



"Essential reading for all who seek rational marijuana policies."

—ERIC SCHLOSSER, author of *Reefer Madness*

MARIJUANA LEGALIZATION

WHAT EVERYONE NEEDS TO KNOW

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WHAT IS MARIJUANA AND WHAT WOULD IT MEAN TO LEGALIZE IT?

What is marijuana legalization?

Marijuana is the most commonly used illegal drug in the world; various forms of the drug have been used for thousands of years for their medicinal, social, and aesthetic effects.

International treaties and the laws of almost every country forbid growing, selling, and possessing marijuana. That makes lawbreakers out of more than 125 million people who have used marijuana in the past year, and those who supply them. It creates illicit markets with a total value in the tens of billions of dollars per year. Some of that illicit activity leads to violence and to the corruption of public officials. Millions of users each year are arrested for possessing the drug, and smaller but substantial numbers of traffickers go to prison.

The question of legalization concerns whether to change the laws to make it legal to produce, sell, and possess marijuana, and, if so, what rules should apply.

Full legalization would replace black market production and distribution with an aboveboard industry. There could still be rules and regulations, just as there are rules and regulations governing production and distribution of alcohol and automobiles and avocados. But the bulk of the trade would be populated by farmers and merchants and retail clerks, not by criminals.

There are many ways to liberalize marijuana policy short of full legalization. Use could be allowed but production and sale still forbidden. Use and sale of small quantities could be allowed but production and wholesale distribution still forbidden; that's the current policy in the Netherlands. The penalties for possession of small amounts could be reduced and treated as civil rather than criminal matters (an option called "decriminalization"). Production, sale, and use could be permitted only for medical purposes. Or they could be restricted to noncommercial channels, with users growing their own or forming cooperatives.

Likewise, legalization could be accompanied by more or fewer restrictions on sale and use. Alcohol may be sold only to adults and only by licensed sellers, while caffeine—in the form of coffee or cola drinks—is sold without restriction. Thinking about marijuana legalization, then, involves an exercise in policy design. Repealing current laws is simple in concept; figuring out what might replace those laws is more complex.

For most drugs in most countries at most times, legalization is a political non-starter. That is not the case for marijuana, especially in the United States. A recent poll reports that half of all Americans support legalization, and California's legalization initiative (Proposition 19) came fairly close to passing in 2010. Petitions are circulating in other states for ballot measures to allow commercial marijuana production for nonmedical use. The odds of such an initiative passing in at least one state over the next decade seem to be no worse than even.

What is marijuana?

"Marijuana" is the American term for the dried flowers and leaves of the plant *Cannabis sativa*. The flowers contain concentrated amounts of mind-altering chemicals known as "cannabinoids"; the leaves that have become the symbol of marijuana contain lesser quantities of the same chemicals. "Hashish" is

made by extracting the cannabinoid-rich trichomes—tiny hair-like structures produced by the plant. Different plants produce different amounts and mixtures of cannabinoids; these vary with the genetics of the plant, with growing practices, and even with the timing of the harvest.

Most of the rest of the world refers to marijuana as “herbal cannabis” and hashish as “cannabis resin,” with “cannabis” being a catchall term that includes both products. Scientific papers mostly use the same language. However, this book generally employs the vocabulary more familiar in the United States, using “marijuana” except when referring specifically to other forms of the drug or to the plant itself.

How does it feel to get high?

The sensation of being under the influence of marijuana varies based on the type and quantity consumed, the person and his or her purposes in using, and the social circumstances—what the late Harvard psychiatrist Norman Zinberg described as “drug, set, and setting.”

Since sellers have a strong interest in understanding the viewpoint of consumers, advertising themes can offer insight into what products are “about.” Purely illegal products aren’t generally advertised, but hundreds of retail dispensaries supply marijuana products to the hundreds of thousands of California residents with doctors’ letters “recommending” marijuana to them for (at least purportedly) medical use. Dispensary advertisements reflect the sellers’ beliefs about the range of experiences marijuana users are seeking. One website describes the popular Purple Kush as “soothing & relaxing” and “great for sleep, pain, stress, & nausea.” Sour Diesel, on the other hand, is said to provide “an uplifting & visual experience” that is “great for mood & appetite.” There is also Dutch Crunch, which is claimed to have “mood enhancing qualities” and to encourage “clear-thinking and productivity.”

Science has little to say about the feelings generated by marijuana intoxication and about how those feelings compare with the feelings generated by other drugs. The marijuana experience is complex; while most drugs taken for other-than-medical use can be classified either as central-nervous-system (CNS) stimulants (such as caffeine, cocaine, amphetamines, and MDMA) or as CNS depressants (such as alcohol and the opioid pain relievers including morphine, oxycodone, and heroin), marijuana is neither a stimulant nor a depressant. While most psychoactive drugs used for pleasure influence one or more of three sets of nerve receptors—those for dopamine, serotonin, or GABA—the chemicals in cannabis react with a pair of receptor systems (CB1 and CB2) unique to them and to a naturally occurring neurotransmitter called anandamide (from the Sanskrit word for “bliss”).

The effects of those interactions are multiple and oddly assorted: focusing attention on sensory experience, impairing short-term memory and the “executive function” in ways that interfere with absorbing complex information and managing divided attention (an effect which, for some, might boost creativity), enhancing appetite, and making users more receptive to humor. Especially with low-potency varieties, naive users may not experience the desired subjective effect until they have “learned to get high.” The effects are not always pleasant: at high doses, users can experience intense anxiety and panic attacks. (The positive and negative effects of marijuana are discussed in chapters 5, 6, and 7.)

What are the active ingredients in marijuana?

Until recently, most discussion about the effects of marijuana focused on a single chemical: delta-9-tetrahydrocannabinol, better known as THC. THC is the main psychoactive ingredient in marijuana, and the one most responsible for its intoxicating effects.

THC is just one of more than sixty cannabinoids found in marijuana. Different parts of the plant, plants of different genetic strains, and plants grown under different conditions contain different mixes of these chemicals.

The effects of the other cannabinoids are less well understood than those of THC. They do not produce a high in the absence of THC, but they interact with THC to affect its impact in a variety of ways: enhancing or attenuating it, speeding up or slowing down its onset, and influencing how long the effect lasts.

One compound drawing increasing attention from both scientists and medical marijuana providers is cannabidiol (CBD). CBD is not intoxicating—CBD alone doesn't produce a high—but some claim it may calm the anxiety sometimes produced by high doses of THC. It may even have antipsychotic activity. Some research suggests that marijuana with a better balance between CBD and THC is less risky than the high-THC, low-CBD strains that now dominate the upper end of the marijuana market. A recent RAND study by James Burgdorf and his colleagues shows both great variation in ratios and a strong trend toward more THC and less CBD over time in samples seized in California.

But most marijuana users—even those who know what CBD is—cannot detect its presence or absence in the material they use, and few sellers—even the dispensaries selling marijuana for medical purposes—have their products tested and labeled by chemical content. Learning more about the effects of this ratio and how it varies from one form of marijuana to another could improve knowledge of the mental health and public health consequences of marijuana consumption.

The change in thinking about the roles of THC and CBD suggests that more surprises may be in store as scientists learn about the roles of some of the other compounds in marijuana. Research in this area remains in its infancy.

What are sinsemilla, "commercial-grade" marijuana, hashish, and hash oil?

Potency, measured by THC concentration, varies greatly depending on the plant's genetics, how it is grown, which parts of the plant are used, and how it is prepared. Because of these differences, both participants in the market and enforcement agencies distinguish among different forms of cannabis products. More potent products, as measured by higher THC content, tend to cost more.

The stalks and stems of the plant have almost no psychoactive content; the leaves have some, the flowers ("buds" or "flowering tops") still more, and the tiny hair-like trichomes on the flowers the most of all. Consequently, marijuana that contains large proportions of stems and leaves is less valuable than marijuana consisting mostly of the flowering tops.

Cannabis plants are either males producing pollen, or females, capturing pollen and producing seed. Female plants produce a sticky resin that traps grains of pollen from the air. Marijuana growers have learned that unpollinated females keep producing more and more resin, thus increasing the cannabinoid content of the product. Flowers that are never pollinated never produce seed; therefore the high-potency marijuana produced by keeping females unpollinated is seedless: in Spanish, *sin semilla*. "Sinsemilla" typically runs between 10 percent and 18 percent THC, or about three times the level of the conventional "commercial-grade" marijuana that comes from pollinated plants.

Hashish, made by pressing together the resinous trichomes, can exceed 40 percent THC. Produced mostly in Asia and North Africa and popular in Europe, hashish has a special mystique, connected with its use by Baudelaire and other nineteenth-century French bohemians. Some users claim it has qualitatively different effects from sinsemilla, perhaps due either to the sheer concentration of THC or to the higher

CBD content of the North African hashish usually used in Europe.

The very potent product called "hash oil" is produced from marijuana by chemical extraction; it has nothing in common with hashish save the name and its high potency. Its use is not widespread, but it is available in some medical marijuana dispensaries in the United States.

What is "ditchweed"?

"Ditchweed" is at the other end of the potency spectrum. As the name implies, it is typified by wild weeds growing on the sides of roads. The average THC content of ditchweed is below 1 percent, giving it little value as an illicit drug. Although there is no active market for ditchweed, eradication of uncultivated plants accounts for an overwhelming share of domestic cannabis eradication by U.S. law enforcement, simply because weeds are easier to find than carefully concealed growing operations. This illustrates how misleading statistics on marijuana can be: eradicating hundreds of tons of ditchweed has no practical impact on drug use.

Has marijuana been getting more potent?

Yes, by quite a bit, though not nearly as much as some government and media accounts would suggest.

The potency of any cannabis product depends on its concentration of cannabinoids, and in particular THC. By that measure, potency is much higher today than it was in the 1960s, when marijuana first found a mass market in the United States. Much less is known about changes in the levels of other cannabinoids, but CBD content seems to have fallen as THC content has risen.

Selective breeding and better growing methods (e.g., indoor hydroponic gardening) now make it possible to produce far

more potent marijuana than most of what was used on college campuses in the 1960s. Also, much of the marijuana sold in the 1960s and 1970s consisted of a mixture of the stems and leaves, with only an occasional flowering top. So the growth in potency results not only from advances in cannabis agronomy but also from changes in market practices.

Over just the past fifteen years, potency levels measured in U.S. seizures have more than doubled. That is mostly because sinsemilla accounts for a much greater proportion of the analyzed seizures than in the past. But even if we look at potency for sinsemilla and commercial-grade marijuana separately, average THC levels within each category have increased by about 50 percent.

The United Kingdom has also recorded potency increases in herbal cannabis, as have the Netherlands and Italy. But measuring changes in potency, both within and across countries, is fraught with methodological problems. Most potency estimates are based on seizures, which may not be representative of what is consumed.

Overall, the claim made in drug-prevention programs that “this is not your grandfather’s marijuana”—with its implication that baby boomers who recall using the drug safely should not be complacent about its use by their grandchildren—has a solid basis. However, reports of super-powerful samples (THC levels greater than 25 percent) describe outliers. These samples exist, but they’re hardly typical, even of sinsemilla.

Is higher potency bad?

While there’s some dispute over how much potency has increased, there’s even greater dispute over how much it matters.

In purely commercial terms, higher-potency marijuana is more valuable because a user needs less of it to attain any desired high. A user trying to minimize cost per hour of intoxication should be willing to pay about twice as much for

marijuana that is twice as potent, and there does seem to be a price gradient based on potency, though other factors also influence price. But if more potent pot just meant that users smoked half as much, the main result would be a beneficial one: less throat irritation, and perhaps less lung damage, from smoking. (Another benefit for users is that higher-potency marijuana reduces the amount of time it takes to get high, which reduces the probability of getting caught.)

But there are three reasons to worry that more potent pot tends to lead to higher highs, and a greater incidence of bad effects such as panic attacks.

First, marijuana users, especially those without experience, may have no reliable way of judging the potency of the material they consume. A user who smokes a "joint" weighing a half gram will clearly get higher if that joint is 15 percent THC than if it is 5 percent THC.

Even users who don't smoke a fixed amount of material, but try to "titrate"—smoking enough to get the desired effect and then stopping—may find it more difficult with higher-potency marijuana simply because each individual puff contains such a large dose of intoxicant: it's easier to take about ten "hits" than it is to take precisely three.

Second, the intensity of the subjective "high" is determined by the rate of change of the blood concentration of the drug as well as by the maximum level attained. Smoking high-potency pot compresses the time over which cannabinoids enter the brain, thus generating a more intense intoxication for any given amount of chemical.

Third, as noted above, a very high ratio of the anxiety-inducing THC to the anxiety-relieving CBD may put the user at greater risk of negative side effects, and THC/CBD ratios have been rising along with THC content itself.

So there's reason to think not only that pot has gotten more potent but that more potent pot—especially if it also has high ratios of THC to CBD—could be more dangerous. *

The changing age-pattern of use constitutes a separate source of concern. The college students who experimented with marijuana in the 1960s were about five years older than the typical person initiating marijuana today, and earlier ages of initiation are associated with much greater likelihood of dependence and other problems.

How long does intoxication last?

The duration of the high depends on the potency of the drug, how much is used, how and in what environment it is used, and the user's history of marijuana use.

When marijuana is consumed in cigarettes ("joints"), less than half of the THC is inhaled and absorbed by the lungs; the rest is burned up in the smoking process or lost to the atmosphere. The THC enters the bloodstream and begins to reach the brain within seconds, but it takes longer for the concentration to build up; effects are typically perceived within a minute or two and peak after several minutes more.

Ingesting marijuana orally (e.g., eating marijuana-laced brownies) is less efficient: a smaller fraction of the THC ends up in the user's bloodstream. This fraction varies with what else is in the user's digestive system; the "bioavailability" of the active agents is much greater if marijuana products are consumed on an empty stomach. Compared to smoking, the effects of eating take longer to be felt, typically half an hour to two hours after ingestion. Both variable bioavailability and delayed onset undermine efforts to adjust the dosage level to get to some target high. That leads some users to eat more in the belief that the original dose wasn't strong enough, and this can cause problems. The effects of orally ingested marijuana also tend to last longer than smoked marijuana, because of slow absorption by the stomach. While a smoker who feels "too high" can stop smoking with the assurance of not getting much higher, a marijuana eater who starts to feel anxious still has to

deal with whatever chemicals remain in the gut on their way to the bloodstream.

How long can marijuana use be detected?

Employers and criminal-justice agencies use chemical tests—primarily urine tests—to detect the use of banned drugs. For heavy users, marijuana remains detectable longer than most other psychoactive substances.

The body's fatty tissues store both some of the THC itself, and some of the metabolic by-products generated when the liver breaks THC down. Over time, the fat cells rerelease those chemicals into the bloodstream, though generally too slowly to have much subjective effect. Thus marijuana can be detectable in a user's system well after the high has abated, and there is no simple relationship between the amount of THC metabolite detectable in a user's urine and time since consumption. How long the chemical traces remain in the body depends on many factors, most notably the user's metabolic rate and the amount and frequency of marijuana use.

This variation makes marijuana testing a messy business. Most users will have detectable levels of THC in their urine within about thirty minutes of use. First-timers and infrequent users could expect to test positive for days after use, depending on how much they consume. Frequent users will typically have a much longer "detection window," because THC metabolites accumulate more quickly than they can be eliminated, and are released slowly. As a result, a frequent user could continue to test positive for weeks after he or she stops using.

Hair testing extends the detection window to months, and does so for many illicit drugs, not for marijuana alone. But hair testing—more complicated, more expensive, and slower to produce an answer—is much less common than urine testing.

Is medical marijuana the same as illegal marijuana?

Yes and no. It's the same plant, and it has the same chemicals in it; the molecules don't know whether they're legal or illegal, or why they're being used. In principle, medical users are taking a drug recommended by a physician to help some ailment, rather than trying to get intoxicated; in practice, that distinction tends to blur, especially in California. Some medical marijuana dispensaries, but not all, are more careful about what they sell than the typical illegal dealer: they test the material for pesticides, fungus, and mold, and sometimes label it for its content of the various active agents. High-potency marijuana and hashish seem to account for a larger share of dispensary sales than they do of strictly illegal sales.

There are also conventional, government-approved pharmaceuticals derived from marijuana. Synthetic THC in capsule form is an approved drug under the trade name Marinol. Sativex is roughly a 50/50 mixture of THC and CBD extracted from cannabis plants, prepared to be taken under the tongue, and sold legally as a medicine in some countries (but not yet in the United States). Unlike suppliers of either purely illegal or medical marijuana, the manufacturers of Sativex have standardized their product so that each dose has the same chemical composition.

What is synthetic marijuana (Spice or K2)?

Spice and K2—sometimes called “herbal incense”—are names of products that contain plant material mixed with synthetic chemicals whose effects are similar to those of cannabinoids. These drugs purportedly deliver a stronger high than natural marijuana—as reflected in the name “K2,” which refers to the world's second-highest mountain. But their principal appeal is that they exploit a legal and chemical loophole. The U.S. Controlled Substances Act, and similar legislation elsewhere,

outlaws the products of a specific plant (cannabis). It is possible to invent and synthesize similar chemicals that do not appear in the plant; these "designer drugs" thereby skirt the law. The Drug Enforcement Administration invoked its emergency authority to add (temporarily) five of these chemicals to the list of prohibited drugs, thus closing that legal loophole with respect to those specific chemicals, though not yet for similar compounds. The ban is likely to be made permanent, and could be augmented for new synthetics as they arise.

But in another way the chemical loophole will remain open for months or years. Synthetic marijuana is not included in most standard drug test panels. While a number of laboratories now are offering tests to detect the synthetics, most employers and criminal-justice agencies don't employ them yet. Moreover, the synthetics seem to be less fat-soluble and therefore will offer a shorter detection window. Thus some users are likely to continue to prefer the synthetics, despite their possibly greater health risks.

Additional Reading

Decorte, Tom, Gary Potter, and Martin Bouchard. *World Wide Weed: Global Trends in Cannabis Cultivation and Its Control*.

DuPont, Robert L., and Carl S. Selavka. "Testing to Identify Recent Drug Use."

Iversen, Leslie L. *The Science of Marijuana*.

Pollan, Michael. *The Botany of Desire*.

"Here is a book by four leading experts who collaborate in answering questions about marijuana and its possible legalization. Everything you might want to ask, answered crisply and accurately! And the four authors give, at the end, their separate recommendations: they differ, but they've agreed on 149 answers. A remarkable collaboration, and a pioneering format worth emulating."

—**THOMAS SCHELLING**, Nobel Laureate in Economic Sciences

Should marijuana be legalized? Opinion couldn't be more evenly divided; about 50 percent of Americans say "yes." But what does "legalization" mean? Making it legal to use marijuana? Grow it? Sell it? Advertise it? If sales are legal, under what regulations? And with what taxes? Different forms of legalization might have very different results.

Marijuana Legalization: What Everyone Needs to Know provides readers with a non-partisan primer covering everything from the risks and benefits of using marijuana to the current laws, to the open scientific questions. The authors discuss the likely costs and benefits of legalization at the state and national levels and explore the "middle ground" of policy options between prohibition and commercialized production. The book also considers the personal impact of marijuana legalization on parents, heavy users, medical users, employers, and even drug traffickers.



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