

The Werc Shop, Inc.
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Jeffrey C. Raber, Ph.D., President

January 27, 2014

Pennsylvania State Senate Law and Justice Committee
N. 3rd Street
Harrisburg, PA 17120

Re: Public Comment Regarding SB1182 – Compassionate Use of Medical Cannabis Act

Dear Senate Committee Members:

I would first like to commend Senators Folmer and Leach for their leadership and wisdom in crafting and subsequently introducing the Compassionate Use of Medical Cannabis Act. We look to our elected officials to help guide our society and offer the proper legal and regulatory frameworks upon which we can thrive safely in our pursuit of health and happiness. This is an increasingly difficult duty that is rapidly becoming more technically complex and the medical use of cannabis may be one of the most difficult to fully understand as it is incredibly multifaceted and mired in misinformation. I hope my perspective and technical information on the cannabis plant is useful to the committee and other elected officials within Pennsylvania.

I am originally from Pennsylvania and grew up in Lebanon County until I left in 1997 to attend graduate school in California. Like my country I love my home state and only want to see it offer the best for its communities and all of its citizens. While I now live in southern California I still have a vested interest in what transpires within Pennsylvania as my father and a number of friends currently reside in and around Lebanon. I was very fortunate to receive an excellent education by teachers that inspired me to chase my dreams and utilize my talents to the absolute best of my abilities. When I was in 5th grade I was asked to write down what I wanted to do when I grew up and when I was a senior in high school my 5th grade teacher sent the writing back to me. I wrote down that I wanted to be a scientist and wanted to work on cures for epilepsy to help the less fortunate children of the world. Cannabis now appears to hold the keys to realizing that dream, and it provides that to us in a non-psychoactive form of a molecule we call cannabidiol (CBD).

As I knew I always wanted to be scientist it wasn't too surprising that I was headed to Lebanon Valley College to major in biochemistry in 1993. At that time I couldn't decide which path was more interesting, biology or chemistry, so I decided learning more about both would be best. I couldn't be happier with that decision as it has provided me with an excellent foundation for understanding physiological conditions and the underlying molecular mechanisms that need to be considered when you aim to positively impact disease states. At Lebanon Valley College I was introduced to organic chemistry, a most fascinating topic involving manipulation of matter and the creation of new molecular entities and manufacturing methods for virtually everything around us in the world today. I decided after my sophomore year, again being inspired by an incredible educator, that I would pursue the path of being a synthetic organic chemist so that I could help make the medicines that doctors could use with their patients. Organic chemists are required to understand physical chemical properties, have a command of analytical chemistry in order to analyze what is being produced, and understand molecular reactivity in order to develop formulations and efficient synthetic pathways to new molecular entities. Not all chemists are the same and the organic chemist possess a very unique perspective on the chemical world that can be seen as multi-faceted

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and technically diverse as numerous demands can be placed on the organic chemist. Upon graduating from Lebanon Valley College I moved on to the University of Southern California (USC) to receive a Ph.D. in organic chemistry where I developed new manufacturing methods for non-natural amino acids, benzodiazepines and various heterocycles using environmentally friendly condensation reactions involving organoboronic acids, amines and carbonyl compounds. My graduate and post-graduate work at USC enriched my understanding of organic chemistry, molecular design of new pharmaceutical lead compounds and environmentally friendly manufacturing methods.

Today I possess an extremely solid and in-depth understanding of biology, chemistry and more recently added, cannabis. For the last 5 years in California I've been aiming to further our understanding of cannabis and how it may be beneficial in a medicinal sense. California passed their Compassionate Use Act in 1996 and I was simply unaware of it until the fall of 2008 when my brother, while working at a construction company, was asked to build-out a store-front dispensary in a medical facility. My first inclination was of course to be taken aback and be immediately concerned about the legalities of such activities. As good students do we went to classes about the Compassionate Use Act, a voter initiative, and the subsequent Senate Bill 420 enacted to govern the activities surrounding the initiative. I can assure you all that virtually nothing pertaining to cannabis regulations are clear in any sort of legal or regulatory sense within California. You most certainly do not want to see that type of system and activity evolve within your state. It is far better to provide clear laws, clear regulations and a tightly licensed system of carefully monitored operators providing this medication to those in need. While it wasn't exceptionally clear on how to best operate, we still felt exceptionally compelled to do so as so many people were sharing detailed accounts of how cannabis helped them with their ailments. We also saw a tremendous need to understand what molecules were responsible for these actions as well as providing public health and safety assurance through pesticide and contaminant testing, something seriously needed within California. As my literature studies on the medicinal use of cannabis began in earnest it didn't take me long to realize the molecules present in cannabis are some of the safest known to mankind today, offering an incredible efficacy to toxicity profile that is greater than even aspirin. I concluded, like many other scientists before me that this plant contained chemical constituents that would be beneficial to me in alleviating my irritable bowel and offer a more natural and safer approach to mitigating my brother's chronic pain. The medical research literature contains volumes of information on the physiological impacts caused by some of the molecules within cannabis. From a pharmaceutical perspective I pondered why do we need this plant if Marinol, a synthetic tetrahydrocannabinol (THC) preparation, was available through prescription? What I've learned repeatedly from many discussions since then is that Marinol simply doesn't work for many patients, where whole-plant cannabis does. There was obviously something missing from Marinol and that something else is what is known in the scientific community as the entourage effect, the synergistic and broader swath of physiological impact made by many chemical constituents being offered at once as opposed to a single molecular entity. This can be seen as the power of plants, and why they are known to be so effective in many indigenous areas around the world where they are still used by many to modulate their physiological well-being. In short, THC by itself is very different than THC with the rest of the plant's chemicals going along with it.

In early 2009 my brother and I were encouraged to more formally participate within the California medical cannabis system when we heard President Obama state his

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administration's new policy that individuals who benefit from the medical use of cannabis would not be actively prosecuted for such activities. We were both qualified patients who were having an exceptionally difficult time navigating the California medical cannabis landscape having come to recognize that virtually no one knew what plant they were providing, and worse yet, what other chemicals, pesticides and microbiological contaminants may be present as well. Additionally, I was desperately seeking CBD but almost no one in Southern California even knew what I was talking about when I mentioned it. We realized scientific understanding and quality control were desperately lacking and that a broader medical utility available from the cannabis plant could never be realized if there was no understanding of what varieties contained which molecules of interest. Feeling compelled to help those in our community as much as ourselves gain access to useful and clean medicinal cannabis products, and encouraged by our President's words to take steps to help ourselves and other patients, we began planning to offer laboratory testing services to the medical cannabis community. In the beginning of 2010 we had secured our capital and launched our science based company, The Werc Shop. Today we're recognized as a leading commercial laboratory having pioneered new analytical approaches to better understand the chemical constituents within cannabis and we've been published in the peer-reviewed literature for our work on understanding the potential to inhale pesticides present on cannabis. I have been invited to provide lectures at international conferences and provide information to numerous state regulators about the scientific complexities pertaining to cannabis and its distribution. Over the past 5 years, as long as it took me to receive my Ph.D. in chemistry, I've been seeking to understand cannabis chemistry and the operations and regulations surrounding its production, distribution and physiological impacts. Just as was the case in graduate school within that timeframe I've come to learn quite a bit about the topic!

A considerable part of what I've come to learn is that not all cannabis varieties are the same. Most people have heard of hemp and marijuana, and think they are two different plants but they are both cannabis. We've legally defined the same species of plants, *Cannabis sativa* L., in two different forms in an attempt to regulate the use of products or materials derived from these different varieties. The result of these definitions today now sees almost 30 other countries around the world producing hemp and hemp products while we are incarcerating an alarming rate of individuals for mere possession of even a small amount of cannabis plant material. We've most definitely not properly regulated, fully understood or properly embraced all of the opportunities the cannabis plant has to offer our society. Another major aspect we've come to understand is the power of plants and how offering a broader range of physiologically active chemical constituents at one time allows the body to re-equilibrate into a better state of ease, out of dis-ease. I still remember the words of my Lebanon Valley College biochemistry professor stating "everything wants to go to equilibrium". I understand that far better today as cannabis impacts the body's own cannabinoid system, known generally as the endocannabinoid system, which contains both molecules and receptors responsible for modulating a large number of the body's regulatory functions. When you hear cannabis can help for so many ailments it almost doesn't make sense at first, but when you consider that comes from bringing aspects of mood, sleep, pain, inflammation and more back into a more natural equilibrium, it makes a whole lot more sense! Whole-plant cannabis products offer the body the chemicals needed to activate, regulate and modulate itself back to a state of comfort and ease. You may have experienced a similar approach when a patient is first prescribed a pharmaceutical to mitigate some disease, but the side-effects are so pronounced they needed additional prescriptions to then mitigate those negative aspects. That's a much more difficult

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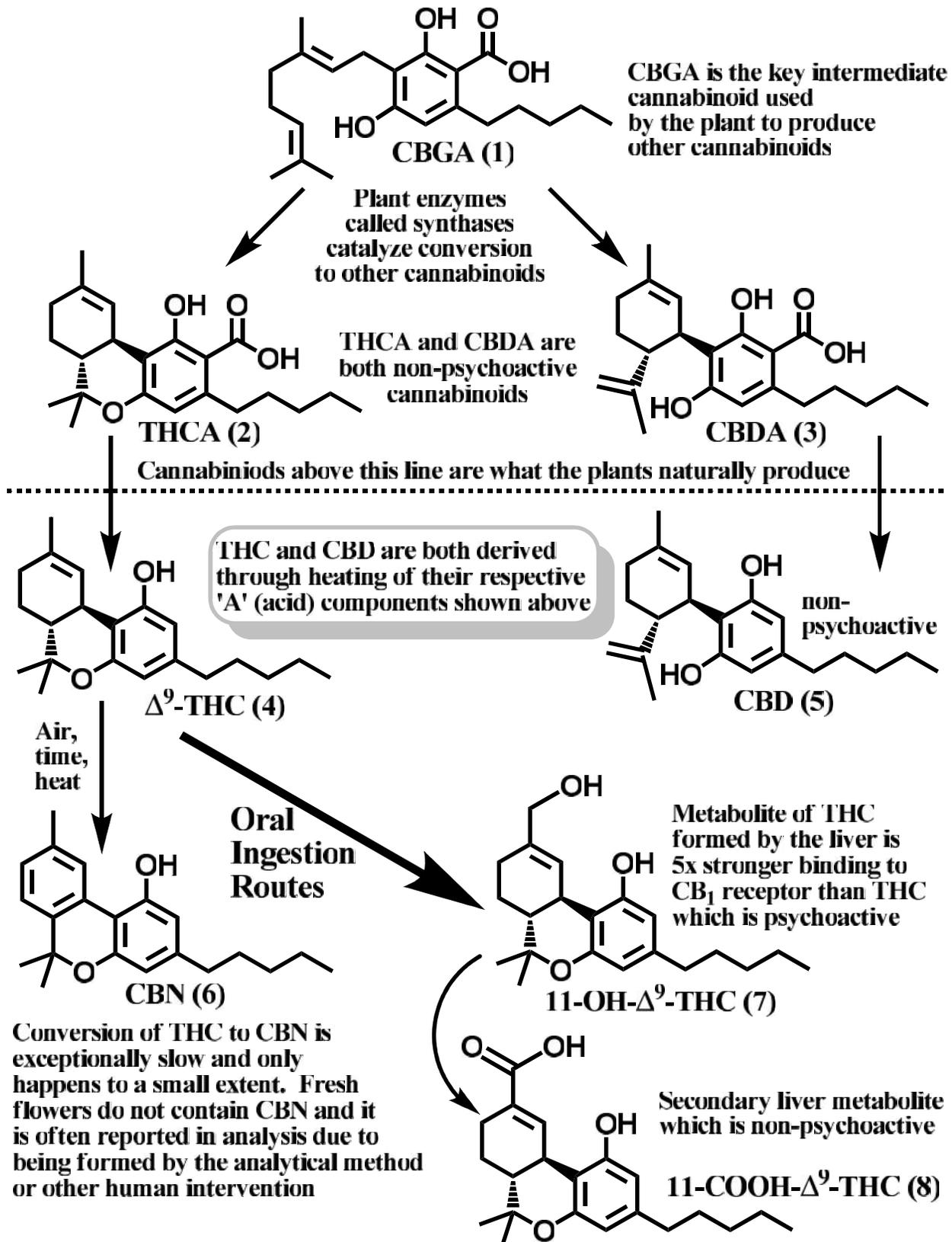
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approach to get correct in terms of establishing a new successful equilibrium within the chemical environment of the body as opposed to offering a plant-based product that inherently has those abilities. I believe we need to re-equilibrate our legislative equilibrium with cannabis as well, and offering a tightly controlled medical system is a great first step to explore.

Our analytical efforts with cannabis aimed to first understand which cannabinoids were present so that we can help plant breeders and cultivators select unique profiles in an effort to guide away from solely psychoactive uses and facilitate access to non-psychoactive varieties. We selected the analytical approach based on liquid chromatography to allow us to view all of the chemical constituents present and maximize the plant's uses as well. Our approach and information quickly sent ripples through the cannabis community as we were almost perceived as being crazy when we stated raw cannabis is not psychoactive, the plant does not produce THC directly, it in fact produces tetrahydrocannabinolic acid (THCA), which could be an exceptional anti-inflammatory and additional non-psychoactive modulator of the endocannabinoid system. THC is not made by the plant, but is only formed from heating THCA. Popularized more recently by juicing of raw cannabis, the consumption of cannabinoid acids is being found to benefit a diverse number of patient types. Fortunately we've also been able to identify and help capture plants capable of providing the non-psychoactive chemical CBD. It is important to also understand that these varieties of plants produce the acidic natural component, cannabidiolic acid (CBDA), which only upon heating provides CBD. CBD based products are finally becoming more readily available and are now beginning to make considerable positive impacts in the lives of many people. More recently Dr. Sanja Gupta informed the general public of the potential these products hold in helping children suffering from Dravet's Syndrome, an extremely debilitating form of epilepsy that can see children having hundreds of seizures a day. The right amount of CBD can virtually bring those episodes to a grinding halt. How can we not enable access to that treatment for those individuals currently suffering every day now that we know this is possible?

The following figure offers a brief overview of some of the chemicals present within cannabis and how they may be manipulated or further transformed and metabolized inside of the body after consumption.

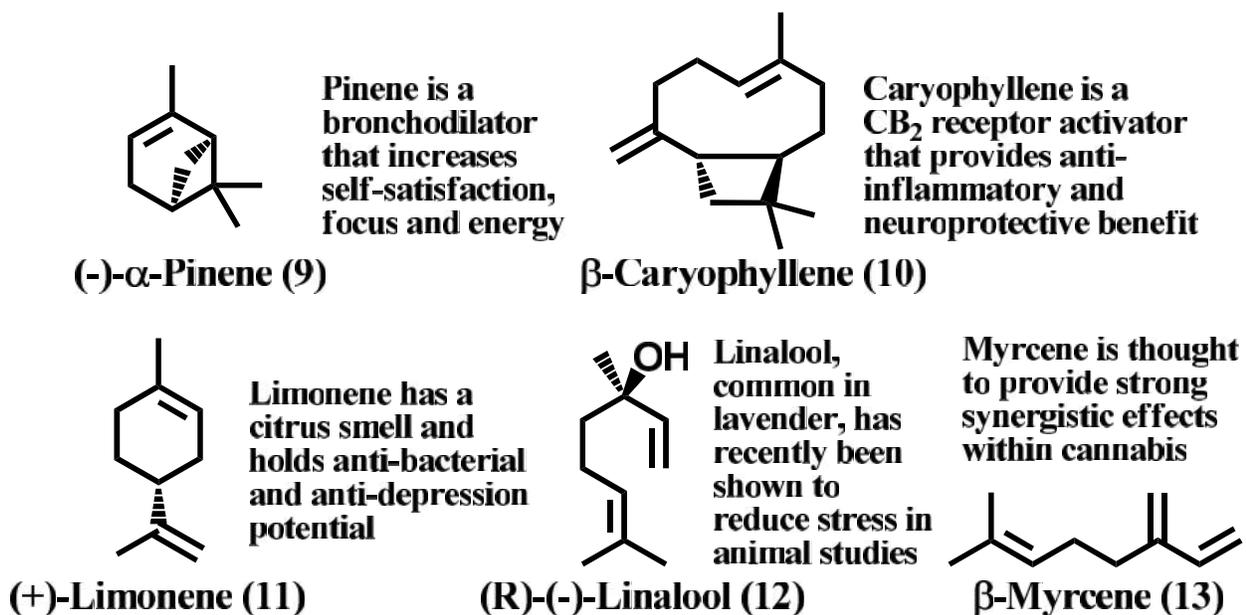
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We've come to understand much more about the cannabis plant through pioneering the first commercial assays of other plant constituents called terpenes. In 2011 we began screening for over 35 of these molecules in cannabis as we quickly learned even with the same amount of THC available from different varieties patients experience different physiological responses. For example, 12% THC available in 3 different varieties did not provide the same physiological effects when consuming the same amount of material in the same fashion. There was something else going on and we now know that terpenes play a significant role in that respect. Anyone familiar with cannabis will be able to tell you that every variety isn't all the same, from the looks to the feel, and especially to the smell. The differences in smells, and effects, are being driven by these different terpenes. Chemically speaking the term terpene represents over 20,000 different molecules which are comprised of repeating isoprene units. They are generally recognized as safe (GRAS) and some are very well known such as lycopene, pinene and even serve as the foundation of the anti-cancer compound Taxol. An incredible amount of chemical diversity and utility can be harnessed from the use of terpenes. This is certainly true within cannabis as well, as cannabis is known to be able to produce over 100 different types of terpenes. We've used our terpene profiling to help better identify which varieties may be useful to specific patients. We've also come to learn that there is rampant misnaming and misidentification of these varieties within California, as the same common plant name does not always represent the same terpene profile. I was exceptionally happy to see your Compassionate Use Act required registration of the product types and I believe that foundation should be built upon the use of terpene profiling in conjunction with cannabinoid profiling of the particular cannabis varietal.

The following figure provides a very small overview of some of the more prevalent terpenes present within cannabis.



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We are only beginning to scratch the surface of the potential that cannabis holds in terms of medicinal, food additive, textile and building material sources for our society. We've begun to learn a lot from around the world, but there is so much more we need to understand to begin to utilize this renewable resource to its fullest extent while educating about minimizing any potential negative harms that may come from its use. We can look back through history and realize humans have been consuming cannabis in a large variety of forms for thousands of years. That's an amazingly long phase IV clinical study conducted with what is most likely a huge number of different cannabis varieties. We're also aware that a significant portion of our population, including even President Obama, has consumed cannabis with no ill effects. It's pretty safe to say cannabis is safe for consumption. A major concern is what contaminants may go along with the naturally produced plant components that may prove harmful. We witness considerable contamination of plant material with pesticides and plant growth regulators in addition to microbiological contaminants such as molds and bacteria. We've also studied that up to 70% of a pesticide present on a cannabis flower could be consumed via combustion and inhalation through a typical pipe. Past studies with cannabis are considerably confounded by the fact that illicit supply chains encourage the use of pesticides and chemicals and it may in fact be these chemicals that are the cause of any ill effects being observed. A considerable number of problems and concerns we see with cannabis today are a direct result of the lack of licensed regulations around its production, processing and distribution. Drug dealers do not ask for identification nor do they care about contamination issues.

Smoking of cannabis has not been shown to increase the rates of cancer occurrence, or pulmonary distress, but may irritate the airways and may in fact not be the best mode of administration. Processing operations being formalized and regulated will allow a plethora of alternative products, not requiring inhalation methods, to be delivered to patients. Without a formalized and regulated production, processing and distribution system patients are virtually left to resort to only inhalation as the mode of ingestion. We now know there are far better modes of administration, unfortunately unregulated processing of these products has led to other contaminants, mostly residual solvents, remaining in the products. Professional methods developed by those skilled in the arts who are licensed to operate within a tight regulatory system will be able to avoid these issues and will make available to patients a broad array of non-inhalation based products. What is observed in unregulated systems is that patients in need, sometimes parents who are desperate to help their children, will have heard that maybe cannabis can help them and they will unknowingly acquire whatever they can gain access to, even if it is contaminated or containing the wrong cannabinoid profile. Unfortunately, many charlatans are currently operating within California, and they are all too happy to provide any material, sometimes at very high prices, to those in need without any oversight of quality control or possible contaminations. To me, nothing demands greater responsibility and professionalism than providing medicine to those in need, especially children. We often see the end result and need to deliver the bad news that some unknowing parent has just paid thousands of dollars for contaminated cannabis oils being marketed as a cure. It is exceptionally difficult to watch. Without a formal regulated system this will happen within all of your communities, and is most likely already happening today. There is an extremely large motivation factor called profits, which are even untaxed and untracked in a cash only non-identification checking system currently being operated on our community street corners. Needy patients and their caregivers do not need to be considered criminals, nor resort to those experiences, when you today have the ability to change how access to cannabis can

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evolve and be improved. Cannabis holds many possible medicinal uses and the medical literature is now exploding with more and more information attesting to that fact. Only in the late 1980s did we discover the first cannabinoid receptor, and in 1992 we located the first endocannabinoid anandamide. Today we know there are many different receptors of this type and a multitude of molecules made by the body to regulate these core equilibrium activities. You may have heard stories of how a consistent cannabis user can fail a urinalysis test for THC metabolites up to 30 or more days after they stop using cannabis. This is because the body holds on to these valuable compounds so that it can use them to regulate itself with them. It also enables a slow release of these compounds from the body which mitigates the potential for addiction and physical cravings. The ability to help many different people suffering from a plethora of ailments can be found through modulation and regulation of the endocannabinoid system. Those who are endocannabinoid deficient also benefit greatly from the introduction of plant based cannabinoids to help their bodies better regulate themselves.

Democracy in general is a system of utilizing smaller, local experiments to provide the necessary information required in preparing a proper federal regulatory system. Being in Pennsylvania I can't help but think Benjamin Franklin most likely had influence on that structure as he was someone who understood the value of running experiments. State's rights were preserved by our founding fathers to assure the freedom of flexibility of all of our citizens in shaping a safe democratic rule of law. We're currently a long way from where our founding fathers once stood with cannabis, not to mention where our country as a whole once stood not even that long ago when cannabis cultivation was mandatory and it was seen as a national resource. You now have a rare opportunity, with much greater information and understanding supporting you, to properly reintroduce this marvelously multifaceted and useful botanical known as cannabis to the Commonwealth of Pennsylvania. Absolutely this is a defining moment in history. I implore you to please allow people like me to come to the Commonwealth to offer professional medical cannabis products and help alleviate the unnecessary suffering of many people who could benefit from such products. The time to act is now, there are no further reasons for any delays as safe, secure and regulated models can and do exist which are helping many people across the country. The people of the great state of Pennsylvania deserve access to cannabis. I have a lot to thank Pennsylvania for and am hoping I can be proud of its current leadership that will enable me to safely re-introduce cannabis to our society and fully give back to the community that helped me grow in to the person I am today.

Sincerely,

A handwritten signature in black ink that reads 'Jeffrey Raber'. The signature is fluid and cursive, with a long horizontal stroke at the end.

Jeffrey C. Raber, Ph.D.
President
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jeff@TheWercShop.com