

The Pharmacology of Nicotine Addiction by PAXIS Institute

Tobacco kills people, and both the public and scientists know more about its harm than any time in history. Why would people continue to smoke or chew? Millions of Americans try quitting and fail.

Why can't they quit? Because, nicotine and other addictive substances change the structure of the brain. Just a few years ago, there was tremendous pressure on the public and even the scientific community that tobacco wasn't addictive.

Most of us remember the infamous statement by the senior management of tobacco companies before Congress, saying "tobacco isn't addictive."

There are ways to test that scientifically, and scientists know otherwise. Central Nervous System Nicotine dependence is basically the chemical phenomenon that keeps people using tobacco.

Nicotine binds to acetylcholine receptors in the brain and at autonomic ganglia, the adrenal medulla, and the neuromuscular junctions. The specific sites of binding in the brain are the hypothalamus, hippocampus, thalamus, midbrain, and brain stem, as well as the cerebral cortex. Nicotine also binds to receptors in the nigrostriatal and mesolimbic dopaminergic neurons. When nicotine receptors are stimulated, they lead to the release of acetylcholine, norepinephrine, dopamine, serotonin, vasopressin, growth hormone, and ACTH neurotransmitters.

Nicotine triggers a variety of neurotransmitters and is one of the most potent stimulants of the midbrain dopamine reward pathway. Nicotine acts on the locus ceruleus, regulating vigilance, arousal, concentration and stress reactions, causing the tobacco user to be more alert. Nicotine acts on the mesolimbic dopamine center, the brain's "pleasure center," creating a dependency cycle. The combination of heightened arousal with a pleasure trigger creates a sense of cyclical satisfaction.

Over time, smoking, for example, appears to change the structure and functions of the brain. This can be seen in scans of the brains of smokers and non-smokers, a sample of which is reproduced from studies at the National Institutes of Health.

In this scan, the brain of a smoker is working less actively than the brain of a matched non-smoker. Scientists believe that these differences help explain the long-term cognitive deficits that emerge among long-time users of tobacco.

Why does the Working Group so strongly focus on the prevention of tobacco use? Because by reducing the early use, conversion to regular use and the cessation of tobacco use, we can save and improve the health of present and future generations in Wyoming.

