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978-1-108-73573-5 — From Bud to Brain: A Psychiatrist's View of Marijuana

Timmen L. Cermak

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Timmen L. Cermak, MD

Private Practice of Psychiatry and Addiction Psychiatry, California



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To Laird

Who challenged his younger brother's opinions
to be based on more than mere opinion

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Foreword

From Bud to Brain: A Psychiatrist's View of Marijuana, by Timmen Cermak, represents a major contribution in the struggle to improve clinicians' and the general public's understanding of the science of marijuana and the brain's natural cannabinoid chemistry. Beginning with the assertion that the effects of marijuana cannot be understood without understanding the basic neuroscience of our endogenous cannabinoid system (ECS), Cermak reviews the fascinating history of advances in cannabis research, explaining each discovery in clear narrative language physicians, nurses, psychologists, therapists, and counselors can use with their patients. The well documented, objective, and up-to-date scientific information he reviews provides the foundation needed to understand the acute and ongoing impacts of marijuana use on the brain and mind, as well as the potential medical uses of cannabis products. While he documents the relative safety of marijuana for most adults, Cermak also focuses attention on potential risks for specific populations: adolescents, those exposed prenatally, and those at increased genetic risk of schizophrenia. Clinical vignettes, a clear explanation of motivational interviewing, and the author's personal therapeutic approach richly illustrate how science can be effectively integrated into patient education.

This book is important for two reasons. First, the process of discovering the relationships between plant and human physiology is truly an amazing story! Tracing the threads of research tying laboratories around the globe into a tapestry of competition and cooperation, exploration and discovery, makes as good reading as any detective story. Second, the book does an outstanding job of identifying the important practical implications of these research findings. The normal gap between bench and practice – between research findings and therapeutic application – has been widened in the case of cannabis to an absolute gulf by ideologic bias and misinformation. *From Bud to Brain* goes a long way to bridge this gulf.

People tend to get information about cannabis largely from personal experiences, friends, Internet websites, biased media reports, and marijuana product marketing. Unfortunately this means that the public, and even most clinicians, remain unaware of the deep body of research that is available. The author states, “This is not because the public lacks curiosity about the topic. Rather, the general lack of scientific literacy about marijuana stems from the “Googlization” of information [providing facts without context], the failure of clinicians to have objective and useful answers to patients' questions about marijuana, the superior power of stories to persuade more than facts, and scientists' difficulty translating their vast body of information about marijuana into an intriguing, easily understood narrative”. *From Bud to Brain* is what we have needed to provide access to the fascinating topic of marijuana, the brain, and the mind.

The scientific research on cannabis has been robust and continuous since the 1960s. The psychoactive cannabinoid of *Cannabis sativa* and *indica*, delta-9-tetrahydrocannabinol (THC), was first isolated and described by Dr. Raphael Mechoulam in 1964. Following this seminal discovery, the human type 1 cannabinoid receptor (CB1R) was identified, isolated, and cloned. Other components of the ECS were soon identified, including two endogenous cannabinoids, anandamide (AEA) and 2-arachidonoylglycerol (2-AG), as well

as the type 2 cannabinoid receptor (CB2R) and specific enzymes that synthesize and degrade the endogenous cannabinoids. An entire neurotransmitter system exists based on chemistry similar to that found in marijuana.

Over 100 cannabinoid molecules have been identified in the cannabis plant. Three well studied cannabinoid molecules are CBG (cannabigerol – the plant’s precursor for both of the more well-known cannabinoids), THC (delta-9-tetrahydrocannabinol – marijuana’s most psychoactive cannabinoid), and CBD (cannabidiol). None of these plant-based cannabinoids – CBG, THC, or CBD – naturally occur in the human body. They should more aptly be referred to as phytocannabinoids (plant-based) to be distinguished from the unique “cannabinoid” molecules found in the ECS. Although not natural to the brain, phytocannabinoids can interact and affect human biology through the ECS by mimicking anandamide and 2-AG.

From the momentum of basic cannabis research came preclinical and clinical data to study the efficacy of cannabinoid-based medicines in the treatment of pain, anxiety, addiction, metabolic disorders, and a host of other health conditions. Preclinical and clinical data also documented potential harms associated with cannabis use, in particular the long-term use of THC. It is in this area, perhaps the least understood, that Cermak’s book comprehensively and compellingly reviews the science of marijuana and the brain.

Exactly how THC impacts the brain to produce marijuana’s characteristic “high” and what parts of the brain are impacted remained a mystery for nearly two decades after its structure was known. As scientific research unraveled this mystery, many important questions began being answered. Are there impacts that last longer than the period of acute intoxication, or that accumulate over time? How does marijuana use, especially heavy or early onset use, affect behavior, cognition, emotions, and personality? Can marijuana be addictive? And how does marijuana benefit a seemingly unconnected variety of illnesses?

From Bud to Brain is a clearly and engagingly written resource with a focus on helping clinicians and educators engage a variety of patients, from recreational users to heavy users, adolescents, worried parents, and those interested in marijuana’s potential medical benefits, in meaningful conversation. Dr Cermak’s extensive clinical experience caring for patients with cannabis-related concerns, his knowledge of scientific research, and his numerous publications on marijuana policy reform make him the perfect individual to advance a comprehensive, evidence-based perspective on marijuana with pragmatic value for clinicians. His work makes a very timely contribution as rapidly changing marijuana policies around the globe desperately need guidance and data-informed direction. I believe it will be a trusted resource for anyone seeking an increased understanding of marijuana, *from bud to brain*.

Mark Stanford, PhD

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Acknowledgments

No book is written alone, though one set of fingers may be all that touch the keyboard. This is especially true of one as reliant on reporting the research narrative as I have done. I am entirely indebted to the countless researchers and their generally anonymous assistants and technicians for the scientific story they have forged for all of us.

My personal brush with research was during a neurophysiology postdoctoral fellowship under Dr. Karl Pribram, one of the fastest thinkers I have met. I quickly discovered that I lacked the patience to repeat experiments sufficient times to be statistically meaningful, preferring instead to be an explorer of scientific literature. I remain grateful for being introduced to amygdala research at his hands, despite the fact that we were handicapped by not yet knowing of the existence of the endocannabinoid system and its integral role in this small area of the brain.

Clinical training with the diverse clinical faculty at Stanford University Department of Psychiatry helped maintain a career long openness to a pragmatic approach to what works best in differing clinical situations. I am especially indebted to Dr. Stephanie Brown for introducing me to the field of addiction and training me in the integration of psychotherapeutic principles into the real world needs of patients transitioning from various levels of dysfunction to effective, principled lives. Her focus on the lifelong impact of growing up with an alcoholic parent proved personally useful at a profound level.

My colleagues at the California Society of Addiction Medicine encouraged, nurtured, and I hope benefited from my interest in cannabinoid research. First among these is Dr. Peter Banyas, a constant since medical school and an exquisite observer of the underlying power dynamics of political and administrative systems. His rigor as a partner in writing advocacy positions has made a significant contribution to their success. I also owe a debt of gratitude to my colleagues on the Youth Work Group of California's Blue Ribbon Commission on Marijuana Policy Reform convened by Gavin Newsom before he became California Governor. Their assistance made my work as chair easy and rewarding.

Turning even a good idea into an actual book requires many skills this author does not have. The Path to Publishing program at my local independent bookstore – Book Passage – supplied the help I needed, including Pamala Livingstone, Alices Acheson, Candace Thurman, and Elaine Petrocelli. Elsa Dixon provided excellent consultation regarding my book proposal and approaches to publishers. Mary Osborne worked tirelessly to create graphic designs that I could comprehend with my limited vision. Lighthouse of the Blind-SF provided invaluable support as my retinitis pigmentosa worsened and slowed progress with the manuscript.

Two readers throughout the development of this book, Mark Stanford and my wife Mary Cermak, offered encouragement and let me know when I had lost, muddled, or tangled the thread of my narrative. I owe incalculable gratitude to Mary not only for being the best editor I have had but also for supporting and tolerating my mind's absorption in writing – a singular and compulsory activity involving struggles, frustrations, and triumphs dominating my interior along the way. Along with a close knit group

of friends – Colleen, Robert, Cynthia, Dennis, and Jan – we made it through to the end together.

I cannot praise enough the professionalism and personal relationships offered by the staff at Cambridge University Press, including Jessica Papworth, Charlotte King, Catherine Barnes, Anna Whiting, and my copy-editor Juliet Wilberforce. Their guidance through the project was always clear, their responses to questions quick, and their willingness to include my concerns in a mutual process was deeply appreciated. Any mistakes contained in this manuscript, however, are mine alone.

I write to a variety of music, depending on the time of day, my mood, and level of energy. It would feel neglectful not to express appreciation as well to my muses: Beethoven, John Kaewe's slack key guitar, The Rolling Stones, Bob Dylan, Hans Zimmer, Bob Marley, and Pink Floyd.

My patients have informed critical portions of this work. I thank you all for granting me the privilege of witnessing and hopefully guiding your struggles. I pray I have reflected your varied experiences accurately and respectfully.

Introduction

Most people get information about marijuana from friends, the Internet, popular news-casts, and personal experience – all echo chambers filled with anecdotes, opinions, exaggerations, and a smattering of facts. This is not because the public lacks curiosity about the topic. Rather, the general lack of scientific literacy about marijuana stems from the “Googlization” of information, the failure of clinicians to have objective and useful answers to patients’ questions about marijuana, the superior power of stories to persuade more than facts, and scientists’ difficulty translating their vast body of information about marijuana into an intriguing, easily understood narrative. Googlization encourages people to seek specific answers to specific questions without requiring familiarity with the deeper background context. People no longer need to study a field of information in order to discover individual facts that satisfy their immediate curiosity. And, of course, Google is designed to gather and present information that comports with each individual’s interests. Marijuana advocates are directed toward one set of website “facts” while opponents are presented another set of cherry picked “facts,” which leads to different silos of information reinforcing already fixed perspectives.

Unfortunately, while science is the most logical arbiter of fact, far too little of the fascinating and detailed discoveries about marijuana and the brain have filtered down into the public’s awareness. Research has answered many of the questions continuing to puzzle the general public but its findings often remain locked away in journal articles that are too dense and literally unavailable to help most people. At the same time, the delay of information transfer commonly seen from “bench to practice” has left most health professionals less equipped than one might hope to interpret the science for their patients. (Although many clinicians have abandoned the word “patient” in favor of the more egalitarian term “client,” I still prefer “patient” because its Latin meaning of “one who suffers” is an ongoing reminder to empathize with the pain that each person brings to their clinician.) Most health professionals received little or no education about marijuana during their formal training, though more than a few have personal experience with the effects of inhaling. Only 9% of medical schools teach students anything about the medical use of marijuana.¹ Once in practice, however, nearly every health professional is confronted with questions from patients about the impact of using marijuana recreationally and/or its potential medical benefits. Despite knowing far more about heart failure or depression than their patients, professionals too often have no more information to offer about marijuana than what can be read on the Internet.

I sympathize with the demands on hard working clinicians – physicians, nurses, psychologists, psychotherapists, social workers, counselors, and educators. Much is expected of them, with too little time provided for continuing their education. At the same time, I believe the public needs to be able to rely on health professionals for objective and relevant advice about the safe and effective use of marijuana. *From Bud to Brain: A Psychiatrist’s View of Marijuana* provides information that health professionals, and the general public, need to know about marijuana and outlines a science-based approach to the therapeutic technique called motivational interviewing to effectively communicate this information to a variety of patients, from adult

recreational and medicinal users to those who use marijuana excessively, adolescents, their worried parents, and political leaders. I have found that each subpopulation can usually be engaged in useful conversation about marijuana if approached empathically and provided scientific information in common language that is relevant to their individual concerns.

In a 2015 *JAMA Psychiatry* Editorial a senior investigator at the National Institute on Alcohol Abuse and Alcoholism, David Goldman, asked, “In the cannabis debate, does the science of consequences and addictive liability matter?”² Faced with the raucous and opinionated quality of “debate” about marijuana, it is easy to understand how he might legitimately wonder about the utility of science to help the public navigate toward rational policies and personal answers about its use. Goldman authoritatively answers that “Studies of humans and animals strongly indicate that cannabis changes the structure and function of the brain, and the propensity to cannabis addiction is heritable . . .” His authority to advance science into its proper position in the debate is not merely eminence-based. More importantly, his authority is *evidence*-based in a special way; it derives from deep familiarity with the hard-fought path taken by scientists to gather the evidence. His words embody the scientific narrative.

Section 1, *The Science of Marijuana and the Brain*, summarizes the vast amount of scientific information that is now available about marijuana, how it impacts the brain, and thus the mind, and the basis for its potential medical uses. More detail is provided than what most clinicians will ever share with patients because the foundation of a clinician’s authority depends on the depth of her or his understanding of the scientific narrative about marijuana. With the investment of only a few hours of effort, health professionals can master the core scientific discoveries, grasp how the layered patterns of discovery by different disciplines reinforce each other, and learn how to integrate basic science into motivational interviewing’s ability to engage patients. Armed with scientific facts and a framework for reducing people’s attachment to anecdotes and resistance to discomfiting facts, it is easier to communicate the information people need to make informed decisions about whether to use marijuana, or not, and how to determine if they are using it safely. People need this information NOW, but are not sure where to turn for reliable, objective advice. After reading *From Bud to Brain*, clinicians will have the means to guide people toward healthy choices.

The need is huge. A startling 67 million adults in the U.S. (28%) can buy recreational marijuana legally with the number likely to increase to 37% by the time of publication. And over 200 million – 62% of the U.S. population, in 33 states – have legal access to marijuana for medical purposes. The United Kingdom (UK) National Health Service was authorized to prescribe medical cannabis in November 2018 although access remains limited. Canada legalized the medical use of marijuana in 2001 and in 2018 legalized recreational marijuana for ~30 million citizens aged 18 and older, making it the second country, after Uruguay, to adopt such a nationwide policy. In Australia, 35% of the population aged 14 and older (6.9 million) have used cannabis at least once, with 10.4% (2.1 million) having used in the last 12 months.³ Australia legalized medicinal cannabis at the federal level in 2016. The European Monitoring Centre for Drugs and Drug Addiction (EMCDDA)⁴ reported in 2018 that 11.5% of the UK population between 16 and 34 years old (>16 million) used cannabis in the previous year. The need for accurate, digestible information is indeed huge.

I first became curious about how marijuana works as a result of personal experience in the late 1960s, but never expected to see its mysteries solved. Despite training in psychiatry and two years of a postdoctoral fellowship in neurophysiology at Stanford University, I was still left with nothing better to explain marijuana's power than mystical theories that amounted to little more than pixie dust. As I began practicing addiction medicine, my curiosity about how marijuana changes brain function remained unsatisfied. This was in contrast to what had happened with opiates. Scientists had begun unlocking the mystery of opium, heroin, and morphine in the mid-1960s with the discovery of opiate receptors, and then of the brain's natural opiate chemistry (endorphins) in 1975. Regarding marijuana, however, I was left listening to hundreds, and eventually thousands, of people talk about their experience with no explanation to offer for how ingesting small amounts of the cannabis plant did so much more to their mental world than ingesting parsley, sage, rosemary, or thyme. Of course, we all knew the mantra that delta-9-tetrahydrocannabinol (THC) is the primary psychoactive ingredient in marijuana. But the meaning of this fancy chemical name was opaque, since no one knew what THC actually did once it got into the brain.

Fortunately, scientists around the world were also wondering about how marijuana works and they had the right tools to unravel the puzzle. I first learned that research was gradually revealing the answers I wanted when the late Billy Martin (the Abe Lincolnesque chair of Virginia Commonwealth University School of Medicine's Department of Pharmacology and Toxicology) spoke at a California Society of Addiction Medicine conference in 1997. In a review of the previous decade's research, Martin not only provided pieces of the puzzle I lacked, but also fit them together into an overall picture. The science of marijuana had advanced much further than I had dreamed possible – much, much further. Researchers not only knew by then how marijuana worked, but they had also discovered an extensive neural system permeating the brain that uses the same basic cannabinoid chemistry found in marijuana. I have closely followed the research literature ever since and have become convinced that the brain's natural cannabinoid chemistry is one of the most important and fascinating neuroscience discoveries in the last three decades. At the same time, we have only begun to understand the role played by our endogenous cannabinoids in regulating the rest of our brain chemistry.

Understanding how marijuana creates its psychoactive effects, as well as many of its medicinal uses, requires understanding the brain's natural cannabinoid chemistry – for, as I tell patients, the magic is in the brain, not in the weed. Marijuana produces its characteristic “high” by increasing the activity of our own endogenous cannabinoid neural system. Understanding this requires a radical shift in perspective – from the bud to the brain itself. Health professions have a unique opportunity to shift people's thinking from whether marijuana is safe to what their own unique brains can tolerate. As a result of making this shift, I once heard the quarterback of a high school football team I was addressing yell out to his teammates that they had better not smoke pot the day before a game because he did not want their brains dulled when they needed to protect him from getting blindsided by a massive defender intent on slamming him to the ground. (More about this in later chapters.)

Although any understanding of marijuana must begin with understanding our brain's own internal cannabinoid system, the discovery of our natural cannabinoids began with

trying to understand marijuana. Because scientific facts are best understood by knowing how they were discovered, I begin Section 1, The Science of Marijuana and the Brain, with the fascinating story of how researchers discovered our brain's natural cannabinoid system (Chapter 1) and then explain how marijuana interacts with this extensive system to produce its characteristic high (Chapter 2) and potential side effects (Chapters 3 through 9). Section 2, The Science and Art of Healing, next explains how basic science makes sense of the potential medical benefits offered by marijuana (Chapter 10) and explores how to use science to engage people in the treatment of side effects stemming from overuse (Chapters 11 through 13). Section 3, The History and Art of Marijuana Policy, reviews the often racially tinged laws and enforcement governing marijuana in the U.S. and the current post-War on Drugs liberalization, with emphasis on legalization taking place for 40 million people in the state of California (Chapters 14 and 15). An Epilogue speculates on the future of marijuana and introduces intriguing new questions about the function served by our endocannabinoid system's direct connection to the brain's reward mechanism (Chapter 16). Throughout the book I hope to communicate my fascination with the challenges of scientific research and the thrill of discovery. Brain research, like space travel, goes boldly into one of the last frontiers to be explored. No frontier is as personal as our own brain.

Marijuana and Cannabis

The proper name for this book, if it intended to serve academics rather than working clinicians and the general public, would be *A Psychiatrist's View of Cannabis*. I chose to speak of "marijuana" instead because this emphasizes the popular parlance. While there is a gradual shift to the more generic term "cannabis," most people still ask questions about "marijuana." Readers will find multiple examples through the text of descriptions of biology (e.g., receptor sites, synapses, etc.) in plain, nontechnical language. Rather than take offense at my simplifying concepts, I invite health professionals to view these descriptions as models of the images and metaphors that have helped me communicate sophisticated scientific concepts to patients with a wide range of scientific literacy. In the end, little information is effectively communicated without curiosity on the part of the recipient and my descriptions are designed to evoke curiosity wherever possible. There is no substitute for enthusiasm on your part for awakening interest in others.

At the same time, the perceived authority of health professionals often rests, especially for regular marijuana users and adolescents, on their understanding the range of cannabis products capable of delivering psychoactive experience, nuances of differing marijuana strains and the history of marijuana. The Brazilian researcher Antonio Zuardi offers an elegant introductory description of the cannabis plant: "In the tip of secreting hairs located mainly on female-plant flowers and, in a smaller amount, in the leaves . . . there are resin glands that have a considerable amount of chemically related active compounds, called cannabinoids."⁵ Marijuana is the dried buds from those strains that produce enough cannabinoid containing resin to be psychoactive when consumed by humans. Just as different trees produce the best wood for building houses or the best nuts for food, different cannabis strains produce fibers more useful for industry or flower buds better suited to be ingested for recreation and medication. Marijuana should therefore be seen as only one of many products that come from different strains of the cannabis plant.

Cannabis sativa and *Cannabis indica* are the two strains that have been cultivated and carefully hybridized to produce buds with high concentrations of psychoactive compounds in order to produce the most potent marijuana possible. Other strains of cannabis have been cultivated to produce strong fibers containing virtually no mind-altering chemicals. In this way, cannabis is similar to another flowering plant – the poppy. California poppies harmlessly turn hillsides brilliant orange, while other poppies – especially those in Afghanistan – produce the raw material for opium and heroin. One variety can be bought in any nursery, but the other is illegal.

Industrial hemp comes from a variety of *Cannabis sativa* lacking psychoactive properties. Archeologists have found examples of fibers spun from hemp 10,000 years ago. Over the millennia, hemp has been used to produce a variety of commercial items including paper, textiles, clothing, biodegradable plastics, paint, insulation, biofuel, and animal feed. Hemp fiber provided ropes and canvas (derived from the word “cannabis”) on ships circling the globe during centuries of exploration and migration.

My curiosity is focused only on those strains of cannabis that have been bred for high levels of biological activity. Written history since 5000 BC is replete with descriptions of marijuana’s power to treat illness and “change the texture of our . . . experience,”⁶ from Chinese emperors extolling its virtues to Napoleon’s soldiers starting a craze in Paris after bringing marijuana and hashish (concentrated cannabis oil) back from their military campaign in Egypt circa 1800. The last 40 years have seen the largest increase in marijuana’s potency in history, most often measured by its percentage of THC. Dedicated horticulturists in Amsterdam and Northern California cross-pollinated the strongest cannabis strains to produce competitively more powerful hybrids. Improved growing techniques, including hydroponics and specialized indoor lighting, have also increased potency. Sinsemilla (Spanish for “without seeds”), for example, is marijuana harvested from female plants grown isolated from male plants. Males are only useful for pollinating females to produce seeds. They contribute none of the effects of marijuana that people commonly seek because male plants contain few of the psychoactive chemicals found in the flower buds produced by females. The highest THC marijuana at the 2015 Cannabis Cup in Denver, named “Emperor Cookie Dough,” averaged 29% THC. Hashish is the resin concentrated from marijuana and contains up to 65% THC, while newer forms of extracting and solidifying marijuana’s essential oils, variously called dabs, shatter, wax, and budder, produce concentrations of THC up to 90%. These new methods, which can easily be found on the Internet, use dangerous volatile chemicals such as butane in the extraction process. Serious explosions have occurred.

People often refer to today’s more potent marijuana as a “different” drug than the 3% THC pot of the 1960s. The “difference” is only a matter of greater concentration of the same drug, similar to the difference between beer and hard liquor. The alcohol molecule is the same in both, but tequila will get you drunker, and faster, than Budweiser because it contains a higher concentration of alcohol molecules. Similarly, the cannabinoid molecules in Emperor Cookie Dough are exactly the same as in earlier, weaker marijuana. Unlike alcoholic beverages, however, marijuana contains far more than just one chemical. Over 100 cannabinoid molecules have been identified in marijuana, as well as nonpsychoactive volatile hydrocarbon oils called terpenes that give marijuana its characteristic smell. (Terpenes unique to the oil from pine trees is distilled into turpentine.)

Three cannabinoid molecules that have been well studied are cannabigerol (CBG) – the plant’s precursor for both of the next two more well known cannabinoids, delta-9-tetrahydrocannabinol (THC) – marijuana’s most psychoactive cannabinoid, and cannabidiol (CBD) – possessing only mild psychoactive properties and very complex, still only partially understood modes of action. None of these plant-based cannabinoids – CBG, THC, or CBD – naturally occur in the human body. They should more properly be referred to as phytocannabinoids (plant-based) to be distinguished from the unique “cannabinoid” molecules described in the next chapter that are produced in animals. The ability of some phytocannabinoids to interact with human physiology is probably a coincidence. The phytocannabinoids in marijuana evolved for the cannabis plant’s unique, and still to be determined survival needs. On the other hand, as Michael Pollan details in *Botany of Desire*, the attraction marijuana has for some people has led to the cannabis plant’s sudden evolutionary boost in production of its essential oils, similar to how the Dutch infatuation for tulips in the early 1600s led to a sudden increase in varieties of color.

The simple fact is that THC, the other phytocannabinoids, and terpene molecules are foreign to the human body. That does not, in and of itself, make the molecules bad or destructive. But it did create the central mystery of how THC interacts with our brain – a mystery that persisted for nearly two decades after the structure of THC was known. *Exactly* how does THC impact our brain to produce the experience of being high? And what part of the brain is impacted? Beyond this, other questions abound. Are there impacts that last longer than the period of acute intoxication, or accumulate over time? How does marijuana use, especially heavy or early onset use, affect our behavior, cognition, emotions, and personality? And how does marijuana benefit a seemingly unconnected variety of illnesses? None of these fascinating questions will ever be answered by studying only the botany of cannabis or the chemistry of marijuana. The answers lie within the realm of neuroscience.

The expanding availability of legal marijuana (and the rapid shift toward high THC extracts) for both recreational and medicinal use increases the public’s need to be well informed about how this plant affects the brain. Nothing illustrates confusion about marijuana more than the fact that, while the U.S. Food and Drug Administration (FDA) classifies marijuana along with heroin and LSD as a Schedule I drug having high abuse potential, no medical use, and severe safety concerns while approving pharmaceutical preparations of both THC and CBD, and while a recent Attorney General strongly opposed all marijuana use because “Good people do not use marijuana,”⁷ at the same time Congress prohibits the Justice Department from spending funds to interfere with the implementation of state medical marijuana laws.⁸ It is clearly time to bring a better understanding of the neuroscience underlying marijuana’s power into the town square of public discussion. Physicians, psychologists, nurses, psychotherapists, and counselors can play a major role in educating the public by bringing the latest science of marijuana into their medical and mental health practices. Preparing to fill this role begins with learning not only the scientific facts about marijuana but also how these basic facts were established. The next chapter tells the story of how marijuana researchers discovered our natural cannabinoid neural system.

Clinical vignettes appearing at the end of chapters are composite sketches of patients I have treated, with names changed and all identifying information deleted.

The intent is to illustrate how I have learned to integrate evidence-based scientific information into a motivational interviewing approach. These vignettes are set apart from the main text in order to permit readers to focus on, or skip over, them as fits individual interests.

Notes

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7. C. Ingraham. Trump's pick for attorney general: 'Good people don't smoke marijuana'. *The Washington Post*. November 14, 2016. www.washingtonpost.com/news/wonk/wp/2016/11/18/trumps-pick-for-attorney-general-good-people-dont-smoke-marijuana/?utm_term=.919f194b719d. (Accessed March 14, 2019.)
8. The Rohrabacher–Farr Amendment prohibiting the Justice Department from spending funds to interfere with the implementation of state medical cannabis has been passed annually since 2014.

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