

Smoking, drinking, and the brain

In an investigation by Cheng, Rolls and colleagues published in eLife, it was found that smokers have weaker connections between different brain regions, while drinkers had stronger connections.

To understand why people become addicted to alcohol or smoking, it is important to look at how the brains of people who use these substances may be different than those who abstain. Many studies show that substance use activate the reward systems in the brain via a chemical called dopamine. Changes or differences in parts of the brain that control decision-making and restraint also have been implicated in substance use.

Functional magnetic resonance imaging (fMRI) is one tool scientists can use to explore such differences. It can measure how well different parts of the brain are communicating with each other by measuring their activity when a person is at rest. The patterns of activity reveal which parts of the brain are working closely together or have high functional connectivity and which parts are less well connected, or have low functional connectivity.

Cheng, Rolls et al. measured the functional connectivity between different parts of the brain in people who smoke and people who drink alcohol. Smokers had low overall functional connectivity between brain regions. Specifically, in smokers there were weaker connections involving the lateral orbitofrontal cortex and inferior frontal gyrus, which help people change or stop behavior. These differences may make people more impulsive and less able to resist smoking. The stimulating effects of nicotine may enhance communication between different parts of the brain, so people also may use it enhance connectivity which is lower in smokers. Those who drink alcohol had high overall functional connectivity. Reward-related systems, including the medial orbitofrontal cortex and the cingulate cortex, were especially strongly connected. This may make them more sensitive to the rewarding aspects of drinking, or more impulsive.

To confirm their results, Cheng, Rolls et al. analyzed fMRI data from another study. These showed that the characteristic differences in brain connectivity were already present in 14-year olds who would go on to drink or smoke at age 19. This suggests that these functional connectivity differences in the brain make people more likely to smoke or drink.

A press release of the investigation is available here:

https://warwick.ac.uk/newsandevents/pressreleases/discovered_different_brain

And the investigation was published as follows:

Cheng,W., Rolls, E. T., Robbins,T.W., Gong,W., Liu,Z., Lv,W., Du,J., Wen,H., Ma,L., Burke
Quinlan,E., Garavan,H., Artiges,E., Papadopoulos Orfanos,D., Smolka,M.N.,
Schumann,G., Kendrick,K. and Feng,J. (2019) [Decreased brain connectivity in smoking
contrasts with increased connectivity in drinking](#). *eLife* 8: e40765. doi:
10.7554/eLife.40765.