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## **Some brain-damaged patients quit smoking with ease, researchers report in *Science***

A silver dollar-sized region deep in the brain called the insula is intimately involved in smoking addiction, and damage to this structure can completely erase the body's urge to smoke, researchers have discovered. The findings appear in the 26 January 2007 issue of the journal *Science*, published by AAAS, the nonprofit science society.

Obviously brain damage is not a treatment option for nicotine addiction, but the new results may offer leads for therapies to help smokers kick the habit or for monitoring smokers' progress while using existing therapies.

The study was largely inspired by a patient who had smoked around 40 cigarettes a day before his insula was damaged by a stroke and then quit immediately after. He told the researchers that his body "forgot the urge to smoke."

The insula receives information from other parts of the body and is thought to help translate those signals into something we subjectively feel, such as hunger, pain, or craving for a drug. Compared to other brain regions, the insula has not attracted very much attention in drug addiction research until now, but some imaging studies have shown that this region is activated by drug-associated cues, such as the sight of people doing drugs or drug paraphernalia.

"One of the most difficult problems in any form of addiction is the difficulty in stopping the urge to smoke, to take a drug, or to eat for that matter. Now we have identified a brain target for further research into dealing with that urge," said study author Antoine Bechara of the University of Southern California and the University of Iowa.

"This kind of study is quite forward-looking. In addition to investigating a basic scientific mechanism underlying drug addiction, these authors have come up with innovative ideas about how we may be able to treat addiction and prevent relapse," said *Science* senior editor Peter Stern.

Though intriguing, the possibility of insula-targeting drugs that might help smokers quit is still a long way off. More immediately, it may be possible to monitor the success of current smoking cessation therapies by measuring the activity within this brain region.

Bechara and his colleagues are affiliated with a large patient registry at the University of Iowa that allows researchers to study the effects of brain damage. To investigate whether the insula plays a major role in smoking addiction, the authors studied some of the patients enrolled in the registry, all of whom had been smoking more than five cigarettes per day for more than two years when their brain damage occurred.

Bechara and his colleagues studied 69 patients with brain damage who had been smokers before the damage occurred. Nineteen of these patients had brain damage that included the insula.

Thirteen of the insula-damaged patients had quit smoking, and 12 of them had done so quickly and easily, reporting that they had felt no urges to smoke since quitting. The authors don't know why the other six patients did not quit smoking.

Some of the patients with other forms of brain damage also stopped smoking without effort, but, overall, patients who had quit easily were much more likely to have damage to the insula rather than anywhere else in the brain.

At the time of the study, the patients had quit smoking for at least one year.

Because the patients reported losing the urge to smoke so suddenly and without difficulty or relapse, Bechara and his colleagues concluded that insula damage reduced the patients' actual urge to smoke rather than reducing the pleasurable experience, or "reward," associated with smoking. Bechara says these findings don't contradict the importance of the reward system in addiction; rather, they add another piece to the picture.

The authors were also curious about whether insula damage disrupts other behaviors. They couldn't study other forms of drug addiction, since patients with these addictions weren't allowed to enroll in the registry.

In a follow-up survey, the researchers found that insula damage didn't seem to affect patients' desire to eat or their food intake. Because eating is so vital for survival, multiple brain regions may produce the urge to eat, according to Bechara.

He noted that another possible approach to treating smoking addiction might be to use a technique called transcranialmagnetic stimulation, which involves inducing weak electrical currents in the brain tissue, to disrupt the insula's activity. (Currently this technique doesn't penetrate deep enough to reach the insula, however.)

"The insula also carries out lots of normal everyday functions so we would want to make sure we only interfere with functions that disrupt bad habits like smoking but not something vital like eating," cautioned Bechara.

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"Damage to the Insula Disrupts Addiction to Cigarette Smoking," by Nasir H. Naqvi, David Rudrauf and Antoine Bechara at University of Iowa Carver College of Medicine in Iowa City, IA; Hannah Damasio and Antoine Bechara at University of Southern California in Los Angeles, CA. This study was supported by the National Institute on Drug Abuse and the National Institute of Neurological Disorders and Stroke

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