

New Insight on How Fast Nicotine Peaks in the Brain

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(PhysOrg.com) -- Nicotine takes much longer than previously thought to reach peak levels in the brains of cigarette smokers, according to new research conducted at Duke University Medical Center.

Traditionally, scientists thought nicotine inhaled in a puff of cigarette smoke took a mere seven seconds to be taken up by the brain, and that each puff produced a spike of nicotine. Using PET imaging, Duke investigators illustrate, for the first time, that cigarette smokers actually experience a steady rise of brain nicotine levels during the course of smoking a whole cigarette.

The findings, scheduled to appear online in the Early Edition of [Proceedings of the National Academy of Sciences](#) (*PNAS*) the week of March 8, could lead to more effective treatments for smoking addiction.

"Previously it was thought that the puff-by-puff spikes of nicotine reaching the brain explained why cigarettes are so much more addictive than other forms of nicotine delivery, like the patch or gum," says Jed Rose, Ph.D., director of the Duke Center for Nicotine and [Smoking Cessation](#) Research. "Our work now calls into question whether addiction has to do with the puff-by-puff delivery of nicotine. It may actually depend in part on the overall rate at which nicotine reaches and accumulates in the brain, as well as the unique habit and sensory cues associated with smoking."

Yet, when the researchers compared 13 dependent smokers to 10 non-

dependent smokers, they were surprised to find the dependent smokers had a slower rate of nicotine accumulation in the brain. "This slower rate resulted from nicotine staying longer in the lungs of dependent smokers, which may be a result of the chronic effects of smoke on the lungs," surmises Rose.

The difference in rate of nicotine accumulation in the brain doesn't explain why some people become addicted to cigarettes and others don't. "Even if you correct for the speed of delivery, our study showed the non-dependent smokers eventually experienced the same high levels of nicotine in their brain as dependent smokers, yet they did so without becoming dependent. The real mystery is why."

Rose says the absence of addiction in these smokers could be due to genetic differences, differences in the way they smoke, or differences in the psychological effects they derive. "We're still not able to fully explain why these people are able to smoke without becoming addicted."

Despite the questions raised, the study provides important insights into the role of the speed and level of brain nicotine levels, and which receptors in the brain are at work. "Different receptors respond to nicotine at different levels of sensitivity," says Rose. "Knowing the levels of [nicotine](#) that are really getting to the [brain](#) gives us clues as to which receptors are more likely to be important for the dependence-producing effects of cigarette [smoking](#)."

Provided by Duke University Medical Center

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