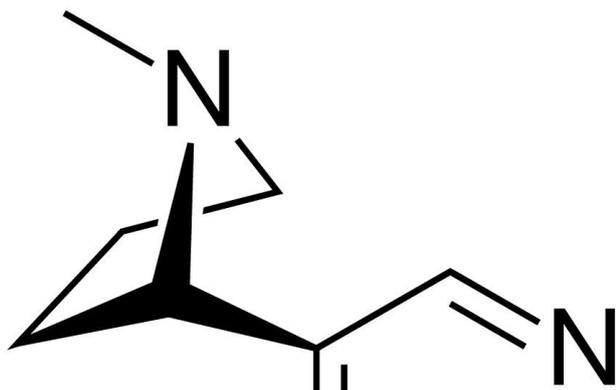


Investigators compare effects of nicotine with and without menthol on brain and behavior

16 November 2017, by Sandra Gray



Nicotine, alternate molecular skeletal 2D rendering showing the 3D conformation of its ring at lowest energy in actual space. Credit: Public Domain

A new study from UMass Medical School researchers at the Center for Comparative Neuroimaging explores the link between mentholated tobacco and nicotine addiction. They found that menthol administered with nicotine alters connectivity patterns in an area of the brain associated with drug reward and addiction and results in behavioral changes.

"Our findings support the notion that beyond flavor, mentholated tobacco may have psychoactive effects that impact [nicotine addiction](#) and withdrawal," said Guillaume Poirier, PhD, instructor in psychiatry and co-author of the study. "Adding menthol to nicotine increased the communication between a brain area in the reward pathway and one involved in memory already known to be involved in nicotine [addiction](#) and withdrawal."

Published in the *Journal of Psychopharmacology*, the study addresses the long-standing question of whether menthol is merely a flavor additive or may

contribute to addiction, especially in youth. While tobacco control efforts have greatly reduced smoking across all ages, rates of mentholated cigarette smoking by 18- to 25-year-olds in the United States have remained the same or increased. Menthol is the only cigarette flavor additive allowed by the U.S. Food and Drug Administration and appeals to young smokers with a minty taste that masks the burning sensation of smoking by activating cool receptors in the nose and mouth.

"To our knowledge, this is the first study to test the effects of menthol on whole-brain functional connectivity," said Dr. Poirier. "This is also the first study to provide evidence that effects of menthol during adolescence may be modulated by environmental stress."

Scientists already know that genetic and environmental effects interact to contribute to an individual's propensity to nicotine addiction, including hyperactivity, stress and anxiety, and that individuals experiencing at least moderate psychological stress are more likely to smoke [menthol cigarettes](#). In the study's animal model, those who had been exposed to prior stress and were given nicotine with menthol daily exhibited greater locomotor sensitization, a measure of sensitization to drugs of abuse including nicotine, than either adults or adolescents with no prior stress who had been exposed to nicotine only.

The National Institute of Drug Abuse wrote in its latest Science Highlight, "This finding suggests that menthol amplifies nicotine-induced changes in the young brain's reward system that contribute to addictive behaviors. The study's results may contribute to understanding previous research findings. Other studies have suggested that smokers of mentholated cigarettes display more

severe [nicotine](#) dependence and have greater difficulty quitting smoking, compared to smokers of nonmentholated cigarettes."

The Department of Psychiatry's Center for Comparative Neuroimaging uses sophisticated functional imaging technology to research brain changes accompanying the development and treatment of mental health disorders, including addiction. Poirier joined the center in 2014. The research team's next steps will be to examine the impact of mentholated cigarette use on brain structure and connectivity in humans.

"Added to what is already known about menthol's actions on nicotinic receptors, our data indicate that [menthol](#) may be considered a psychoactive agent until proven otherwise," Poirier concluded.

More information: Matthew F Thompson et al. Menthol enhances nicotine-induced locomotor sensitization and in vivo functional connectivity in adolescence, *Journal of Psychopharmacology* (2017). [DOI: 10.1177/0269881117719265](https://doi.org/10.1177/0269881117719265)

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