

INTRODUCTION

FOR ALL OF our history, we humans have believed that it is possible to reach beyond our simple consciousness. We hunger to expand ourselves into a universe that we feel but cannot touch. Chemicals that alter the way we perceive the world have played a large role in this search. In some instances, people have believed that the chemicals themselves had spiritual powers and mystical properties.

Others use chemicals to reduce a particularly painful state. They use drugs to reduce anxiety or suppress shyness, or they are prescribed drugs to treat serious illnesses like depression and schizophrenia. Some seek the stimulation and power they do not have in their social situations and choose drugs to help them attain this. Some use chemicals as part of their daily life to stimulate or calm themselves as the situation dictates. As science has progressed, the laboratory has replaced nature as a source of chemicals, and the number of chemical choices has grown. There is every reason to believe that this trend will continue almost without bounds. So whether a person is seeking a way to expand his understanding or only trying to make normal life less painful, that person will have many, many choices of chemicals to use.

As scientists, we have devoted years to the study of the effects of drugs on the brain and behavior. We have seen the stunning advances in understanding the actions of the chemicals that have been with us for thousands of years. Yet surprisingly, little of this information is effectively translated for the public. We have become convinced that contem-

porary efforts to educate people about the effects of alcohol and other drugs are inadequate and misdirected. There is a lot of important information in the scientific literature about addiction and the effects of drugs, but it is not reaching the people who need to know it. The actions of drugs on the brain are complicated and vary tremendously from drug to drug and person to person, making it impossible to make blanket statements like "drugs kill" and have them believed by anyone who has any drug experience.

Imagine two trains headed at high speed in different directions, one being the scientific understanding of drug actions and addictions, the other being the public understanding of drug problems. The gap between scientific information and public information is growing hour by hour. This is the image portrayed in a speech by Dr. Alan Leshner, then director of the National Institute on Drug Abuse. In his words, "There is a unique disconnect between the scientific facts and the public's perception about drug abuse and addiction. If we are going to make any progress, we need to overcome the 'great disconnect.'"

We agree that it is crucial to get these trains headed in the same direction. Each of us must understand what different drugs do to our brains and our consciousness, and what the physical consequences of their use might be. The number of consciousness-altering chemicals is increasing rapidly as medical scientists and pharmaceutical companies take advantage of new discoveries in neuroscience. Every time a new brain circuit or a new neurochemical is discovered, that discovery provides an opportunity to develop drugs that alter brain function in a new way. Some of these prove to be valuable treatments for mental illness, and many of the drugs that are currently abused (for example, amphetamines, barbiturates, and "roofies") come directly from this same medical research.

Because of the incredible complexity of the brain, most drugs that affect it have actions in addition to those for which they were developed. Often dangerous drugs remain on the prescription market because they offer the only opportunity to treat a medical condition; their potential side effects seem worth the risk if they are used under medical supervision. Yet recreational use may not be worth the risk of the known and unknown effects on health. The fast-acting opioid fentanyl used in the operating room is a great example. This chemical is very safe and effective if there is a medical professional monitoring body functions such as heart rate, blood pressure, and the amount of oxygen getting to the brain. But with just a small error, it can turn dangerous and deadly. So imagine how

risky using it could be in some alley or dorm room, where it might be sold as "Apache" or "Jackpot."

It is easy to see how drug information can become subject to distortion. The public can be easily confused and manipulated. For example, some people (especially those in the drug culture) know individuals who have consumed various drugs in various combinations in various settings over long periods of time and do not seem permanently impaired or addicted, or are not involved with the legal system. Yet they may not realize that many drug effects can be subtle enough to do a good deal of harm before the damage is recognized.

Conversely, others routinely carry out drug education by telling the worst horror stories they can recall, and often place any illegal substance in the category of "terribly dangerous." Stories of celebrity deaths from basketball players to musicians are used to illustrate the dangers of drug use. However, most people who use addictive drugs like cocaine and heroin do not die as a result, and the users and their friends certainly know it. Therefore, when horror stories are used as the principal tools in drug education, people soon recognize that such stories do not represent the whole truth. The educator then loses credibility.

Good drug education requires a lot of effort. The scientific and medical literature is often difficult for most people to find and even more difficult to understand. Most interpretations of this literature to the general public are oversimplified, inaccurate, or disseminated by organizations that slant the research to further political and moral agendas.

The marijuana controversy is an excellent example. Some organizations have taken a hard line that this drug is devastating to anyone who uses it. Other organizations view it as harmless and support its legalization for totally unregulated consumption. In our opinion, the truth is somewhere in between. As you will read in the marijuana chapter, marijuana causes memory problems and interacts with the immune system in unknown ways. It has effects many hours after it enters the body, even if the user is unaware of those effects. So it is not harmless. But people do not die from marijuana overdoses (as they do from overdoses of alcohol). Any truthful discussion of marijuana must include a range of topics and a realistic representation of risk, which cannot be accomplished by exchanging slogans.

Drugs should be viewed individually on a continuum of risk. Those we review in this book vary remarkably in their chemical structures; in target systems in the brain; and in their pharmacological, behavioral,

and psychological effects. Also, people vary markedly in their reactions to drugs. The rapidly expanding literature on genetic and hereditary predispositions toward addiction is just one example of our growing understanding of individual differences in drug reactivity.

The internet is also making it difficult to carry out good drug education. An immense amount of easy-to-read information about drugs is accessible there, but much of it is wrong. Anyone can create a website and say whatever he or she pleases; the astute reader must weed out fact from fiction. A naïve reader, on the other hand, may get into serious trouble by following website advice. The drug GHB, for instance, can be deadly at doses not far above those that produce a high. Yet some of the internet literature would lead us to believe that the drug is not only safe but will treat alcoholism, insomnia, narcolepsy, sexual problems, and depression. One website that we accessed provided directions for making GHB and stated that "GHB is the safest recreational drug ever used by humanity." This information could not be further from the truth, and readers who believe it are at great risk.

→ The primary goal of this book is to provide an unbiased, readable, and detailed presentation of the scientific facts about the drugs most commonly abused. We expect that this book will have its largest impact on people who are not addicted to drugs but are in a position to use drugs socially. During adolescence and young adulthood, most people—newly independent from parental control—will find themselves in situations in which drugs are available. College dorm rooms are often active, misguided psychopharmacology labs. We do not expect that this book will end drug abuse, but we hope it will prevent some bad experiences and some real tragedies.

We also hope that this book will facilitate a dialogue between scientists and legislators. The use of illegal drugs in the United States is common, and the social and legal reactions to that use have placed enormous stress on the resources of this country. The debate about drug laws in the United States is raging and has been driven in part by this usage and the huge increase in the prison population. It is very costly to keep a person in prison, and the number of sentenced prisoners in state and federal institutions has skyrocketed from about 300,000 in 1978 to more than 1.5 million in 2016.* About 46 percent of the people in federal prisons are there

* Bureau of Justice Statistics (<http://www.bjs.gov/>)

for drugs,* and as bad as these numbers are, they are an improvement over those we found as we wrote the previous editions of this book. It appears there is a trend toward reducing prison populations.

The distinction between drugs that are considered legal or illegal in a given society is often based on much more than just scientific information. Traditions, economics, religion, and the popular media all influence the stance that a community takes on drugs. The religious rituals of some Native American communities include the use of hallucinogens, while many of those in Jewish and Christian traditions include the use of alcohol. Other cultures take very hard-line stances against the use of any substance that is considered intoxicating. Even within a given culture, the legality of drugs can change over time. In the United States, the use of alcohol was legal for more than a century, was declared illegal during Prohibition, and is now legal again. Similarly, marijuana was legal until the 1930s, when its use was prohibited. Now nine states and the District of Columbia have legalized both medical and recreational marijuana, and nineteen additional states have legalized medical marijuana.

Again, in the words of Dr. Leshner, "Science must replace ideology as the foundation for drug abuse and addiction prevention, treatment, and policy strategies." The legislative authorities of developed societies must understand that no matter what legal efforts are taken, their citizens will have access to increasing numbers of chemicals that can cause addiction and impair human function. Effective protection from the kind of societal disruption being experienced in the United States rests in good education that is accessible to everyone and good scientific research that addresses the problems that drugs cause.

We hope that this book will be part of that process. The first twelve chapters are devoted to particular drugs or classes of drugs. Each one starts with a quick-reference summary of the effects and dangers of the drug. Next we present a detailed picture of how the drug works. We describe how the drug gets into and out of the body, its effects on physical and psychological functions, and its long-term effects. We've organized the drugs by class—even though some drug classes, like the entactogens, are much less familiar to most readers than the specific drug names—because drugs in the same class generally have the same mechanisms of action, effects, and risks. However, the table of contents, the chapter contents, and the index make it easy to determine where to go for informa-

* US Federal Bureau of Prisons (<http://www.bop.gov/>)

tion on a specific drug. In the second part of the book, we've provided general chapters on the brain, how drugs work, addiction, and legal issues. We recommend that any reader using the book for a broad general understanding, rather than as a quick reference, read those chapters first, as they provide an important background for all of the scientific information relating to specific drugs.

We believe that when provided with an unbiased and authoritative source of information about drugs and drug interactions, individuals are empowered to make healthy decisions.

JUST SAY KNOW

(A College Student's Perspective by
Leigh Heather Wilson and Jeremy Foster)

This section was written by our college interns for the first edition of Buzzed. We feel the advice is still as good and relevant as it was then and so we include it in this edition.

"JUST SAY NO." Well, no thanks. We would like a bit more information before making decisions about drug use. And when you say "Just say no," does that mean you're telling us alcohol is as dangerous as cocaine? Before you start lumping together everything from smoking cigarettes to shooting heroin, could we have a little bit more information? "Just say no" might not always be the right choice. Hasn't research shown that a glass of wine can be healthy? It is only natural that phrases like "Just say no" are not sufficient to satisfy many young people. It is the very basis of our society to value proof, logic, and fact above all. Instead of asking us to respond blindly, convince us!

We have been friends all our lives. Because Heather's dad is a neuropharmacologist, we knew about psychoactive drugs early on. Ever since we can remember, drugs and how they do this or that to the something-or-another region of the brain has been a familiar topic of conversation.

Like many kids, in high school we became bored with the same-old, same-old that radio and MTV offered and wanted to broaden our musical horizons. This sparked an interest in some of the bands popular in the sixties and seventies. Consequently, we developed a fascination with the

surrounding culture. It was clear that drugs, of one character or another, were cast in many roles during those times. The deaths of Janis Joplin, Jim Morrison, and Jimi Hendrix were all related to their drug use, and still, by way of their association with these and other musicians, drugs have an air of romance and intrigue.

Around the same time that we became aware of these issues, similar concerns about the nineties' music culture became a trendy topic in the media. The flurry of publicity on the rising use of drugs again among young people, as well as the resurgence of heroin use, in particular, has led many to compare our times to the sixties and seventies. All the hype—not to mention the allure of the positive feelings people say they get from taking drugs—made us quite curious about the subject.

We were both way past believing the slogans and hyperbole on the subject of drugs. Heather began nagging her dad with question after question about drugs in a struggle to understand their effects, and the questions evolved into a series of great conversations with him and some of his colleagues. We were so interested because finally we were getting straight, unbiased information about the actions of drugs in our bodies.

We learned a lot about heroin, which had seemed so attractively mysterious. Its "rush" is commonly described as better than experiencing an orgasm. Its associated dangers, however, included several major risks: addiction, overdose, and contracting HIV from needles. The risk of overdose, we learned, is unpredictable because of individual responses to the drug and varying degrees of purity of the compound sold by dealers. The particular compounds used to cut it can also be dangerous. So it became clear to us that with heroin, as with many other drugs, the safety issues are very complicated and often the danger is not limited to the specific effects of the drug but can include many other peripheral issues. For heroin, some of these issues arise from economic considerations because its high street value and relative scarcity lead dealers to cut it in unpredictable ways.

After all these conversations with Heather's dad and his colleagues, heroin seemed far less alluring and mysterious, and we avoided it. We felt lucky to have learned the truth, and with the new knowledge we felt armed. If someone offered heroin to one of us, we wouldn't be "just saying no," but defending an informed decision to stay away from the drug.

Through learning about heroin we realized that not all the threats have direct causes and that by giving people good information, some of the dangers can be lessened (some people will use drugs regardless). We know

that a drug's effects can change in a novel environment, that the risk of overdose increases when the drug purity is not consistent, and that some drugs taken together become lethal. Making people aware of these kinds of issues could decrease some risks of using drugs.

Overall we were struck by the lack of unbiased and complete information available to people like us, and the contrast between the formal education we had received and the scientific facts we had learned.

During high school, we had had experiences with alcohol, many of them positive. It wasn't until Heather's freshman year in college that she had her first really adverse experience with drugs. During Parents' Weekend, she, her roommate, and their parents went to her best friend's room and found her soaked in blood and tears on the floor. Heather's friend had a history of depression, and the combination of this, a bottle of Jack Daniel's Black Label, and too much cold medicine left her ravaged and suicidal. She didn't know that alcohol and antihistamines have a synergistic, depressing effect and that at high levels the combination can even be lethal. They found her in time to save her, but she will always carry the scars where she cut her wrists.

Heather's friend wasn't the only girl left with scars. Everyone involved was affected. She and Heather were part of an unusually close-knit group of five. They had, unknowingly, become a family to each other. By doing almost everything together, they had become a source of strength and love for each other as they adjusted to college life. When Heather's friend went home, she left a hole, a missing link in that safety net. An irresponsible act, taken without knowledge of drugs and their interactions, changed the lives of everyone who found her, all of her friends, and all of her family.

A second experience occurred on the same dormitory hall. Heather and her friends were invited to share some Ecstasy with boys from a nearby school. They were excited, having heard that Ecstasy was a lot of fun. But Heather remembered one of the strongest statements about drug use her dad had ever made. He had said, "Ecstasy permanently alters your brain, Heather. It is a bad drug, and frankly, this is one that I would like to ask you, as a personal favor because I'm your dad and I love you, not to try. There are some kids who have used it and suffered problems with sleep, anxiety, and depression. These poor kids have changed their own brains, and they will never be the same."

Cindy Kuhn had loaned Heather a neuropharmacology textbook the year before; the students used it to read about Ecstasy. With a clear view

of what the drug could do to their brains, most of them chose not to try it, though others decided to take the risk.

With these experiences still vivid in our minds, the vast and cavernous difference between what we know from the most current research on drugs and what drug education and prevention programs teach was obvious. We realized that we are all being sold a bill of goods when it comes to recreational drugs. There are dangers involved in using drugs, but the issue is much more complicated than that. Each drug works differently in the brain, and there are very different issues to consider with each drug. Also, some drugs pose risks that are far greater than others. We do an injustice to ourselves when we try to make blanket statements like "Drugs Kill" or "Users Are Losers."

We realized that not everybody has a scientist to talk to and that the world needed a book that would not use scare tactics but would have reliable, in-depth information—a book that would not insult our intelligence. This book is about making the most current research on the pharmacological and psychological effects of drugs available to you in a friendly and useful way. We hope you enjoy reading it, but most of all, we believe that with information that is both clearly presented and unbiased, you will be qualified to make better decisions for yourself about drugs.

TEST YOUR DRUG KNOWLEDGE

1. The effects of smoking pot can last for two days. True or false?
2. Chocolate and marijuana stimulate the same receptors in the brain. How much chocolate would you have to eat to get the same effect as one joint?
3. Which cup of coffee has more caffeine—the one brewed in the office coffeemaker from grocery-bought beans or the expensive cup from the new gourmet coffee bar?
4. Ecstasy was first popularized by California psychotherapists who tried to use it for "empathy training" in marriage counseling. True or false?
5. What popular recreational drug was originally developed as a treatment for asthma?
6. What popular nightclub drug is actually an animal tranquilizer—and the difference between a recreational dosage of it and an overdose is dangerously small?
7. What are the most dangerous drugs and also the ones most often used by children under age fourteen?
8. Which drug prescribed each year to millions of Americans impairs memory?
9. Put these drugs in the order of addictiveness: marijuana, nicotine, heroin.
10. Tonight you are at a club sipping on a soft drink, or still on your first beer, when suddenly you begin to feel very drunk and uncoordinated. What might have happened?

11. What was the drug misinformation promulgated by the movie *Pulp Fiction*?
12. What was the drug effect correctly portrayed by the movie *Train-spotting*?
13. Which drug carries a greater danger of fatal overdose—alcohol or LSD?
14. Right or wrong: alcohol before bed makes you sleep better.
15. Are the herbal remedies sold in health-food stores actually drugs?
16. Why do people inject a drug instead of just taking a pill?
17. What is the most popular illegal drug in America now?
18. If a child or an animal eats a cigarette, will it cause harm?
19. Does marijuana kill brain cells?
20. Does alcohol kill brain cells?
21. Isn't it safe to drink a glass or two of wine with your dinner when you're pregnant?
22. Is caffeine addictive?
23. Are crack babies doomed to mental retardation and behavioral problems?
24. What drug, popular on the club scene and among high school students, causes definitive brain damage in rodents and monkeys?

ANSWERS

1. True. THC, the active ingredient in marijuana, is extremely fat-soluble and can still enter the bloodstream from the fatty tissues and have effects on the brain for up to two days after being smoked. Its by-products can turn up in the blood many months after the last use if the smoker suddenly loses a lot of weight. (See chapter 7.)
2. About twenty-five pounds. (See chapter 2.)
3. The office cup. The African robusta beans found in grocery stores can contain up to twice as much caffeine as the more expensive arabica beans found in specialty coffee shops. Plus you can add as much coffee as you want. (See chapter 2.)

4. True! (See chapter 3.)
5. Amphetamine, which was originally synthesized as a derivative of ephedrine, the active ingredient of the Chinese herbal drug mahuang. (See chapter 12.)
6. Ketamine, otherwise known as Special K (not the cereal!). (See chapter 4.)
7. Chemical solvents such as toluene, benzene, propane, and those found in glue and paint. More than 12 percent of eighth graders have used such inhalants. (See chapter 6.)
8. Valium and other drugs of its class. (See chapter 10.)
9. Nicotine, heroin, marijuana (actually, there is little evidence that marijuana is addictive). (See chapter 7.)
10. Someone probably slipped a sedative into your drink, like a roofie (Rohypnol) or GHB (gamma-hydroxybutyrate), also known as Easy Lay. These drugs can be fatal, so seeking medical attention is wise. (See chapter 10.)
11. The movie shows a heroin overdose being treated by an injection of adrenaline into the heart, which is useless and dangerous. The opioid-blocking drug naloxone reverses heroin overdose after injection by more conventional routes. (See chapter 9.)
12. The main character in the movie is overcome with diarrhea after coming down off heroin. Because heroin causes constipation, once it's eliminated from the body just the opposite effect kicks in. (See chapter 9.)
13. Alcohol. Many deaths each year are caused by alcohol overdose. There is little danger of LSD overdose unless it is combined with or contaminated by other drugs. (See chapter 1.)
14. Wrong. Alcohol might make you sleepy at first, but its by-products can cause sleeplessness, so after a night of drinking you might fall asleep quickly but wake up in the middle of the night feeling agitated. (See chapter 1.)
15. Anything you take with the intention of changing how your body acts is a drug. Any drug that comes from a plant is herbal. This includes nicotine, ephedrine, and cocaine. "Herbal remedies" are completely unreg-

- ulated and the amount and purity of what you buy is unknown. (See chapter 5.)
16. For the speed with which the drug gets into the bloodstream and into the brain. The faster it gets to the brain, the better the "rush." This faster delivery also means a greater chance of overdose because the amount of drug can reach fatal levels before the user can do anything about it. (See chapter 13.)
 17. Marijuana is used by far more people than any other illegal drug: 77 percent of all illegal drug users use marijuana, and almost 5 percent of the population used marijuana in the last month. (See chapter 7.)
 18. Yes. There is enough nicotine in a cigarette to make a small child or animal very sick, or even to kill one. (See chapter 8.)
 19. Probably not, but it does interfere with learning and memory. (See chapter 7.)
 20. It is unlikely that a single drink kills brain cells, but long-term chronic drinking can cause permanent memory loss and definite brain damage. (See chapter 1.)
 21. No. Studies have shown that even very moderate drinking during pregnancy can permanently hinder a child's ability to learn and to concentrate. (See chapter 1.)
 22. Not really. People who stop drinking coffee may experience mild withdrawal that includes drowsiness, headaches, and lethargy, but people very rarely engage in the compulsive, repetitive pattern of drinking coffee that typifies use of addictive substances. Addiction is not defined simply by the presence of withdrawal. (See chapter 2.)
 23. Not necessarily. In fact, the most common problems that crack babies experience are the same as those experienced by children of women who smoke cigarettes: low birth weight and the associated health risks, and subtle developmental delays in childhood. Cocaine can cause very severe problems, including premature separation of the placenta from the uterus, premature birth, and intrauterine stroke, but these are rare. (See chapter 12.)
 24. Ecstasy (MDMA). Studies show dramatic damage to nerves containing the neurotransmitter serotonin that is irreversible at doses approximating those consumed by humans. (See chapter 3.)