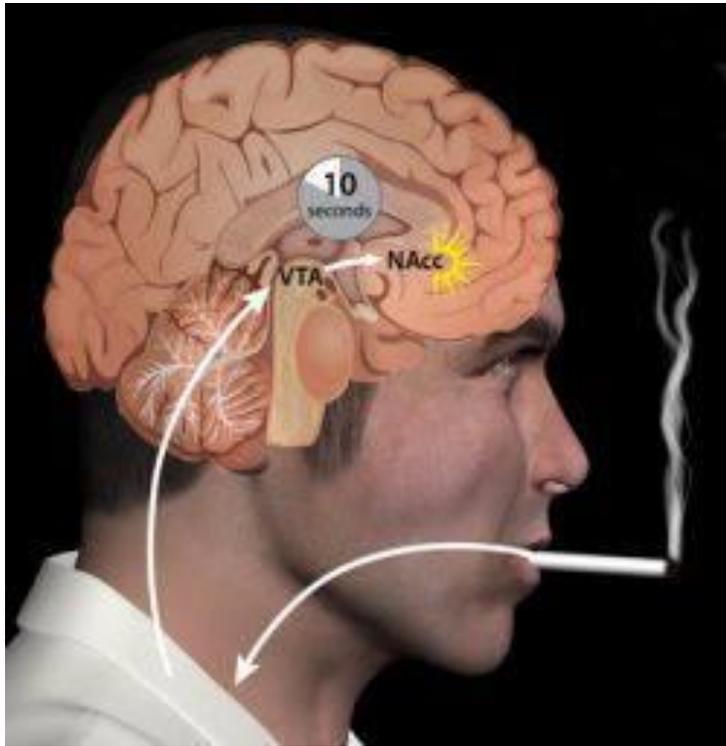


**Daily Life with Christ-72: Understanding brain addictions (11). Psychoactive drugs: how nicotine changes the brain.**



Given that there are different chemical changes that take place in brain addictions that are specific to each addiction, we need to look at each addiction individually to understand the diverse brain changes. This series includes a scientific examination of such psychoactive drugs as caffeine, tobacco, alcohol, marijuana, and cocaine. Following this, we will look at brain addictions caused by certain behaviors like gambling, porn, video games, and junk food that also chemically change the brain.

In the last article, we noted how caffeine affects brain chemistry by inhibiting adenosine, which is related to slowing down neural activity for sleeping. We now take a look at how nicotine changes the brain. Understanding the science behind brain addiction caused by nicotine enables us to have greater compassion for those who suffer under its power—understanding is always the first step in gaining true compassion. The second is always love (seeking the good of the object of love). In sum, whether we are talking about God or fellow human beings, it always comes down to proper knowledge and proper love.

Most of us know very well how difficult it is to stay on a diet or avoid eating certain foods that are not good for us. Well, to stop smoking is enormously more difficult than any diet or any vice we struggle with. Most all of us some compulsive behavior that we cannot seem to lick—whether that compulsion is drug-induced or not. In sum, we need to understand that most of our addictions are not nearly as difficult as brain addiction to nicotine. Smokers do not need our judgment or pity. What is needed is a proper understanding and proper love and prayer. I would add that having an biblical and classical anthropology of hylomorphism, rather than modern Cartesianism, is also very helpful in understanding, both for the addict as well as others. We are all soul/body, not soul in a body, which means that there is an inextricable connection between the physical and the immaterial.

Nicotine is a very common psychoactive drug. It has very similar stimulating effects to caffeine's effects. But unlike caffeine, nicotine is one of the most addictive substances in the world. And it also comes with life-threatening consequences.

Nicotine is actually a naturally produced insecticide. Purified nicotine was used as an insecticide by farmers for a number of years, but they stopped using it because it was too toxic to humans. It only takes about 60 milligrams of nicotine to kill an adult human being. At low doses, this toxic chemical is extremely addictive. About 1/3 of the world's adult population smokes tobacco on a regular basis.

Moreover, tobacco smoke contains thousands of chemicals other than nicotine, and the health consequences of inhaling those chemicals are disastrous. Cigarette smoke contains more than 50 chemicals that are known to cause cancer. Cigarette smoke also contains tar, a collection of solid particle that forms a sticky brown residue on smokers' teeth, fingers, and lung. Tar is also carcinogenic. Inhaling these chemicals is very bad for one's health. Smoking-related illnesses are estimated to kill more than 5 million people every year. Smoking is estimated to be responsible for 80-90% of lung cancer deaths. For every person who dies, there are approximately 20 other smokers who suffer from at least one serious illness associated with smoking like heart disease or stroke. The life expectancy of smokers is more than 10 years shorter than nonsmokers.

Research indicates that most smokers do not want to smoke, but they are hooked on nicotine. Approximately 70-75 percent of smokers say they would like to quit. And 40% of regular smokers try to quite every year. But as I noted, it is an extremely tough habit to kick. In fact, fewer than 10% of quit attempts end up succeeding in the long term. This rate is about the same as the quit rate for heroin.

The behavioral effects of nicotine are relatively mild and are similar to those of caffeine. Low doses of nicotine increase arousal and can actually improve concentration and enhance performance in attention-demanding tasks. However, there are also negative effects such as tension and light-headedness. And higher doses can produce nausea, sweating, and dizziness.

Chronic smokers actually become tolerant to many of the effects and thus find smoking to be relaxing rather than arousing. They also experience withdrawal symptoms when their nicotine levels drop, for example, they can become irritable, stressed, and have difficulty concentrating. It

is likely that the relaxing effect in chronic users is due to relief from negative withdrawal symptoms.

So how does nicotine change the chemistry of the brain? Like caffeine and other psychoactive drugs, nicotine works by binding to receptors used by a normal brain chemical. In this case the chemical is acetylcholine. Acetylcholine is a chemical that is used to tell our muscles to contract and is also associated with arousal, vigilance, and paying attention.

Nicotine is an agonist for acetylcholine receptors. An agonist is a chemical that binds to a receptor and activates it. Nicotine strongly activates acetylcholine receptors, putting them in overdrive and thus creating greater alertness and vigilance.

Why is nicotine so addictive? Recall how the ventral tegmental area, the VTA, (see Daily Life in Christ-59 for illustration) produces dopamine. Well, nicotine binds to acetylcholine on the VTA dopamine neurons and puts them into overdrive, overstimulating the reward circuit in the brain. The result is that the VTA dopamine neurons fire a lot, and they release unusually large quantities of dopamine. This large dopamine release has two important consequences that contribute to addiction: it triggers an intense craving, and it makes powerful markers for increased associative learning and with it the strengthening of neural pathways. Over time, the dopamine signal makes increasingly strong environment markers that are associated with smoking—like seeing a pack of cigarettes, a book of matches, the smell of smoke, or the inside of a bar. These environmental clues provide powerful stimuli that, in and by themselves, release more dopamine, which produces even more strong cravings. As the associations become stronger, it is almost impossible to resist the urge to smoke, and an addiction is born.

Another reason smoking is so addictive is that it is an extremely efficient method for delivering nicotine to the brain. Ingesting low doses of nicotine is not particularly addictive. Even intravenous administration of nicotine is less addictive than smoking because smoking gets the nicotine to the brain quickly. In fact, nicotine reaches the brain about ten seconds after a puff on a cigarette. It is not hard to see that that fast action only contributes to its addictiveness.

There are three major treatments for smokers. First, the most common approach is called nicotine replacement therapy, which involves providing low-dose nicotine without smoking (patches, gums, lozenges, inhalers) and then gradually decreasing the dose over time until the smoker has kicked the habit entirely. Studies find that those who try replacements are about twice as likely to quit. Second is e-cigarettes, but they have not been approved as treatment by FDA. Third is what is known as behavioral therapy, which seeks to break strong associations between smoking and a variety of environmental triggers that smokers have.

The most effective treatment is behavioral therapy + nicotine replacement therapy. The combined method deals with both the physical (replacement) and the psychological (behavior, associations). This is not surprising given man's hylomorphic nature.

Again, we must remember that we are not body + soul. We are inextricably a body/soul composite. What we do with our bodies have profound effects on our souls and vice versa. It is closer to say that "we are what we actualize in our lives" rather than the idea that "we are what

we think” (as per Rene Descartes). This explains the many passages that command the believer to avoid indulging in flesh desires (e.g., 1 Thess. 4:3; 5:22; 1 Pet. 2:11; Rom. 13:14).

While we do enjoy a certain freedom in our choices to what we actualize in our life, we need to understand that with each actualization we become less free from the consequences of what we actualize. Moreover, we are not free to pursue what we perceive as our good. By nature, we all must choose what we perceive as our good, be it God or the world. The realm of our freedom is in the filtering of our perception of what we already desire to be our good. The only escape is to have a desire for the whole truth, total truth. This is fundamental to understanding not only the Word of God and God, but politics and addictions. The easiest person to deceive is our self. Thank God for His marvelous matchless grace and His pure love that enable us to live in true freedom as well as compassion and thus become “imitators of God as beloved children” (Eph. 5:1).

His Grace,

Pastor Don