Explainer: The nico-teen brain

The adolescent brain is especially vulnerable to the addictive effects of nicotine TERESA SHIPLEY FELDHAUSEN AUG 19, 2015 — 7:00 AM EST

Nicotine is the addictive chemical in tobacco smoke and e-cigarette vapors. And doctors say the teenage brain is no place for it to end up. Nicotine can reach the brain within seven seconds of puffing on a cigar, hookah, cigarette or electronic cigarette.

The area of the brain responsible for emotions and controlling our wild impulses is known as the prefrontal cortex. It’s very vulnerable to nicotine’s effects, research shows. This is especially true for young people. The reason: This part of the brain doesn’t finish developing until about age 25.

Nicotine acts like a key to unlock special receptor molecules on the outside of cells in the brain, including those in the prefrontal cortex. Nicotine causes these cells to release signaling molecules, such as dopamine (DOE-pah meen). These chemical signals travel across a gap between nerve cells (called a synapse). When they reach the neighboring nerve cell, they release their “message.” And it gives users get a feel-good high.

But after repeated exposure to nicotine, those brain cells can change. The effect of these changes is to reduce the body’s ability to release its own, natural pleasure- giving chemicals.

Meanwhile, the brains of teens who smoke or vape may create more receptors to handle the flood of nicotine they have come to expect. As the number of receptors increases, teens will need more nicotine to get the same high. That makes nicotine users seek hit after hit. In teens, this can provoke side effects. For instance, it can make it hard for them to stay focused. It might also trigger bouts of depression or anxiety, research suggests.

Some of the negative effects of nicotine on the young brain will fade with time — if exposure ends. Others, however, may persist. For instance, brain scientists at VU University Amsterdam found that exposing adolescent rats to nicotine increased their impulsive behavior. It made them a bit more reckless than usual. It also made it harder for them to focus their attention — even later, as adults.

No one is sure that the same thing happens in humans, but that’s the concern. Exposing the developing adolescent brain to nicotine “could lead to a high risk of lifelong addiction,” says Garry Sigman. He heads adolescent medicine at the Loyola University Chicago Stritch School of Medicine in Maywood, Ill.

Power Words:

Addiction: The uncontrolled use of a habit-forming drug or uncontrolled and unhealthy habit (such as video game playing or phone texting). It results from an illness triggered by brain changes that occur after using some drugs or engaging in some extremely pleasurable activities. People with an addiction will feel a compelling need to use a drug (which can be alcohol, the nicotine in tobacco, a prescription drug or an illegal chemical such as cocaine or heroin), even when the user knows that doing so risks severe health or legal consequences. (For instance, even though 35 million Americans try to quit smoking each year, fewer than 15 out of 100 succeed. Most begin smoking again within a week, according to the National Institute on Drug Abuse.)

adolescence: A transitional stage of physical and psychological development that begins at the onset of puberty, typically between the ages of 11 and 13, and ends with adulthood.

anxiety: A nervous disorder causing excessive uneasiness and apprehension. People with

anxiety may even develop panic attacks.

behavior: The way a person or other organism acts towards others, or conducts itself.

depression: A mental illness characterized by persistent sadness and apathy. Although these feelings can be triggered by events, such as the death of a loved one or the move to a new city, that isn’t typically considered an “illness” — unless the symptoms are prolonged and harm an individual’s ability to perform normal daily tasks (such as working, sleeping or interacting with others). People suffering from depression often feel they lack the energy needed to get anything done. They may have difficulty concentrating on things or showing an interest in normal events. Many times, these feelings seem to be triggered by nothing; they can appear out of nowhere.

dopamine: A neurotransmitter, this chemical helps transmit signals in the brain.

e-cigarette: (short for electronic cigarette) Battery-powered devices that disperse nicotine and other chemicals as tiny airborne particles that users can inhale. They were originally developed as a safer alternative to cigarettes that users could use as they tried to slowly break their addiction to the nicotine in tobacco products.

hookah: A water pipe used to cool smoke — usually tobacco smoke — that will be inhaled. According to the U.S. Centers for Disease Control and Prevention, “hookah smoking carries many of the same health risks as cigarettes.”

neuron: or nerve cell Any of the impulse-conducting cells that make up the brain, spinal column and nervous system. These specialized cells transmit information to other neurons in the form of electrical signals.

neurotransmitter: A chemical substance that is released at the end of a nerve fiber. It transfers an impulse to another nerve, a muscle cell or some other structure.

nicotine: A colorless, oily chemical produced in tobacco and certain other plants. It creates the ‘buzz’ effect associated with smoking. It also is highly addictive, making it hard for smokers to give us their use of cigarettes. The chemical is also a poison, sometimes used as a pesticide to kill insects and even some invasive snakes or frogs.

nicotinic receptors: A group of brain proteins that affects the signaling of dopamine. Repeated exposure to nicotine leads