# Drugs in College

by Joy Yang

"Experimentation" is a large part of the college experience. It could be argued that no campus is completely clean of drug abuse and the three most common drugs used by college students are alcohol, marijuana, and prescription stimulants. This article will focus on the two legal, but recklessly abused drugs: the godfather of campus drugs - alcohol, and the new kid on the block - prescription stimulants.

## Alcohol

Fermentation is said to be the oldest chemistry utilized by man. Alcohol sat proudly in the holy grail during the last supper, intoxicated the Trojans during their celebration of a big wooden horse, and was both the gift and the weapon of choice of the Grecian/Roman god Bacchus. Alcohol, a depressant, has accompanied man throughout the ages, making him hyper-social, dizzy, numb, indecent, unconscious, and ultimately hung-over.

So how does alcohol inflict its power? An alcohol is an organic compound with one or more hydroxyl or alcohol (-OH) groups attached. Ethanol, in particular, is the alcohol that we consume. Although the fine details of the biochemistry of alcohol are still uncertain, it has long been suspected that the transmission of gamma-aminobutyric acid (GABA), a mostly inhibitory neurotransmitter, is somehow effected by alcohol (Paul 2006). In 2006, researchers demonstrated that the actions of GABA are amplified by the presence of alcohol at the GABAA receptors, a ligand-gated ion channel in charge of GABA transmission (Hanchar 2006 and Wallner 2006). When GABA binds to the GABAA receptors, the pore opens, allowing chloride ions (Cl-) to rush down the electrochemical gradient. The result is an axon with a charge more negative than one at normal resting membrane potential. Thus, depolarizing the neuron becomes extremely difficult (Siegel 1999). Ultimately, this process impairs fluidity in movement and delays reaction time.

Microscope view of Ritalin

While most alcohol consumers drink only until they are "tipsy," sometimes they lose control and drink to the point of being "blacked out." Later, they may possess no memory of events that had occurred during that time. This black-out period has recently been proven to be connected to the effects of alcohol on the hippocampus, an area of the brain in which short-term memories are stored (White 2000).

Non-alcohol related damage to the hippocampi causes similar behavioral effects in comparison to the consequences of drinking alcohol. To illustrate, in one famous procedure, the hippocampi of a patient, HM, were removed in order to relieve his epileptic seizures. The subject continued to score above average on IQ tests despite lacking his hippocampi. Researchers also found that the patient was perfectly capable of carrying on a coherent conversation with another individual. However, upon returning to the room after just a few minutes of absence, dialogue with the subject would reveal that he could neither recall who the speaker was, nor what the conversation had been about. This phenomenon closely resembles that of an alcohol induced black-out, further suggesting that alcohol may affect the hippocampus.

So far, the alcohol side-effects of drowsy, uncoordinated movements and memory loss have been explained, but what about the symptom with which alcohol is most associated - poor judgment? Researchers have hypothesized that the frontal lobe, which controls information processing, impulse suppression, and social awareness, might be the target region that causes the lack of judgment after alcohol consumption. Sure enough, it has been shown that the short-term effects of intoxication include a decrease in metabolism and activity in the frontal lobe (Wang et al. 2000). Similarly, chronic alcohol abuse can damage and even shrink the frontal lobe, but there is much less information on alcohol's acute effects on this region of the brain (Kril and Halliday 1999).

The frontal lobe has also been chosen as an area of alcohol research because of the similarity in behavior between intoxicated individuals and those with frontal lobe damage. Frontotemporal lobar degeneration (FTLD) is a disease that can illustrate the effects of an impaired frontal lobe, which may illuminate the impact of alcohol on this region of the brain. In patients with FTLD, the frontal and temporal lobes of the brain experience tissue atrophy and shrinkage. Patients tend to lose such characteristics as: good judgment, manners, or common sense

During an interview with an FTLD sufferer (to be referred to as the interviewee), the interviewee seemed normal at first, though perhaps a little too relaxed and happy to be at an

FTLD interview session (Jagust, 2007). However, it soon became apparent that he lacked impulse control. After the interview, while in the middle of a casual conversation, he stooped down and began shuffling through a candy bowl that the interviewer had placed on the ground. Not only did the interviewee not politely ask permission, but he proceeded to stuff handfuls after handfuls of candy into his pockets. This behavior bears a striking resemblance to that of an intoxicated individual. When inebriated, some people may say things they normally would not say or do things that they (and others) would normally consider inappropriate. However, unlike an FTLD patient, inebriated individuals can recover their social consciousness after the effects of alcohol has worn off.

All this is not to say that consumption of alcohol produces only negative effects. Recent studies suggest that antioxidants in red wine can help ward off cancer if consumed in moderation. And of course, with moderation, alcohol can be a powerful icebreaker, great for social networking. Yet, it is also important to keep in mind that alcohol is a potent depressant and its abuse can wreak havoc on the brain. There is still much research to be conducted on the effects of alcohol on the brain. The exact mechanisms of how alcohol affects neurons and certain brain regions are still either debatable or unknown. After traveling through the ages together, man still has much to learn about his manipulative companion.

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## Prescription Drugs

While alcohol and marijuana continue to be college students' top two drugs of choice, stimulants that are prescribed for narcolepsy and attention deficit hyperactivity disorder (ADHD), such as Adderall and Ritalin, have been rapidly ascending the charts in their alarming popularity. Since these drugs were introduced to the prescription drug market quite recently, they are also fairly new to college campuses. Amphetamines, which are used in Adderall, were first synthesized in 1887. However, they were not widely used until World War II, when amphetamines were distributed to soldiers to ward off exhaustion and to increase vigilance. Adolf Hitler was known to have taken daily dosages of his essential vitamins along with amphetamines (Rasmussen, 2008). In the United States, amphetamines were limited to medicinal use in 1965. Methylphenidate, used in Ritalin, is an even more recently synthesized drug. It was patented in 1954 by Ciba, a predecessor of Novartis, the company from which Ritalin arose. Today, it is approximated that 20% of U.S. residents have taken prescription drugs for nonmedical purposes (National Institute on Drug Abuse 2008).

Amphetamines (alpha-methylphenethylamine) are chiral compounds that are believed to function by binding to monamine receptors, causing an increase in the levels of dopamine, norepinephrine, and serotonin production. D-amphetamine is believed to function mostly in the dopaminergic system, while L-amphetamine focuses mostly on the norepinephrinergic system. ADHD is believed to be the result of a dopamine level imbalance. Amphetamines increase the amount of dopamine transported between neurons and block reuptake. This ensures that dopamine will remain inside the synaptic cleft for longer periods of time, giving the user a high (Sulzer 2005).

Methylphenidate is also a chiral compound. This chemical blocks the reuptake chambers of dopamine and norepinephrine. Here, D-methylphenidate seems to mainly target norepinephrine reuptake chambers, while L-methylphenidate targets mainly those of dopamine. Although both are attracted to serotonin reuptake chambers, no binding has been observed. Using position emission, Dr. Nora Volkow was able to observe the effects of L-methylphenidate and compared them to the effects of cocaine. It was found that methylphenidate is more effective at blocking dopamine reuptake than cocaine, yet it is less addictive (Jiedd 2003). This characteristic of the drug may be correlated with how quickly it is absorbed into the brain. Namely, while highly-addictive cocaine is absorbed in a matter of seconds, methylphenidate is absorbed within the course of an hour, showing that it is much less (or perhaps not) addictive (Volkow 1998).

Although these drugs have been shown to deliver a high in some abusers, this is not the primary side-effect that students seek. Using these drugs as an aide in last-minute studying or for weight loss are the most common reasons why they are so popular on college campuses. From personal observation (not experience), abusers can become so focused on studies that they appear to be working in a trance. Calling out the student's name will not induce him to take his attention away from his work. Upon being physically shoved, an abuser may glance up, make a fast and frenzied explanation, then continue to proceed with his studying. One abuser hurriedly commented, "I feel so focused right now. It's amazing. I've never felt so focused in my life."

Another abuser experimented with a more dangerous version of amphetamines: their illegal cousins methamphetamines. After going without sleep for three days, this particular student managed to ace all of his finals. This, unfortunately, leads to certain issues about academic honesty and unfair competition. However, he did manage to take a lesson away from this experience. He was able to recognize the dangers of his high, which he described as a feeling that nothing, not food, love, nor any other pleasure, could mimic. He even stated, "Now that I know why people become so easily addicted, I won't ever try it again."

The question then arises: are prescription stimulants addictive? The accepted answer is that with careful doctor supervision, these prescription stimulants should not be addictive nor should they cause dependence. However, when abused, the danger of addiction does become real. Amphetamines, especially, are well known to be highly addictive. To avoid withdrawal symptoms, some abusers fearfully continue to take the drug which can cause an inability to sleep for two or three days. Then, when they become fearful of these side effects, abusers will cease usage and may even ingest depressants to numb their withdrawal pains. Needless to say, this cycle of behavior is disastrous for the central nervous system. Prolonged abuse contributes to cardiovascular disease, hypertension, psychosis, and even schizophrenia (Merck 2003). As a testament to their harmful effects, amphetamine inhalers were banned in 1965. Likewise, prescription stimulant gel capsules, which are peeled and injected for a faster kick, were banned in the 1990s (Rasmussen 2006).

There are many websites that post instructions on how to get high off of pharmaceuticals. This easily accessible information heightens the drugs' dangers. One site proclaims, "If you just swallow them, you will not be getting the full effects." One website recommends crushing the pills into powder in order to destroy the time-release capsule, and then snorting this for faster delivery to the brain. For longer-lasting results, the site recommends wrapping the powder in tissue wrap and then swallowing it (Muir 2006). The number of people misusing legal pharmaceuticals has reached 6.3 million in 2003, more than twice the numbers for cocaine (Bernstein 2008). The Drug Enforcement Administration (DEA) reported the existence of shocking instances of abuse known as "pharm parties," basically a potluck of pharmaceuticals. The drugs are mixed in a bowl and passed around like chips (DEA 2007).

Still, almost any behavior-altering drug will probably have a history of abuse. There have even been instances in which NyQuil has been abused (Medhelpt 2003). Family and friends should be cautious of their home medicine cabinets, as injuries and deaths resulting from accidental overdose of prescription drugs have been a rising trend. Yet, the benefits that these drugs impart upon those who need them must also not be forgotten.

One of the best ways to reduce the dangers of abuse would be to learn about how these drugs work, what effect they have on abusers, and how addictive they are. By understanding the mechanisms of drugs, researchers may be better able to find methods to combat abusers' habits. Manufacturers may be able to develop packaging or other means by which abuse can be reduced. Then, perhaps less people may fancy "experimenting" with certain drugs in a life-threatening manner while they are in college.

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