

"This book should be required reading for all medical professionals, elected officials, and everyone interested in health and wellness."

—Andrew Weil, M.D., author of *Spontaneous Healing*

MARIJUANA GATEWAY TO HEALTH

HOW CANNABIS PROTECTS US FROM
CANCER AND ALZHEIMER'S DISEASE

CLINT
WERNER



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“Clint Werner’s book, *Marijuana Gateway To Health* is packed with scientific revelations about cannabis—a real eye opener and a must read. It is refreshing to see the truth!”

—Brad Lane, Executive Producer, Cannabis Planet TV

“The compilation of scientific studies in this book is just superb. I can’t wait to see how *Marijuana Gateway To Health* changes the world as we know it”

—Angela Fairless, LaRoach.com

“Clint Werner’s *Marijuana: Gateway to Health* sets a new milestone in the understanding of marijuana as medicine. This book is a masterpiece—clearly written, well documented, and it pushes back against the ill-conceived propaganda against these useful plants. Any skeptic is well advised to read this book before voicing an opinion. I highly recommend this book!”

—Paul Stamets, author *Growing Gourmet and Medicinal Mushrooms*
and *Mycellium Running*

“*Marijuana: Gateway to Health* is a refreshingly readable book that engages the reader from page one. Werner brings to life the story of how marijuana’s medical benefits have been discovered, covering all the bases and putting clinical studies into their proper, broader perspective. A terrific book with heart and soul.”

—Ellen Komp, editor *The Emperor Wears No Clothes*

“Clint Werner demonstrates numerous qualities of medicinal cannabis with well-documented research and dispels myth after myth. *Marijuana Gateway to Health* delves into everything from Alzheimer’s to the War on Drugs with important details on monumental discoveries about the endocannabinoid system and how it can prevent disease and pain. If you want to know about medical marijuana today, this is the best source of information. I keep my copy on my desk!”

—Jorge Cervantes, author *Marijuana Horticulture*, photographer

“*Marijuana Gateway to Health* blends a clear and concise overview of the science supporting cannabis as medicine with an engaging account of the politics of prohibition that still keeps it from patients. Werner shows just how cruel and counterproductive federal marijuana policy is. This book should be required reading for all medical professionals, elected officials, and everyone interested in health and wellness.”

—Andrew Weil, M.D. author
Spontaneous Healing and Spontaneous Laughter

“*Marijuana Gateway to Health* documents important and hitherto under-reported scientific discoveries and developments concerning the endocannabinoid system and how it influences health and wellness.”

—Morris Schambelan, MD, Professor Emeritus of Medicine
University of California San Francisco

CANNABIDIOL: THE OTHER SIDE OF THE HIGH

CANNABIS IS AN AMAZINGLY VERSATILE plant. It produces a huge number of unique compounds that work against the stress and inflammation that are at the root of many diseases. Due to its mind-altering and therapeutic qualities, tetrahydrocannabinol (THC) is the superstar of the phytocannabinoid family. Apart from THC, however, the *Cannabis sativa* plant produces more than 75 other phytocannabinoids that have not been found in any other plant. Although none of these other cannabinoids have the psychoactive properties of THC, many of them appear to have powerful effects on other parts of the body. Among the non-psychotropic phytocannabinoids, cannabidiol (CBD) has received the most attention.

Part of what makes CBD such an interesting cannabinoid is that, unlike THC and other cannabinoids, it does not produce its action by binding to an endogenous receptor (see Chapter 1). While some other cannabinoids affect cells by attaching to specific receptor sites, thereby promoting or inhibiting their activity, CBD acts indirectly on those receptors. It is more of a modulating agent. For example, CBD increases the amount of the endocannabinoid anandamide present in the body by slowing its degradation, thereby increasing its overall activity. It also works by steering THC away from the CB1 receptors, therefore reducing its psychoactivity. Like other cannabinoids, CBD does not work as well alone. For example, GW Pharmaceuticals, a British drug manufacturer, is currently manufacturing and testing a medicine derived from the cannabis plant that is composed of nearly equal parts THC and CBD.

They believe that CBD can reduce certain undesirable side-effects of THC (such as disorientation, drowsiness, and accelerated heart rate), while producing several of its own desirable effects (such as pain relief, nausea relief, and cancer protection).⁷³

Raphael Mechoulam, the Israeli scientist famous for isolating the THC molecule, has been studying CBD since he first charted its chemical structure in 1962. Among the diseases that he believes it can effectively treat are diabetes, rheumatoid arthritis, epilepsy, and myocardial infarction (heart attack). Now, as researchers further investigate the structure and functions of this newly-appreciated compound, they are identifying even more of its positive effects on health. There is a growing body of evidence that CBD could help prevent the onset of diabetes in those vulnerable to the disease. Researchers working with Mechoulam, for example, found that CBD “ameliorates the manifestations of the disease” in mice with latent or early diabetes.⁷⁴ They found that while more than 86 percent of those mice who were not treated with CBD were diagnosed with diabetes, only 32 percent of those given CBD got the disease. This effect appeared to be due to CBD’s ability to simultaneously reduce the amount of inflammation-causing compounds and to increase the amount of anti-inflammatory compounds in the mice.⁷⁵ Further research in this area has found that CBD protects the health of diabetic patients’ hearts. An international research group found that CBD helped to reduce some negative cardiac symptoms and therefore concluded that “it may have great therapeutic potential in the treatment of diabetic complications, and perhaps other cardiovascular disorders...”⁷⁶ CBD also has the highest potency of all non-psychoactive cannabinoids against cancer of the breast, prostate, colon, and stomach in humans, as well as brain cancer and leukemia in rats.⁷⁷ According to Mechoulam and others, “the plethora of positive pharmacological effects observed with CBD makes this compound a highly attractive therapeutic entity.”⁷⁸

In addition to holding promise for preventing diabetes, CBD might also work to treat one of the worst aspects of the illness in those already afflicted. One of the few American studies of CBD led one investigator, Gregory Liou, M.D., to proclaim that CBD helps prevent diabetic retinopathy, which occurs when diabetes damages the blood vessels in the eye.⁷⁹ Diabetic retinopathy is the leading cause of blindness in adults and affects almost 16 million Americans. Despite its complete lack of

psychoactivity, CBD is illegal to use and difficult to research because it comes from the same plant as THC.

The failure of researchers to follow up on a Brazilian study on CBD's strong anti-epileptic properties, for example, recently prompted Raphael Mechoulam to decry the lack of progress in developing CBD-based medicines. "[I]t seemed a very promising approach, but unfortunately, nothing has been done ever since. To the best of my knowledge, nobody has done any work with cannabidiol in the clinic with epilepsy, and I just wonder why."⁸⁰ It is a question well worth asking. By preventing the development of effective medicines, is prohibition robbing us of our birthright of health and happiness?

Despite scientists' recognition that CBD is a nontoxic and highly effective antagonist of breast cancer cells, this cannabinoid is still forbidden.⁸¹ Against all the evidence, CBD is still classified by the federal government as a dangerous drug with no medical application. In fact, our government is so committed to the continued criminalization of cannabis that it actively works to prevent research that might show its benefits. NIDA-funded researcher Theodore Sarafian, Ph.D., admitted that research showing the effectiveness of cannabis against cancer actually makes it harder to do follow-up studies. "Funding becomes much tougher to get when we show that there isn't much harm."⁸²

One of the main problems with marijuana prohibition is that it makes it difficult or impossible for researchers to legally obtain cannabis rich in CBD. It is only in the last 15 years that we have begun to understand the value of CBD—before then, few even knew it existed. CBD and THC compete for space in the chemical composition of cannabis, meaning that the more THC a plant contains, the less CBD it contains, and vice versa. Prohibition creates a large black market of marijuana cultivators, and since it is THC that produces the high that recreational users seek out, most plants are selectively bred to produce optimum levels of THC. Greater THC potency means using and transporting smaller amounts of the illegal plant, consequently the percentage of THC in illegally-grown marijuana has risen while CBD levels have declined. In fact, marijuana prohibition makes all varieties and preparations of the cannabis plant more difficult and more expensive to obtain.

Despite the charges of drug warriors that California's medical marijuana laws are merely a back door for legalization, activists and

patients are teaming up with talented researchers and respected physicians to move the state to the forefront of therapeutic cannabis research and development. If, as the opposition often claims, medical marijuana is just an excuse to get high, there would be no interest in producing strains of cannabis with high concentrations of CBD. The truth, however, is just the opposite: The legitimization of medical marijuana in California has encouraged the revival of CBD-rich cannabis strains.

In Northern California, a group of scholarly activists who understand the healing potential of cannabidiol have launched Project CBD, a “not-for-profit educational service dedicated to promoting and publicizing research into the unique medical properties of Cannabidiol (CBD) and other components of the cannabis plant.”⁸³ The goals of Project CBD include monitoring the progress of efforts to reintroduce CBD-rich cannabis strains and providing updates for patients on the supply of CBD-rich strains at specific medical marijuana dispensaries. The project also distributes a survey on CBD strains to patients, doctors, and dispensaries, which is intended to gather information about which strains have the most effective levels of CBD for treating specific disorders.

Steep Hill Lab, which occupies a nondescript one-story building on the outskirts of Oakland, California, is an independently-run testing facility for marijuana products. The lab has the tools to analyze samples for potency, chemical composition, and contamination from mold or pesticides, and has been recruited by Project CBD in order to identify cannabis strains that are rich in CBD. The lab began testing marijuana samples for CBD in early 2009, and as of mid-2010 it had identified twelve strains rich in CBD out of 9,000 samples. Eight of these strains are now being cultivated for distribution by dispensaries (unfortunately, four of the strains were lost due to the failure of growers to conserve and reproduce the source plants).

So far, the most CBD-rich strain found by the lab is “True Blueberry x OG Kush,” which when grown indoors under artificial conditions contains approximately 10 percent cannabidiol and 6-7 percent THC (when grown outdoors under natural sunlight, the CBD level increases to around 14 percent). The grower is now working to produce genetically-stable seeds of this valuable strain. Another strain, called “Women’s Collective Stinky Purple,” was tested at 9.7 percent CBD and

1.2 percent THC. This strain has such a small amount of THC it is essentially non-psychoactive. The lab also analyzed a strain from dispensaries in Southern California known as “Pineapple Thai,” which contains 5 percent CBD and 2.4 percent THC, as well as several other varieties containing around 8 percent CBD and varying low levels of THC.

Here are some of the strains identified as having significant amounts of CBD:

CBD to THC Ratio		
	CBD %	THC %
True Blueberry x OG Kush	10	7
Harlequin	8	5
Soma A-plus	5	5
Cannatonic	6	6
Cotton Candy Diesel	6	6
Women's Collective Stinky Purple	9.7	1.2
Jamaica Lion	8.9	5.6–6.5
Pineapple Thai	5	2.4
Good Medicine	9	8.2
Full Spectrum True Blueberry x OG Kush	14	6
Omrita Rx3	10	5.5
Bubble Gum Kush	5.8	4.1
Good Medicine	9	8
Sour Tsunami	10.1	6.7
Kushage	6.98	2.92
Wu#1	6.34	3.57
Phnom Penh	7.5	2.3

Dr. Jeffrey Hergenrater, President of the Society of Cannabis Clinicians, has an illuminating perspective on what patients' demand for CBD-rich marijuana means. “I am seeing many older patients who would like to try cannabis for pain, muscle spasms, insomnia, and management of various cancers. One thing that most of these cannabis-naïve patients are not interested in is ‘getting high.’ My hope is that

CBD-rich strains will enable them to use cannabis and get its benefit without—or with less of—the usual ‘high.’”⁸⁴ The rising demand for marijuana rich in CBD should silence those who still claim that the medical marijuana movement is only about getting high.

Apart from CBD, other non-psychoactive phytocannabinoids include cannabinol (CBN), cannabichromene (CBC), cannabigerol (CBG), tetrahydrocannabivarin (THCV), tetrahydrocannabinolic acid (THCA), cannabidiolic acid (CBDA), and cannabidivarin (CBDV). Like THC and CBD, these compounds have a broad array of protective effects on health. These include reducing inflammation, pain, and infection; protecting against seizures and spasms; encouraging bone growth; and (once again) helping prevent the spread of cancer. In addition to these compounds, the cannabis plant also generates many other unique phytochemicals which reduce inflammation, inhibit tumor formation, and help prevent the damage caused by inhaling smoke.

Although many people think it is possible to judge the quality of marijuana by smelling it, cannabinoids are in fact odorless. It is therefore entirely possible to have a strain with a powerful scent yet little potency. The enormous range of scents and flavors found in marijuana actually depends on the presence of certain kinds of phytochemicals known as terpenoids. Unlike cannabinoids, most terpenoids are not unique to the cannabis plant. That is why there are varieties of marijuana that smell like lemons, pine pitch, lavender, mint, guava, or fermented grapefruit. These other plants generate many of the same terpenoids that the cannabis plant does.

A large percentage of the essential oil found in cannabis is comprised of these terpenoids; so far 120 have been identified in the plant. Most of what we know about the terpenoid profile of cannabis comes from research intended to train drug detection dogs to locate marijuana and hashish. All varieties of the cannabis plant contain the terpenoid b-caryophyllene-epoxide, and since this chemical is rare in other plant species this is what the hounds are trained to detect. Law enforcement officials also use the widely varying terpenoid composition of seized cannabis products to help identify the product’s point of origin. As researchers learn more about terpenoids in an effort to increase the effectiveness of law enforcement efforts, they also learn more about the positive health effects of the terpenoids found in cannabis. This is

yet another example of research driven by the War on Drugs resulting in a serendipitous discovery about a health-guarding component of marijuana.

Thankfully, there are no restrictions on researching terpenoids since they are found in numerous plants besides cannabis. As a result, we know that the various terpenoids produced by cannabis have an impressive array of beneficial biological effects. Some of these effects are similar to the anti-carcinogenic, anti-inflammatory actions of cannabinoids and may be jointly responsible for making marijuana such a beneficial substance. Like THC and CBD, these plant compounds help protect against cancer both by slowing it down and by helping to prevent it in the first place.⁸⁵ Limonene, for example, which has a strong citrus odor, is a terpenoid commonly found in cannabis oil that has a strong anti-depressant effect due to its suppression of stress hormone production. Like THC, limonene also works against cancer in a variety of ways. A review of data published in the *Journal of Nutrition* revealed that limonene helps prevent or delay breast, skin, liver, lung, and stomach cancer in rodents.⁸⁶

Some terpenoids also seem to have qualities that moderate the effects of using marijuana that some patients find undesirable. Linalool, citronellol, and α -terpinene have all been found to have both sedative and anti-depressant effects which may temper the anxiety that some people experience as a result of ingesting THC.⁸⁷ This could be one reason that so many medical marijuana patients prefer whole cannabis products to the legally available pure THC pill (dronabinol).

Some of these terpenoids work additionally to protect the body from the harmful by-products associated with smoking marijuana. Burning marijuana, like burning tobacco, produces toxic gases, known as polycyclic hydrocarbons that are linked to the development of lung and other cancers. Unlike tobacco, however, the cannabis plant also produces a generous amount of terpenoids which stimulate the production of enzymes that help detoxify those harmful compounds.⁸⁸

Some terpenoids have also been shown to increase cerebral blood flow, which could be helping THC work against Alzheimer's by allowing it to reach the brain more efficiently. Other terpenoids have antimicrobial effects, which may help protect the lungs of marijuana smokers from infections.

The following table lists several of the terpenoid compounds found in cannabis and the biological activities they possess.

Terpenoid	Known Properties
B-myrcene	Analgesic, anti-inflammatory, antibiotic, antimutagenic
B-caryophyllene	anti-inflammatory, cytoprotective, antimalarial, CB2 agonist
d-limonene	immune potentiator, antidepressant, antimutagenic
linalool	sedative, antidepressant, anxiolytic, immune potentiator
pulegone	acetylcholinesterase (AChE) inhibitor, sedative, antipyretic
1,8 cineole	AChE inhibitor, stimulant, antibiotic, antiviral, anti-inflammatory, antinociceptive
a-pinene	anti-inflammatory, bronchodilator, stimulant, antibiotic, antineoplastic, AChE inhibitor
a-terpineol	sedative, antibiotic, AChE inhibitor, antioxidant, antimalarial
terpineol-4-ol	AChE inhibitor, antibiotic
p-cymene	antibiotic, AChE inhibitor

Along with cannabinoids and terpenoids, there is another group of phytochemicals produced by the cannabis plant that is beneficial for health. Unlike cannabinoids, which are found primarily in the flowers of the plant, these chemicals, flavonoids, are distributed throughout the leaves, flowers, and stems of the plant. These compounds give cannabis its pigmentation and flavor, and also seem to protect it from pests and diseases. Some researchers believe that, like terpenoids, flavonoids may enhance the beneficial effects of cannabinoids or reduce their unwanted side-effects. Twenty-three flavonoids have been identified in cannabis, and two of these—cannaflavin A and cannaflavin B—are unique to the plant.

Like cannabinoids, flavonoids have a wide range of biological activities. For many years, flavonoids' cancer-fighting ability was believed

to result from their antioxidant effects. Scientists at Oregon State University, however, have found that the compounds actually “have little or no value in that role.”⁸⁹ Flavonoids are metabolized so efficiently by the body that they have no chance to function as antioxidants. Instead, the body identifies them as foreign substances and quickly destroys or denatures them. This denaturing process triggers the production of a cascade of other chemicals (known as Phase II enzymes), which then also work to neutralize mutagens and carcinogens. Though they do so indirectly, flavonoids seem to share cannabinoids’ ability to “induce mechanisms that help kill cancer cells and inhibit tumor invasion.”⁹⁰

Like cannabinoids, the scope of these compounds’ activity is impressive. Flavonoids may also trigger biochemical reactions that protect the heart and blood vessels from damage by reducing inflammation and blood pressure. The flavonoid apigenin, for example, binds effectively to estrogen receptors and helps slow the proliferation of breast cancer caused by the sex hormone estradiol.⁹¹ Flavonoids isolated from a Mexican strain of cannabis were also found to inhibit the formation of an enzyme linked to the development of cataracts in diabetic patients. Cannflavin A and B, the two flavonoids found only in cannabis, have been found to have 30 times more potency against rheumatoid inflammation than aspirin. Researchers have noted that flavonoid supplement pills are unnecessary, and possibly counterproductive, since it takes relatively small amounts of flavonoids to obtain their beneficial effects. We can get all the flavonoids our bodies need from eating fruits and vegetables—and ingesting cannabis. As research on these compounds advances we will undoubtedly discover other biological activities and applications.

Because terpenoids and flavonoids are volatile (that is, they vaporize easily) they can be effectively ingested by smoking marijuana plant material. Vaporization, however, may be an even better mode of delivery. The lower temperatures required for vaporization would be less likely to degrade the active chemicals in marijuana, thereby delivering larger doses of cannabinoids, terpenoids, and flavonoids to the user.

Research on the phytochemical complex produced by the cannabis plant is still in its earliest stages. Who knows which combinations of these cannabinoids, terpenoids, and flavonoids will prove most effective for treating serious ailments? If the shackles of prohibition were

removed from marijuana use and research, it would be possible to breed strains of cannabis with the most effective anti-cancer, anti-inflammatory, and neuroprotective properties. These varieties could be used for disease prevention in and of themselves, and as adjuncts to treatment for any number of illnesses from Alzheimer's disease to diabetes to various cancers. But until the laws change, we are wasting valuable time that could be spent finding ways to prevent and relieve suffering.