of, or simply

coincide with criminality.

"Our lab has developed a new technique for understanding neuropsychiatric symptoms based on focal [brain lesions](#) and a wiring diagram of the human brain," said senior author Michael Fox, MD, PhD, who is the Associate Director of the Deep Brain Stimulation Program at Beth Israel Deaconess Medical Center (BIDMC) "We've successfully applied this technique to hallucinations, delusions, involuntary movements, and coma—and in perhaps its most interesting application to date, we applied it to criminality."

Interest in a potential link between brain [lesions](#) and criminality became especially high following the 1966 Texas Tower mass shooting carried out by Charles Whitman, who complained of headaches and personality changes prior to his killing 16 people and wounding 31 others. He was found to have a tumor in his brain, prompting the question of whether the brain injury contributed to his [behavior](#). Lead author Richard Darby, MD, formerly of BIDMC and now assistant professor of neurology at Vanderbilt University and director of the frontotemporal dementia clinic at Vanderbilt, noted that he personally became interested in how neurological diseases might result in criminal behavior after caring for patients with frontotemporal dementia, who often commit nonviolent crimes as a result of their dementia.

To investigate the issue, Fox, Darby and their colleagues systematically mapped brain lesions in 17 patients who exhibited criminal behavior after - but not before - the lesions occurred.

Analyses revealed that the lesions were located in diverse brain regions, but all mapped to a common network. "We found that this network was involved in moral decision-making in normal people, perhaps giving a reason for why brain lesions in these locations would make patients more likely to behave criminally," said Darby. The network is not involved

with cognition control or empathy.

The findings were supported in tests of a separate group of 23 cases where the timing between brain lesions and criminal behavior was implied but not definitive. It is important to note, however, that not all individuals with brain lesions within the network identified in the study will commit crimes. Genetic, environmental, and social factors are also likely to be important. "We don't yet know the predictive value of this approach," said Fox, who is also an Assistant Professor of Neurology at Harvard Medical School. "For example, if a brain lesion falls outside our network, does that mean it has nothing to do with criminal behavior? Similarly, we don't know the percentage of patients with lesions within our network who will commit crimes."

Darby added that it is important to consider how the study's findings should not be used. "Our results can help to understand how brain dysfunction can contribute to criminal behavior, which may serve as an important step toward prevention or even treatment," he said. "However, the presence of a brain lesion cannot tell us whether or not we should hold someone legally responsible for their behavior. This is ultimately a question society must answer."

Indeed, doctors, neuroscientists, lawyers and judges all struggle with criminal behavior in the setting of a brain lesion. Is the patient responsible? Should he or she be punished in the same way as people without a lesion? Is [criminal behavior](#) different than other symptoms suffered by patients after a [brain](#) lesion such as paralysis or speech trouble? "The results don't answer these questions, but rather highlight their importance," said Fox.

**More information:** R. Ryan Darby et al., "Lesion network localization of criminal behavior," *PNAS* (2017).

[www.pnas.org/cgi/doi/10.1073/pnas.1706587115](http://www.pnas.org/cgi/doi/10.1073/pnas.1706587115)

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