

ALTERING CONSCIOUSNESS WITH PSYCHOACTIVE DRUGS

SPEEDING UP THE BRAIN WITH STIMULANTS: CAFFEINE, NICOTINE, COCAINE, AND AMPHETAMINES

A **stimulant** is a psychoactive drug that operates by blocking the reuptake of dopamine, norepinephrine, and serotonin in the synapses of the CNS. Because more of these neurotransmitters remain active in the brain, the result is an increase in the activity of the sympathetic division of the autonomic nervous system (ANS). Effects of stimulants include increased heart and breathing rates, pupil dilation, and increases in blood sugar accompanied by decreases in appetite. For these reasons, stimulants are frequently used to help people stay awake and to control weight.

Used in moderation, some stimulants may increase alertness, but used in an irresponsible fashion they can quickly create dependency. A major problem is the “crash” that results when the drug loses its effectiveness and the activity of the neurotransmitters returns to normal. The withdrawal from stimulants can create profound depression and lead to an intense desire to repeat the high.

Caffeine is a bitter psychoactive drug found in the beans, leaves, and fruits of plants, where it acts as a natural pesticide. It is found in a wide variety of products, including coffee, tea, soft drinks, candy, and desserts. In North America, more than 80% of adults consume caffeine daily (Lovett, 2005). Caffeine acts as a mood enhancer and provides energy. Although Health Canada lists caffeine as a safe food substance, it has at least some characteristics of dependence. People who reduce their caffeine intake often report being irritable, restless, and drowsy, as well as experiencing strong headaches, and these withdrawal symptoms may last up to a week. Most experts feel that using small amounts of caffeine during pregnancy is safe, but larger amounts of caffeine can be harmful to the fetus (Health Canada, 2014).

Nicotine is a psychoactive drug found in tobacco and other members of the nightshade family of plants, where it acts as a natural pesticide. Nicotine is the main cause for the dependence-forming properties of tobacco use, and tobacco use is a major health threat. Nicotine creates both psychological and physical addiction, and it is one of the hardest addictions to break. Nicotine content in cigarettes has slowly increased over the years, making quitting smoking more and more difficult. Nicotine is also found in smokeless (chewing) tobacco.

People who want to quit smoking sometimes use other drugs to help them. For instance, the prescription drug Chantix acts as an antagonist, binding to nicotine receptors in the synapse, which prevents users from receiving the normal stimulant effect when they smoke. At the same time, the drug also releases dopamine, the reward neurotransmitter. In this way Chantix dampens nicotine withdrawal symptoms and cravings. In many cases, people are able to get past the physical dependence, allowing them to quit smoking at least temporarily. In the long run, however, the psychological enjoyment of smoking may lead to relapse.

Cocaine is an addictive drug obtained from the leaves of the coca plant (Figure 6.9). In the late 19th and early 20th centuries, it was a primary constituent in many popular tonics and elixirs and, although it was removed in 1905, was one of the original ingredients in Coca-Cola. Today cocaine is taken illegally as a recreational drug.



Figure 6.9 Cocaine. Snorting

cocaine tends to cause a high that averages about 15 to 30 minutes.

Cocaine has a variety of adverse effects on the body. It constricts blood vessels, dilates pupils, and increases body temperature, heart rate, and blood pressure. It can cause headaches, abdominal pain, and nausea. Since cocaine also tends to decrease appetite, chronic users may become malnourished. The intensity and duration of cocaine's effects, which include increased energy and reduced fatigue, depend on how the drug is taken. The faster the drug is absorbed into the bloodstream and delivered to the brain, the more intense the high. Injecting or smoking cocaine produces a faster, stronger high than snorting it. However, the faster the drug is absorbed, the faster the effects subside. The high from snorting cocaine may last 30 minutes, whereas the high from smoking "crack" cocaine may last only 10 minutes. In order to sustain the high, the user must administer the drug again, which may lead to frequent use, often in higher

doses, over a short period of time (National Institute on Drug Abuse, 2009a). Cocaine has a safety ratio of 15, making it a very dangerous recreational drug.

An **amphetamine** is a stimulant that produces increased wakefulness and focus, along with decreased fatigue and appetite. Amphetamines are used in prescription medications to treat attention deficit disorder (ADD) and narcolepsy, and to control appetite. Some brand names of amphetamines are Adderall, Benzedrine, Dexedrine, and Vyvanse. But amphetamine (“speed”) is also used illegally as a recreational drug. The methylated version of amphetamine, *methamphetamine* (“meth” or “crank”), is currently favoured by users, partly because it is available in ampoules ready for use by injection (Csaky & Barnes, 1984). Meth is a highly dangerous drug with a safety ratio of only 10.

Amphetamines may produce a very high level of tolerance, leading users to increase their intake, often in “jolts” taken every half hour or so. Although the level of physical dependency is small, amphetamines may produce very strong psychological dependence, effectively amounting to addiction. Continued use of stimulants may result in severe psychological depression. The effects of the stimulant methylenedioxymethamphetamine (MDMA), also known as “Ecstasy,” provide a good example. MDMA is a very strong stimulant that very successfully prevents the reuptake of serotonin, dopamine, and norepinephrine. It is so effective that when used repeatedly it can seriously deplete the amount of neurotransmitters available in the brain, producing a catastrophic mental and physical “crash” resulting in serious, long-lasting depression. MDMA also affects the temperature-regulating mechanisms of the brain, so in high doses, and especially when combined with vigorous physical activity like dancing, it can cause the body to become so drastically overheated that users can literally “burn up” and die from hyperthermia and dehydration.

SLOWING DOWN THE BRAIN WITH DEPRESSANTS: ALCOHOL, BARBITURATES AND BENZODIAZEPINES, AND TOXIC INHALANTS

In contrast to stimulants, which work to increase neural activity, a *depressant* acts to slow down consciousness. A **depressant** is a psychoactive drug that reduces the activity of the CNS. Depressants are widely used as prescription medicines to relieve pain, to lower heart rate and respiration, and as anticonvulsants. Depressants change consciousness by increasing the production of the neurotransmitter GABA and decreasing the production of the neurotransmitter acetylcholine, usually at the level of the thalamus and the reticular formation. The outcome of depressant use (similar to the effects of sleep) is a reduction in the transmission of impulses from the lower brain to the cortex (Csaky & Barnes, 1984).

The most commonly used of the depressants is **alcohol**, a colorless liquid, produced by the fermentation of sugar or starch, that is the intoxicating agent in fermented drinks (Figure 6.10). Alcohol is the oldest and most widely used drug of abuse in the world. In low to moderate doses, alcohol first acts to remove social inhibitions by slowing activity in the sympathetic nervous system. In higher doses, alcohol acts on the cerebellum to interfere with coordination and balance, producing the staggering gait of drunkenness. At high blood levels, further CNS depression leads to dizziness, nausea, and eventually a loss of consciousness. High enough blood

levels, such as those produced by “guzzling” large amounts of hard liquor at parties, can be fatal. Alcohol is not a “safe” drug by any means — its safety ratio is only 10.

Alcohol use is highly costly to societies because so many people abuse alcohol and because judgment after drinking can be substantially impaired. It is estimated that almost half of automobile fatalities are caused by alcohol use, and excessive alcohol consumption is involved in a majority of violent crimes, including rape and murder (Abbey, Ross, McDuffie, & McAuslan, 1996). Alcohol increases the likelihood that people will respond aggressively to provocations (Bushman, 1993, 1997; Graham, Osgood, Wells, & Stockwell, 2006). Even people who are not normally aggressive may react with aggression when they are intoxicated. Alcohol use also leads to rioting, unprotected sex, and other negative outcomes.



Figure 6.10 Liquor Bottles.

Alcohol is the most widely used drug of abuse in the world. Alcohol acts as a general depressant in the central nervous system, where its actions are similar to those of general anesthetics. Alcohol increases aggression in part because it reduces the ability of the person who has consumed it to inhibit his or her aggression (Steele & Southwick, 1985). When people are intoxicated, they become more self-focused and less aware of the social situation. As a result, they become less likely to notice the social constraints that normally prevent them from engaging aggressively, and are less likely to use those social constraints to guide them. For instance, we might normally notice the presence of a police officer or other people around us, which would remind us that being aggressive is not appropriate. But when we are drunk, we are less likely to be so aware. The narrowing of attention that occurs when we are intoxicated also prevents us from being cognizant of the negative outcomes of our aggression. When we are sober, we realize that being aggressive may produce retaliation, as well as cause a host of other problems, but we are less likely to realize these potential consequences when we have been drinking (Bushman & Cooper, 1990). Alcohol also influences aggression through expectations. If we expect that alcohol will make us more aggressive, then we tend to become more aggressive when we drink.

Barbiturates are *depressants that are commonly prescribed as sleeping pills and painkillers*. Brand names include Luminal (Phenobarbital), Mebaraland, Nembutal, Seconal, and Sombulex. In small to moderate doses, barbiturates produce relaxation and sleepiness, but in higher doses

symptoms may include sluggishness, difficulty in thinking, slowness of speech, drowsiness, faulty judgment, and eventually coma or even death (Medline Plus, 2008).

Related to barbiturates, **benzodiazepines** are *a family of depressants used to treat anxiety, insomnia, seizures, and muscle spasms*. In low doses, they produce mild sedation and relieve anxiety; in high doses, they induce sleep. In the United States, benzodiazepines are among the most widely prescribed medications that affect the CNS. Brand names include Centrax, Dalmane, Doral, Halcion, Librium, ProSom, Restoril, Xanax, and Valium.

Toxic inhalants are also frequently abused as depressants. These drugs are easily accessible as the *vapours of glue, gasoline, propane, hairspray, and spray paint, and are inhaled to create a change in consciousness*. Related drugs are the nitrites (amyl and butyl nitrite; “poppers,” “rush,” “locker room”) and anesthetics such as nitrous oxide (laughing gas) and ether. Inhalants are some of the most dangerous recreational drugs, with a safety index below 10, and their continued use may lead to permanent brain damage.

OPIOIDS: OPIUM, MORPHINE, HEROIN, AND CODEINE

Opioids are *chemicals that increase activity in opioid receptor neurons in the brain and in the digestive system, producing euphoria, analgesia, slower breathing, and constipation*. Their chemical makeup is similar to the endorphins, the neurotransmitters that serve as the body’s “natural pain reducers.” Natural opioids are derived from the opium poppy, which is widespread in Eurasia, but they can also be created synthetically.

Opium is *the dried juice of the unripe seed capsule of the opium poppy*. It may be the oldest drug on record, known to the Sumerians before 4000 BC. **Morphine** and **heroin** (Figure 6.11) are *stronger, more addictive drugs derived from opium*, while **codeine** is a *weaker analgesic and less addictive member of the opiate family*. When morphine was first refined from opium in the early 19th century, it was touted as a cure for opium addiction, but it didn’t take long to discover that it was actually more addicting than raw opium. When heroin was produced a few decades later, it was also initially thought to be a more potent, less addictive painkiller but was soon found to be much more addictive than morphine. Heroin is about twice as addictive as morphine, and creates severe tolerance, moderate physical dependence, and severe psychological dependence. The danger of heroin is demonstrated in the fact that it has the lowest safety ratio (6) of all the drugs listed in Table 6.1, “Psychoactive Drugs by Class.”

The opioids activate the sympathetic division of the ANS, causing blood pressure and heart rate to increase, often to dangerous levels that can lead to heart attack or stroke. At the same time the drugs also influence the parasympathetic division, leading to constipation and other negative side effects. Symptoms of opioid withdrawal include diarrhea, insomnia, restlessness, irritability, and vomiting, all accompanied by a strong craving for the drug. The powerful psychological dependence of the opioids and the severe effects of withdrawal make it very difficult for morphine and heroin abusers to quit using. In addition, because many users take these drugs intravenously and share contaminated needles, they run a very high risk of being infected with

diseases. Opioid addicts suffer a high rate of infections such as HIV, pericarditis (an infection of the membrane around the heart), and hepatitis B, any of which can be fatal.



Figure 6.11 Injecting Heroin.

Intravenous injection of heroin typically causes a rush within seven to eight seconds. This method of drug use provides the highest intensity and quickest onset of the initial rush but is also the most dangerous.

HALLUCINOGENS: CANNABIS, MESCALINE, AND LSD

The drugs that produce the most extreme alteration of consciousness are the **hallucinogens**, *psychoactive drugs that alter sensation and perception and that may create hallucinations*. The hallucinogens are frequently known as “psychedelics.” Drugs in this class include lysergic acid diethylamide (LSD, or “acid”), mescaline, and phencyclidine (PCP), as well as a number of natural plants including cannabis (marijuana), peyote, and psilocybin. The chemical compositions of the hallucinogens are similar to the neurotransmitters serotonin and epinephrine, and they act primarily as agonists by mimicking the action of serotonin at the synapses. The hallucinogens may produce striking changes in perception through one or more of the senses. The precise effects a user experiences are a function not only of the drug itself, but also of the user’s pre-existing mental state and expectations of the drug experience. In large part, the user tends to get out of the experience what he or she brings to it. The hallucinations that may be experienced when taking these drugs are strikingly different from everyday experience and frequently are more similar to dreams than to everyday consciousness.

Cannabis (marijuana) is the most widely used hallucinogen. Marijuana also acts as a stimulant, producing giggling, laughing, and mild intoxication. It acts to enhance perception of sights, sounds, and smells, and may produce a sensation of time slowing down. It is much less likely to lead to antisocial acts than that other popular intoxicant, alcohol, and it is also the one psychedelic drug whose use has not declined in recent years (National Institute on Drug Abuse, 2009b).

In recent years, cannabis has again been frequently prescribed for the treatment of pain and nausea, particularly in cancer sufferers, as well as for a wide variety of other physical and psychological disorders (Ben Amar, 2006). While medical marijuana is now legal in several Canadian provinces, it is still banned under federal law, putting those provinces in conflict with the federal government. The provinces of Ontario, Quebec, Newfoundland and Labrador, and British Columbia are known to have more relaxed enforcement of cannabis laws and do not normally pursue criminal charges for possession of relatively small amounts of cannabis. These four provinces also refuse to implement and enforce the federal government's new "tough on crime" Bill C-10. British Columbia is taking an extraordinary step in considering the passage of legislation to effectively decriminalize cannabis by proposing a provincial law (to be called the Sensible Policing Act) that redirects police resources from the pursuit of criminal charges for simple possession of cannabis in favour of other means such as tickets and civil citations as well as diversion programs for youth. The cultivation of the hemp plant of the genus *Cannabis* (family *Cannabaceae*) is currently legal in Canada for seed, grain, and fibre production only under licenses issued by Health Canada (Health Canada, 2012).

Although the hallucinogens are powerful drugs that produce striking "mind-altering" effects, they do not produce physiological or psychological tolerance or dependence. While they are not addictive and pose little physical threat to the body, their use is not advisable in any situation in which the user needs to be alert and attentive, exercise focused awareness or good judgment, or demonstrate normal mental functioning, such as driving a car, studying, or operating machinery.

WHY WE USE PSYCHOACTIVE DRUGS

People have used, and often abused, psychoactive drugs for thousands of years. Perhaps this should not be surprising, because many people find using drugs to be fun and enjoyable. Even when we know the potential costs of using drugs, we may engage in them anyway because the pleasures of using the drugs are occurring right now, whereas the potential costs are abstract and occur in the future.

Research Focus: Risk Tolerance Predicts Cigarette Use

Because drug and alcohol abuse is a behaviour that has such important negative consequences for so many people, researchers have tried to understand what leads people to use drugs. Carl Lejuez and his colleagues (Lejuez, Aklin, Bornovalova, & Moolchan, 2005) tested the hypothesis that cigarette smoking was related to a desire to take risks. In their research they compared risk-taking behaviour in adolescents who reported having tried a cigarette at least once with those who reported that they had never tried smoking.

Participants in the research were 125 students from Grades 5 through 12 who attended after-school programs throughout inner-city neighbourhoods. Eighty percent of the adolescents indicated that they had never tried even a puff of a cigarette, and 20% indicated that they had had at least one puff of a cigarette.

The participants were tested in a laboratory where they completed the Balloon Analogue Risk Task (BART), a measure of risk taking (Lejuez et al., 2002). The BART is a computer task in

which the participant pumps up a series of simulated balloons by pressing on a computer key. With each pump the balloon appears bigger on the screen, and more money accumulates in a temporary “bank account.” However, when a balloon is pumped up too far, the computer generates a popping sound, the balloon disappears from the screen, and all the money in the temporary bank is lost. At any point during each balloon trial, the participant can stop pumping up the balloon, click on a button, transfer all money from the temporary bank to the permanent bank, and begin with a new balloon.

Because the participants do not have precise information about the probability of each balloon exploding, and because each balloon is programmed to explode after a different number of pumps, the participants have to determine how much to pump up the balloon. The number of pumps that participants take is used as a measure of their tolerance for risk. Low-tolerance people tend to make a few pumps and then collect the money, whereas more risky people pump more times into each balloon.

Supporting the hypothesis that risk tolerance is related to smoking, Lejuez and colleagues found that the tendency to take risks was indeed correlated with cigarette use: the participants who indicated that they had puffed on a cigarette had significantly higher risk-taking scores on the BART than did those who had never tried smoking.

Individual ambitions, expectations, and values also influence drug use. Vaughan, Corbin, and Fromme (2009) found that university students who expressed positive academic values and strong ambitions had less alcohol consumption and fewer alcohol-related problems, and cigarette smoking has declined more among youth from wealthier and more educated homes than among those from lower socioeconomic backgrounds (Johnston, O’Malley, Bachman, & Schulenberg, 2004).

Drug use is in part the result of socialization. Children try drugs when their friends convince them to do it, and these decisions are based on social norms about the risks and benefits of various drugs (Figure 6.12). In the period 1991 to 1997, the percentage of Grade 12 students who responded that they perceived “great harm in regular marijuana use” declined from 79% to 58%, while annual use of marijuana in this group rose from 24% to 39% (Johnston et al., 2004). And students binge drink in part when they see that many other people around them are also bingeing (Clapp, Reed, Holmes, Lange, & Voas, 2006).

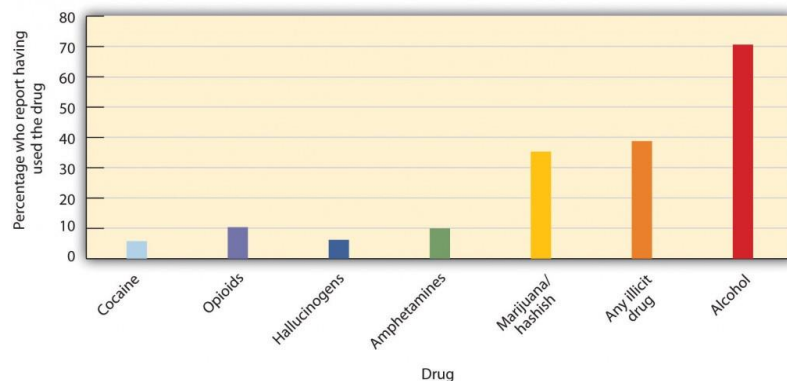


Figure 6.12 Drug Use. Use of various drugs by grade 12 students in 2005. [\[Long Description\]](#)

Despite the fact that young people have experimented with cigarettes, alcohol, and other dangerous drugs for many generations, it would be better if they did not. All recreational drug use is associated with at least some risks, and those who begin using drugs earlier are also more likely to use more dangerous drugs later (Lynskey et al., 2003). Furthermore, as we will see in the next section, there are many other enjoyable ways to alter consciousness that are safer.

Key Takeaways

- Psychoactive drugs are chemicals that change our state of consciousness. They work by influencing neurotransmitters in the CNS.
- Using psychoactive drugs may create tolerance and, when they are no longer used, withdrawal. Addiction may result from tolerance and the difficulty of withdrawal.
- Stimulants, including caffeine, nicotine, and amphetamines, increase neural activity by blocking the reuptake of dopamine, norepinephrine, and serotonin in the CNS.
- Depressants, including alcohol, barbiturates, and benzodiazepines, decrease consciousness by increasing the production of the neurotransmitter GABA and decreasing the production of the neurotransmitter acetylcholine.
- Opioids, including codeine, opium, morphine, and heroin, produce euphoria and analgesia by increasing activity in opioid receptor neurons.
- Hallucinogens, including cannabis, mescaline, and LSD, create an extreme alteration of consciousness as well as the possibility of hallucinations.
- Recreational drug use is influenced by social norms as well as by individual differences. People who are more likely to take risks are also more likely to use drugs.

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