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Training can reverse nicotine-induced brain damage

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Motor-skill training has proved capable of reversing brain impairments in rats treated with nicotine. This effect has been demonstrated in a recent study and, in the long term, the method may also come to be

tested as an aid to human smoking cessation.

"It was as if the training counteracted many of the changes caused by nicotine in the animals' brains, and helped to restore the balance faster," says Louise Adermark, associate professor of neurobiology and corresponding author of the study.

Nicotine is not a drug that normally turns people's lives upside down, and it is not always regarded as particularly serious. Nevertheless, it is one of the most addictive substances the body can be subjected to.

The current paper, published in the journal *Addiction Biology*, describes the effects of nicotine on the experimental animals' brains. Step by step, activity changed in brain regions associated with motivation, habit formation and, finally, reward. The changes conformed to a specific pattern.

Brain recovery

The motor-skill training in the study involved animals that had received nicotine for three weeks. The research group has previously shown that three weeks' nicotine exposure is enough to exert lifelong effects on rat brains.

After the nicotine exposure was concluded, the rats were trained in balancing on a rotating rod known as a "rotarod." Their performance in doing so successively improved. In parallel, there was a control group of rats that did not receive training.

"What we were able to see was that the trained animals showed no impairments persisting in the brain after the nicotine. Neuroplasticity (the brain's ability to reorganize itself by forming new neural connections), too, which was greatly reduced in the control animals,

recovered in the animals that had undergone training," Adermark says.

In her role at Sahlgrenska Academy, University of Gothenburg, Adermark has previously carried out research on the strong association between nicotine addiction in humans and the motor activities involved in smoking—taking out a cigarette, lighting it and taking a drag.

Quite simply, the brain learns to associate this motor behavior with the sensation provided by the nicotine. In the current study, it was therefore important to intervene after the nicotine exposure and teach the animals an entirely new motor pattern.

Complementing smoking cessation

"We know extremely little about what happens in the brain during motor-skill learning. But if we speculate on the basis of the study results, when people give up smoking they could supplement it simultaneously go in for learning something completely new that they've never done before, such as modern dance or tennis.

"Giving up smoking is hard, and most people who try go back to it. So it's important to find new ways of making smoking cessation easier," Adermark concludes.

More information: Valentina Licheri et al. Nicotine-induced neuroplasticity in striatum is subregion-specific and reversed by motor training on the rotarod, *Addiction Biology* (2019). DOI: 10.1111/adb.12757

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