MedicalXpress

# Nicotine Activates More than Just the Brain's Pleasure Pathways

January 26 2009

(PhysOrg.com) -- Duke University Medical System researchers have discovered there are differing taste pathways for nicotine, which could provide a new approach for future smoking-cessation products.

"We learned some of nicotine's secrets," said Albino Oliveira-Maia, MD, PhD, a postdoctoral fellow of the Duke Department of Neurobiology. "This is the first study to explore both the peripheral taste pathways activated by nicotine, and how these pathways are integrated in sensory areas of the brain." The peripheral nervous system refers to nerves that are outside of the brain and spinal cord.

Using genetic engineering and measurements of nervous system activity in mice, the researchers found that nicotine sends signals directly to the brain's sensory systems by several pathways, similar to the way taste is perceived.

These findings complement what is known about the effects of nicotine in the dopamine pathway. This is the classic pleasure pathway in the brain, much studied by addiction experts. "Our study in no way contradicts prior findings about nicotine and dopamine," Oliveira-Maia said. "Our findings add to what is known and suggest new approaches for further study."

The findings appeared in the *PNAS Early Edition* slated for January 19.

"One reason that our findings are interesting is because they relate to

previous work that looked at humans with lesions in the insula region of the brain - they had an easier time giving up cigarettes than most people," Oliveira-Maia said. "We found that a part of the insula, the gustatory cortex, has robust responses to nicotine and a capacity to integrate diverse peripheral information to create a unique sensory representation for nicotine."

One taste pathway the Duke researchers uncovered involves nicotinic acetylcholine receptors (nAChR), which scientists previously proposed were taste receptors for nicotine. The researchers found a previously unknown link between these receptors and activity in the taste region of the insula.

They found a second pathway, the peripheral Trpm5 protein pathway - one that helps animals sense a bitter taste. Mice which had their Trpm5 pathway deleted were unresponsive to several different tastes, including bitterness, but they could still sense the presence of nicotine. "The mice preferred plain water to the nicotine solution, suggesting that there would be a second taste pathway in play, besides the one that had been knocked out," Oliveira-Maia said. The researchers then measured nerve activity in the chorda tympani (CT), which is a branch of the facial nerve that serves the taste buds in the front of the tongue and found that activity in CT nerve fibers increased when nicotine was put on the mice's tongues.

Looking ahead, Oliveira-Maia said that drugs that block the nAChR receptors are now being used in the treatment of tobacco addiction, mainly because of their effects on the central nervous system, "but it is possible they could also modify the sensory effects of cigarette smoke."

This work was supported by grants from National Institutes of Health, Philip Morris USA, Philip Morris International and a GABBA fellowship from the Portuguese Foundation for Science and Technology.