Title: The Forensic Identification of Marijuana: Suspicion, Moral Danger, and the Creation of Non-Psychoactive THC

Author: Aaron Roussell*

Running Head: “Marijuana Identification”

Abstract:

Federal and state laws present marijuana as a dangerous substance requiring coercive control and forbid private citizens from possessing, selling, or growing it. Possession cases brought under these laws depend on a forensic confirmation of taxonomic identity as *Cannabis sativa* to establish and successfully prosecute a case. *Hemp Industries Association v. DEA* (2003), a recent federal appeals court ruling, is at odds with this forensic process.

American citizens may legally possess and even consume a similar substance — hemp and its derivatives — which can be made into such everyday objects as clothing, rope, and food products. Yet these two plants are both *Cannabis sativa* and differ only in physical structure and degree of natural tetrahydrocannabinol (THC). Synthetic THC is also a medically prescribed substance, which introduces further confusion into the legal standing of cannabis. Finally,

*Department of Criminology, Law & Society, University of California, Irvine. Address correspondence to Aaron Roussell, Department of Criminology, Law & Society, University of California, Irvine, Social Ecology II, Irvine, CA 92697; email: roussell@uci.edu. 949-943-9860
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Aaron Roussell is a PhD candidate in the Department of Criminology, Law & Society at the University of California, Irvine. He earned his MA in Sociology at the University of Wyoming. He has published in *Crime & Delinquency* and *Criminal Justice Policy Review*. His current research interests include research methods, drugs and addiction, structural crime correlates, urban ethnography, and critical theory.
recently, the Ninth Circuit’s second *Hemp Industries* decision, *Hemp II*, affirmed the legality of “non-psychoactive” hemp, despite the fact that hemp contains small amounts of THC. This presents obvious difficulties for forensic testing.

The differences between marijuana and hemp remain largely social and legal, rather than chemical. These complications present conceptual and practical difficulties for the law, which is structured around neat, mutually exclusive categories. More practically, current forensic tests are incapable of discerning hemp from marijuana because of this legal confusion. This paper investigates the conflicting social, scientific, and legal understandings of marijuana and the potential practical implications of its legal status.

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I. Introduction

Suspected marijuana samples provide American forensic laboratories with a significant portion of their annual workload. Federal laws present marijuana as a dangerous substance requiring coercive control and forbid private citizens from possessing, selling, or growing it. If law enforcement suspects a substance is marijuana, that substance is subject to impound and forensic testing. Should a forensic science lab declare such a sample to be marijuana, the owner of the substance may be prosecuted. On the other hand, Americans may possess and even consume a similar substance — hemp and its derivatives — some of which are made into such everyday objects as clothing, rope, and food products. These two plants, in many ways, are identical, differing only in physical structure and chemical content — specifically, varying in the


3See United States v. Diaz, No. CR 05-0167 WHA, 2006 WL 3512032, at *1–3 (N.D. Cal. Dec. 6, 2006) (explaining the procedure employed by a crime lab to test for marijuana, the second most common controlled substance analyzed); see also Durose, supra note 1, at 1 (noting that “[i]n 2005 the nation’s forensic crime laboratories received evidence from an estimated 2.7 million criminal investigations,” which included requests for controlled substance identification).


5See Justin M. Holler et al., Tetrahydrocannabinol Content of Commercially Available Hemp Products, 32 J. Analytical Toxicology 428, 428 (2008) (explaining that hemp is legal to possess, but illegal to cultivate, in the United States); T. Randall Fortenbery & Michael Bennett, Opportunities for Commercial Hemp Production, 26 Rev. Agric. Economics 97, 101–02 (2004) (indicating hemp’s various uses, including food, fabric, and cordage).
amounts of tetrahydrocannabinol (THC) they contain.\(^6\) So far, no branch or level of government has yet defined acceptable limits for THC in cannabis material and appear unlikely to do so.\(^7\) In fact, the objectionable chemical is a medically prescribed substance, thus introducing confusion into the federal scheduling of marijuana under the Controlled Substances Act.\(^8\) The legal differences between marijuana and hemp thus remain largely a product of social, not chemical, differences.\(^9\) These complications present conceptual and practical difficulties for the law, which is structured around neat, mutually exclusive categories.\(^10\) Forensic testing depends mainly on the ability to detect THC and identify cannabis, which folds hemp into its purview.\(^11\)

This paper investigates conflicting understandings of marijuana as a scientific and social object, and attempts to parse the intertwined worlds of scientific and legal classification. First, I provide a basic description of the two categories of the plant and their social, physical, and

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\(^8\) See 21 C.F.R. § 1308.11(d), 1308.13(g) (2011); United States v. Turcotte, No. 06 C 5554, 2007 U.S. Dist. LEXIS 45678, at *6 (N.D. Ill. June 21, 2007) (explaining that marijuana and synthetic THC (Marinol) are listed in different drug classification schedules); ALISON MACK & JANET JOY, MARIJUANA AS MEDICINE?: THE SCIENCE BEYOND THE CONTROVERSY 8 (2001) (“[D]octors can legally prescribe THC, in the form of the medicine Marinol . . . .”).


chemical distinctions. Then, I review the published evidence regarding the forensic testing procedures, including the future potential of DNA. Next, I summarize the legal understandings of marijuana, first parsing the linguistic shifts used by Congress in the Controlled Substances Act, and then unpacking the Hemp Industries decisions. The final section overlays various academic disciplines and discusses the scientific and practical problems with regulating morality in this manner.

II. Hemp and Marijuana

Marijuana is known taxonomically as Cannabis sativa from the family Cannabinaceae (order Urticales, subclass Dicotyledons) and is a seed born (division Spermatophyta) and flowering (class Angiospermae) plant. Hemp, a plant cultivated abroad, but used domestically for its fibrous qualities, goes by an identical taxonomy. Title II of the Comprehensive Drug Abuse Prevention and Control Act of 1970 (“the Controlled Substances Act” or “CSA”) lists “Marijuana” under Schedule I, which designates it as a substance worthy of outright prohibition. “Marijuana,” in the CSA, has been understood broadly to mean the species Cannabis sativa, although this has been recently brought sharply into question through hemp and its taxonomy. Curiously, the constituent chemical element recognized as objectionable, psychoactive THC, is also a Schedule I substance and is listed separately. In sum, both

12 Hemp Indus. Ass’n v. DEA (Hemp I), 333 F.3d 1082, (9th Cir. 2003), Hemp Indus. Ass’n v. DEA (Hemp II), 357 F.3d 1012 (9th Cir. 2004).
14 See Fortenbery, supra note 5, at 98–99 (discussing the prohibition of cultivating hemp in the United States and stating that hemp and marijuana belong to the same species).
16 See Hemp II, 357 F.3d at 1013, 1017–18.
“marihuana” and THC, though listed separately in the CSA, are both Schedule I, illegal substances. Hemp, though legal to possess, is not legal to cultivate — it remains, however, nominally unscheduled under the CSA.\(^\text{18}\)

Hemp is a fibrous plant prized for its ease of cultivation and its versatility.\(^\text{19}\) Historically, the fibers that compose hemp have been important for providing paper, sail canvas, and carpet.\(^\text{20}\) Although rope and clothing continue to be made from hemp, and the fiber finds its way into such esoteric products as composite panels found in automobiles, many modern uses revolve around biofuel and alternative proteins from more traditional animal and soy sources.\(^\text{21}\) Despite this litany of uses, hemp remains illegal to cultivate in the United States.\(^\text{22}\), although it is legal to import, possess, and consume, so long as the hemp material does not allow for THC to enter the body.\(^\text{23}\)

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19 See Fortenbery, supra note 5, at 98–101 (describing the multitude of uses for hemp).


22 Monson v. DEA, 589 F.3d 952, 961–62 (8th Cir. 2009) (holding that the CSA “makes no distinctions between cannabis grown for drug use and that grown for industrial use,” and that Congress intended “to ban the growth of all varieties of the Cannabis sativa L. plant”).

Marijuana, on the other hand, is an illegal drug in the United States, normally imbibed by crushing and smoking the leaves, flowers, stems, and seeds of the marijuana plant. A description of marijuana provided by the National Institute on Drug Abuse ("NIDA") declares that marijuana "can cause distorted perceptions, impaired coordination, difficulty with thinking and problem solving, and problems with learning and memory." NIDA contends that marijuana is potentially addictive and may be linked to mental health problems ranging from anxiety and depression to schizophrenia and psychosis. The Drug Policy Alliance (DPA), perhaps the leading opponent of marijuana prohibition in the United States, counters that there is little evidence of increased marijuana dependency, more evidence that marijuana use is a result of psychological conditions than the reverse, and that there is no evidence to suggest that there are long term cognitive deficiencies caused by using marijuana.

While a marijuana plant and a hemp plant, arguably, may be distinct in their full botanical glories, "[m]ost submissions to forensic laboratories are in the form of crushed plant materials that no longer retain gross botanical features." Indeed, one study of cannabis testing

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26 Id.

27 About Us, DRUG POLICY ALLIANCE, http://www.drugpolicy.org/about-us (last visited Nov. 10, 2011); Marijuana Facts, DRUG POLICY ALLIANCE, http://www.drugpolicy.org/facts/drug-facts/marijuana-facts (last visited Nov. 10, 2011). Evaluating the extent to which these statements from DPA and NIDA conflict, or the relative "truth" content of each is not within the purview of this paper.

methods used 100 samples previously received and tested by the Royal Canadian Mounted
Police forensic labs. The samples comprised 68 marijuana “extracts,” 20 liquid and resin hashish
samples, 6 “rinses,” “washes,” or “extracts” from suspected marijuana smoking paraphernalia,
and only 1 “unidentified green material,” presumably crushed botanical material. Clearly, a
sample need not resemble marijuana, or even a plant, to undergo forensic testing — suspicion by
law enforcement is the determining factor rendering the sample suspect.

III. Marijuana and Non-Marijuana: Forensic Science Definition

Perhaps appropriately, the overlapping categories of THC and marijuana mirror the
commonly used methods of testing available to forensic science in determining botanical origin
of a suspected marijuana sample. Chemical spot testing, gas chromatography/mass
spectrometry, and thin layer chromatography attempt to determine the presence of THC, while
microscopic analysis and DNA testing attempt to determine the donor sample’s species. Lab
technicians are supposed to use various tests to reinforce one another. For example, Thornton

(1979).

30 See id. (indicating that the samples tested by the Royal Canadian Mounted Police, including the “unidentified
green material,” were not necessarily identifiable by their botanical characteristics, but were tested due to police
suspicion that the material was marijuana).

31 See Charles Tindall, Jane S.C. Tsai & John Mario, Cannabis: Methods of Forensic Analysis, in HANDBOOK OF
FORENSIC DRUG ANALYSIS 43, 43–44 (Frederick P. Smith ed., 2005) (discussing the need for both quantitative and
qualitative analysis of samples which implies the differences between botanical and toxicological identification).

32 Id. at 48–58; J.I. Thornton & G.R. Nakamura, The Identification of Marijuana, 12 J. FORENSIC SCI. SOC’Y 461,
461, 479–95(1972); Heather Miller Coyle et al., An Overview of DNA Methods for the Identification and

33 See Coutts, supra note 29, at 291; Tindall, supra note 31, at 44 (“In keeping with good laboratory practice, a
positive identification should be based on at least two positive test results from two different test
methodologies . . . ”).
and Nakamura’s widely adopted forensic testing protocol calls for microscopic examination followed by chemical spot testing.\textsuperscript{34}

Physical observation, even microscopically enhanced, presents problems familiar to the criminal justice system — simply put, it is difficult to make a positive and unique identification by observation alone.\textsuperscript{35} The microscopic analyst looks mainly for cystolithic “bear claw” hairs characteristic of \textit{Cannabis sativa} to confirm that the sample is marijuana.\textsuperscript{36} While this approach is appealing in its directness and simplicity, Nakamura, in his seminal paper on the subject, could not distinguish 82 of the 600 species of Dicotyledons that he microscopically examined from marijuana.\textsuperscript{37} Indeed, Whitehurst reports uncertainty on the exact number of relevant Dicotyledons (ranging from 31,874 to about 400,000, depending on the source consulted) in the kingdom of classified plants.\textsuperscript{38} For his part, Nakamura, an expert in marijuana identification, presents an error rate of about 14 percent for a (non-random) handpicked sample.\textsuperscript{39}

Having physically observed the sample, Thornton and Nakamura then call for a chemical “spot” test for the presence of THC, as “confirmation of marijuana” for a suspect sample. This “spot” test is known through various iterations as the Duquénois test, the Duquénois-Levin test, the rapid Duquénois test, and the meta-Duquénois test (“D-L test,” encompassingly).\textsuperscript{40} Duquénois and Negm developed the original test in 1938, and it is often performed by forensic

\textsuperscript{34}Thorton, \textit{supra} note 32, at 461; Whitehurst, \textit{supra} note 28, at 118, 128; People v. Park, 380 N.E.2d 795, 800 (Ill. 1978) (prescribing Thornton and Nakamura’s test as an acceptable procedure for the testing of cannabis).
\textsuperscript{35}See Whitehurst, \textit{supra} note 28, at 118–23; see also Park, 980 N.E.2d at 800 (explaining that physical observation must be followed by a chemical test).
\textsuperscript{36}See Nakamura, \textit{supra} note 13, at 5–8; Whitehurst, \textit{supra} note 28, at 123; Park, 980 N.E.2d at 800.
\textsuperscript{37}See Nakamura, \textit{supra} note 13, at 5.
\textsuperscript{38}Whitehurst, \textit{supra} note 28, at 126.
\textsuperscript{39}See Nakamura, \textit{supra} note 13, at 5 (asserting that 82 of the 600 species were selected for chemical testing).
\textsuperscript{40}Thornton, \textit{supra} note 32, at 461, 495; Whitehurst, \textit{supra} note 28, at 118; Keith Bailey, \textit{The Value of the Duquénois Test for Cannabis — A Survey}, 24 J. FORENSIC SCI 817, 818 (1979); Park, 980 N.E.2d at 800.
Bailey, in his summation of “some kind[s] of positive response[s]” to the D-L test, covers four hundred different sample materials (including coffee grounds, for example, which present a positive reaction the D-L test). He determines that various studies have produced 12 false positives out of 47 tested materials (about 25 percent error) in 1 rapid D-L study; 21 out of 143 (about 15 percent error) for a D-L test; 25 out of 249 (about 10 percent error) for meta-D-L; and none for 73 D-L entries. Unfortunately, Bailey does not discuss the extent of the overlap between Nakamura’s 1969 sample of 600 and the D-L test papers that he utilizes in his own meta-analysis.

As Bailey’s paper acknowledges, any form of the D-L test is interpretive by nature. Two factors — the color (“the purple of authentic marihuana”) and the progression of color over time are the only evaluative standards. Tests on various substances may yield shades of blue or red, but THC yields a particular shade of deep purple or blue, which may change over the course of an hour from indigo to violet to “intense violet.” “Nevertheless,” Bailey reminds us, “the experienced analyst can confidently decide if the similarly described colors perceived from test substances are distinguishable from those from cannabis.” Complicating things further, Thornton and Nakamura also explain that marijuana contains other variations of cannabinol than

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41 See Tindall, supra note 31, at 50; Whitehurst, supra note 28, at 118 (explaining that the method proposed by Thornton and Nakamura is favored by crime labs throughout the United States, and this method includes the D-L test); see People v. Wind, 208 N.W.2d 357, 360–61 (Wis. 1973).
42 Bailey, supra note 40, at 822, 833.
43 Id.
44 Id.
45 Id.
46 See id. at 817–18.
47 See id. at 818, 833 (explaining the progression of colors from sea-green to violet for cannabis samples).
48 Id. at 817.
just THC, as well as other cannabinoids.\textsuperscript{49} In fact, different strains of marijuana are cultivated precisely to enhance or diminish different combinations of these cannabinoids and variations of cannabinol.\textsuperscript{50} These may therefore appear in various samples in varying strengths, some of which produce different variations of purple and blue with respect to the DL test.\textsuperscript{51} Despite these realities, Thornton and Nakamura report that “there appears to be universal agreement that the final color [presumably of “authentic” THC or marijuana] is deep blue to deep violet.”\textsuperscript{52}

The methods discussed above represent the most inexpensive and therefore most widely used methods of forensic marijuana testing.\textsuperscript{53} Other methods, less common and more expensive, include gas chromatography/mass spectrometry (“GC/MS”), thin-layer chromatography (“TLC”), and DNA testing.\textsuperscript{54} Thornton and Nakamura recommend TLC when “marijuana cannot be morphologically delineated” — that is, when the results are inconclusive, rather than for the purposes of retesting a potential false positive or negative.\textsuperscript{55} GC/MS is perhaps the most reliable method of detecting THC, but it relies on complicated and expensive equipment and a greater

\textsuperscript{49}See Thornton, \textit{supra} note 32, at 477–79.

\textsuperscript{50}See Robert C. Clarke & David Paul Watson, \textit{Botany of Natural Cannabis Medicines, in Cannabis and Cannabinoids: Pharmacology, Toxicology, and Therapeutic Potential} 3, 11–12 (Franjo Grotenhermen & Ethan Russo eds., 2002) (discussing how marijuana growers employ seed selection techniques to produce plants with differing THC profiles).

\textsuperscript{51}See Thornton, \textit{supra} note 32, at 479, 481 (explaining how the range of colors produced in a D-L test might depend upon the relative proportions of the various components in the sample tested).

\textsuperscript{52}Id. at 480.

\textsuperscript{53}Carol L. O’Neal et al., \textit{Validation of Twelve Chemical Spot Tests for the Detection of Drugs of Abuse}, 109 \textit{Forensic Sci. Int’l} 189, 189–90 (stating that spot tests, including the D-L test, are widely used as the necessary reagents are inexpensive and the test itself requires comparatively little training).

\textsuperscript{54}Coyle, \textit{supra} note 32, at 317 (discussing how DNA-based tests can be used to identify marijuana); U.N. \textit{Office on Drugs and Crime, Recommended Methods for the Identification and Analysis of Cannabis and Cannabis Products}, at 46, U.N. Doc. ST/NAR/40, U.N. Sales No.E.09.XI.15 (2009) (commenting on the relative expense of DNA testing compared to its forensic value); Rodger L. Foltz et al., \textit{Nat’l Inst. on Drug Abuse, GC/MS Assays for Abused Drugs in Body Fluids} I (Robert C. Petersen & Eleanor W. Waldrop eds., 1980) (identifying reasons GC/MS testing is not more commonly employed, including the expenses involved and the high level of training needed to perform it). See Tindall, \textit{supra} note 31, at 56 (explaining, generally, the TLC process).

\textsuperscript{55}Thornton, \textit{supra} note 32, at 461.
scientific competency of the operator than a color test, things that are prohibitive for many municipal forensic labs.\textsuperscript{56} DNA testing would behave much as it does for human DNA samples, yielding a probabilistic determination of the species of a sample.\textsuperscript{57} The process however, is currently undeveloped and would be very expensive because a database of representative samples has yet to be compiled from ever-evolving strains of marijuana.\textsuperscript{58} Consequently, although the potential exists, no such testing has yet been used for forensic purposes.\textsuperscript{59} 

While each method of testing offers clear advantages and drawbacks, some general problems common to all emerge, even those with low error rates. First, the paucity of research embedding cannabis within a wider botanical setting leaves open whether THC and related cannabinoids are in fact unique to marijuana.\textsuperscript{60} Reasonably, similar plants not yet regulated by statute, may also produce cannabinoids (THC or others) and thus risk producing false positives for marijuana.\textsuperscript{61} Botanically speaking, THC results from complex evolutionary biochemical

\textsuperscript{56}See Foltz, supra note 54, at 1, 67 (“More serious deterrents to wider use of GC/MS . . . are the expense of the GC/MS instrumentation and the relatively high level of training and skill required to make effective use of these instruments.”); David Rosenthal & Dolores Brine, \textit{Quantitative Determination of Δ⁹-Tetrahydrocannabinol in Cadaver Blood}, 24 J. FORENSIC SCI. 282, 288-89 (1979) (stating that while analysis using GC/MS techniques is highly accurate, it requires complex and sophisticated equipment).

\textsuperscript{57}See Coyle, supra note 32, at 317 (“[M]arijuana DNA profiles can be generated and compared between samples and may be useful for forensic purposes.”).

\textsuperscript{58}See id. at 319 (discussing the difficulty of acquiring access to adequate numbers of marijuana samples).

\textsuperscript{59}See \textit{id.} (hypothesizing that in the future marijuana databases could be invaluable for tracking the movement of plant strains and linking individuals to drug-related crimes, as well as aiding in locating marijuana distribution centers).

\textsuperscript{60}See Jürg Gertsch et al., \textit{Phytocannabinoids Beyond the Cannabis Plant — Do They Exist?}, 160 BRIT. J. PHARMACOLOGY 523, 523–26, 528 (2010) (discussing research that shows plants other than cannabis have an effect on the endocannabinoid system); see State v. Greene, 161 N.W.2d 239, 240–41 (Wis. 1968) (holding that a positive chemical test for marijuana was sufficient evidence for a jury to find beyond a reasonable doubt that defendant sold \textit{Cannabis sativa L.}, even though there was no evidence presented that the test could distinguish \textit{Cannabis sativa L.} from \textit{Cannabis indicia}).

\textsuperscript{61}See \textit{id.} at 526, 528 (pointing out that at least one phytocannabinoid, β-caryophyllene, has been discovered to be widespread in various plant oils); see also Greene, 161 N.W.2d at 240–41.
pathways for the self-defense of the plant. The entire genus is replete with cannabinoids of varying strains. Evolution has not developed these pathways uniquely in a single species.

More importantly, the concept of species is itself a construction of science and its compulsion towards taxonomy. In a paper in the *Journal of Forensic Sciences* devoted to debunking the “semantic hokum” used by defense lawyers regarding confusion over the scientific classification of marijuana, biologist Small declares that “Biological nomenclature is merely the veneer of the product of taxonomists, who are concerned basically with assessing biological variation in groups of organisms. . . . [I]t is generally conceded that biological names cannot reflect the complexity of relationships of living things in a universally acceptable fashion.” Indeed, he goes on to declare that “changes in the consensus of use of given scientific names occur regularly and often gradually with the passage of time.” Although Small contends that these constantly shifting boundaries surrounding the ontology of species do not compose a legitimate legal defense for declaring a sample of illegal *Cannabis sativa* to be something other than *Cannabis sativa*, he makes clear that the scientific division of species is a somewhat arbitrary affair and that “all variants of the genus *Cannabis* should be assigned to the species *C.

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62 See Supaart Sirikantaramas et al., *Tetrahydrocannabinolic Acid Synthase, the Enzyme Controlling Marijuana Psychoactivity, is Secreted into the Storage Cavity of the Glandular Trichomes*, 46 PLANT CELL PHYSIOLOGY 1578, 1578, 1581 (2005) (illustrating that THCA synthase creates THCA and hydrogen peroxide, which may contribute to the self-defense of cannabis plants, and THCA is then converted into THC via non-enzymatic decarboxylation).

63 See Clarke, *supra* note 50, at 11 (discussing the different cannabinoid profiles for different varieties of cannabis); *id.* at 1578 (“To date, about 70 cannabinoids have been isolated from marijuana.”).

64 See Ernest Small, *On Toadstool Soup and Legal Species of Marihuana*, 21 PLANT SCI. BULL. 34, 34–35 (1975) [hereinafter Small, *Toadstool Soup*] (describing disruptive selection, which produced two types of cannabis plants); Clarke, *supra* note 50, at 9, 11 (showing that different varieties of cannabis produce differing levels of THC and cannabinoids).

65 Ernest Small, *The Forensic Taxonomic Debate on Cannabis: Semantic Hokum*, 21 J. FORENSIC SCI. 239, 239–40, 247, 250 (1976) [hereinafter Small, *Semantic Hokum*] (criticizing an argument utilized by many defense lawyers that there are several species of marijuana, and that legislation proscribing *Cannabis sativa* does not apply to all species, as the scientific name *Cannabis sativa* is more specific than the common name marijuana).

66 *Id.* at 247.
Marijuana and hemp are thus rendered scientifically analogous, while Small makes his point that cannabis is cannabis. In sum, the degree to which traditional forensic science can guarantee with any measurable degree of accuracy that a sample contains the forbidden Cannabis sativa is somewhat in doubt. One widely accepted protocol for forensic science is a combination of microscopy and the Duquénois-Levin test. Physical observation produces a high error rate for even the tiny subsample on which Nakamura attempted to validate it; the D-L test produces known false positives for non-esoteric substances (e.g., coffee grounds) and also lacks comprehensive scientific validation.

Further, cannabis is not known to be the only species of plant containing THC. More importantly, species is a scientific category requiring somewhat arbitrary distinctions to

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67 Id. at 247–50. Small’s overall point is that Cannabis sativa L, the specifically prohibited variety of marijuana, is essentially the same thing as, for example, Cannabis indica, a different varietal. In other words, Small is arguing that a new strain of marijuana, perhaps bred exclusively for smoking, which may be different enough to warrant a different varietal designation remains covered by the original law. Although he glosses over some important legal points, it seems perfectly reasonable to accept his basic contention — the prohibition on Cannabis sativa L applies to other variants of smoked marijuana. Id. at 239–40, 247–50; Small, Toadstool Soup, supra note 64, at 34–38. The points raised in the current paper transcend these concerns.

68 See Small, Semantic Hokum, supra note 65, at 247–250; Small, Toadstool Soup, supra note 64, at 34–38; see also See State v. Romero, 397 P.2d 26, 29 (N.M. 1964) (“We conclude as a matter of law that marijuana is identical with cannabis, cannabis sativa L., and cannabis indicia. Marijuana and cannabis indicia are merely geographical oriented names of cannabis, whereas cannabis sativa L. is the botanical name of cannabis.”); State v. Wind, 208 N.W.2d 357, 360 (Wis. 1973) (“[T]here is no essential difference between cannabis sativa L. and cannabis indicia.”).

69 Whitehurst, supra note 28, at 131–32 (“We are arresting vast numbers of citizens for the possession of a substance that we cannot identify by using the forensic protocol that is presently in use in most crime labs in the United States. We have no idea what the error rate of marijuana analysis is . . . .”).

70 Id. at 118; JOHN KELLY, FALSE POSITIVES EQUAL FALSE JUSTICE 2, 4, 7 (2008) (stating that the microscopic examination for cystolithic hairs followed by a confirmatory D-L test is the “gold standard” for identifying marijuana).

71 See Nakamura, supra note 13, at 5 (depicting that Nakamura needed a chemical test to distinguish a number of dicotyledons from cannabis); Bailey, supra note 40, at 822, 833; KELLY, supra, note 70, at 3–5, 9.

72 See Gertsch, supra note 60, at 524 (arguing that the existence of other plant products which interact with the endocannabinoid system suggests that plants other than Cannabis may contain cannabinoids or THC).
operationalize effectively. Finally, it is clear that all of the variants of *Cannabis* are contained within the legal definition set forth in the CSA, including hemp.\(^{73}\)

IV. Marijuana and Non-Marijuana: Legal Definitions

The definition and subsequent identification of marijuana is important practically for the legal system, as well as generally, to maintain a sense of legal coherence. These seemingly straightforward issues surrounding marijuana identification obscure awkward compromises implicit in the merging of science and law. Even if the legal system could bracket the implications of substandard forensic science or assume that a current test could determine the exact strain of a botanical sample, the law currently does not clearly identify the object that it has prohibited.\(^{74}\) This is because the distinction the law makes is not a scientific one but a social one — a distinction based on moral categories of use.\(^{75}\) Yet the law is not written as such.

The difference between hemp and marijuana is a dichotomy based largely on social use rather than biology.\(^{76}\) Taxonomically, marijuana and hemp are both *Cannabis sativa*.\(^{77}\) While physical differences in the two strains are evident in intact mature plants, neither chemical nor microscopic analysis would be sufficient to distinguish them in a form that was not “gross

\(^{73}\) See Small, *Semantic Hokum*, *supra* note 65, at 250 (“[U]se of the name *C. sativa* was historically, and continues to be, comprehensive of all marihuana plants.”); U.S. DEA, *supra* note 22 (“The existence of THC in hemp is significant because THC, like marijuana, is a Schedule I controlled substance.”).

\(^{74}\) See Small, *Semantic Hokum*, *supra* note 65 at 248–50 (discussing how ambiguity and subjectivity in taxonomic classification leads to semantic debates regarding marijuana legislation).

\(^{75}\) See *id.* at 247 (arguing that taxonomic classifications, such as *Cannabis sativa*, are based on subjective standards which rely on social values).

\(^{76}\) See U.S. DEA, *supra* note 23 (differentiating between cannabis products that cause THC to enter the human body and those that do not).

\(^{77}\) Small, *Semantic Hokum*, *supra* note 65, at 250 (“[U]se of the name *C. sativa* was historically, and continues to be, comprehensive of all marihuana plants.”).
Since forensic science depends primarily on these two methods for determining the probative value of samples, the question before a court (and therefore a forensic examiner) is, can the court “say that those tests uniquely identify marijuana to the exclusion of all other plants?” Not only is the answer “no,” as Whitehurst argues, but even to identify a sample as *Cannabis sativa* or THC cannot be sufficient for prosecution, because of the current legality of hemp possession. To determine that a sample testing positive for THC or identified as *Cannabis sativa* is truly “marijuana” requires a more amorphous social distinction.

The current federal drug enforcement regime was put in place with the enactment of the Comprehensive Drug Abuse Prevention and Control Act of 1970. Many state legislatures found the Act useful enough to adopt wholesale. More than simply a regulatory tool, the CSA presents, unambiguously, socio-moral statements about drug use, reminding citizens that “[t]he illegal importation, manufacture, distribution, and possession and improper use of controlled substances have a substantial and detrimental effect on the health and general welfare of the American people,” and defining an “addict” as someone who “endangers the public morals.”

Although the CSA attempts to regulate morality — inherently a proscription on activity — in

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78 See Whitehurst, *supra* note 28, at 118–19, 127 (arguing that the identification methods currently available are inadequate with respect to crushed plant materials).

79 Id. at 118, 127.

80 See 21 C.F.R. § 1308.35(2011) (creating an exception for cannabis material containing THC that is not included in the definition of “marihuana” and that do not allow THC to enter the body); U.S. DEA, *supra* note 23 (stating that many hemp products containing THC are still legal in the United States, provided the product does not allow THC to enter the body); id. at 131–32.


82 See Note, *Paraphernalia for Marijuana and Hashish Use: Possession Statutes and Indiana’s Pipe Dream*, 10 Val. U. L. Rev. 353, 353 & n.1 (1976) (explaining that by 1975 forty-three different jurisdictions had adopted the Uniform Controlled Substances Act, which is similar to the federal regime and “provides a comprehensive and flexible system for coordinating state and federal drug control”).

fact, it refers only to physical substances, which continues to present unresolved problems for the legal system’s regulation of cannabis.84

Congress introduces the morality of substances through the lens of social danger in the following manner: “The Congress has long recognized the danger involved in the manufacture, distribution, and use of certain psychotropic substances for nonscientific and nonmedical purposes, and has provided strong and effective legislation to control illicit trafficking and to regulate legitimate uses of psychotropic substances in this country.”85 The CSA cites the dangers of its regulatory object by setting it against nonscientific and nonmedical objects.86 Science and medicine, here, are tapped for their objective, regulable qualities and are treated uncritically.87 We learn from the Act that all nonscientific and nonmedical use of psychoactive substances is dangerous to the country, as compared with all scientific and medical use, which is not.88

Despite the inclusion of “manufacture” and “distribution,” the danger clearly stems from the “use” of illegal substances.89 In fact, the word “use” acts generally as a catch-all throughout the Act when referring specifically to individuals and their interactions with drugs.90 The CSA treats the words “abuse” and “addiction” as largely synonymous with “use,” which reinforces the

86Id.
87See id. (providing for the use of regulated substances for legitimate medical and scientific purposes).
88See id.
90See 21 U.S.C.A. §§ 801a(1), 802(1), (10), (27) (Supp. 2009) (showing that the CSA does not explicitly define the term “use,” though the term is used throughout the act to refer to human consumption of and interaction with controlled substances).
danger by enlarging the category of “use.” Further, drugs are partly scheduled on the basis of their “potential for abuse,” which ranges from low to high — never zero. In titles of sections and summations, Congress uses the word “abuse”, as evidenced by the Act’s title (“Drug Abuse Prevention”) in contrast to the Congressional findings (“The Congress has long recognized the danger involved in the . . . use of certain psychotropic substances . . . ”). This draws the eye to the seriousness of the problem. Again, despite the “manufacture” and “distribution” references, “use” is the category invoked for definitional purposes. This semantic move can be seen in this paragraph regarding methamphetamine: “The abuse of methamphetamine has increased dramatically since 1990. This increased use has led to devastating effects on individuals and the community . . . ” While “use” is ostensibly a neutral label, “abuse” carries unmistakably negative moral connotations.

Finally, the designation “addict,” although used first in relation to opiates, is defined more broadly as the following: “[t]he term ‘addict’ means any individual who habitually uses any narcotic drug so as to endanger the public morals, health, safety, or welfare, or who is so far addicted to the use of narcotic drugs as to have lost the power of self-control with reference to his addiction.” This section appears to make addiction an even more dangerous subcategory of use. However, while any non-medical use of drugs in the CSA might be an “improper use,” drugs are

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96 See id. (describing methamphetamine as a “very dangerous and harmful drug” that has a variety of negative impacts on the individual and society as a whole).
categorized partially by their addictive potential. Although the Act never explicitly defines the relationship between use, abuse, and addiction, the above text defines addiction as use that is dangerous to society. “Use,” though used interchangeably with “abuse” and sometimes “addiction” is the dominant paradigm; to prohibit exclusively “abuse” or “addiction” would imply the possibility of non-problematic usage of illegal drugs. This would undermine the whole category. “Use” is a catchall, essentially translating as non-medical and non-scientific ingestion of dangerous psychotropic substances. Therefore, in a theme we will see repeated below with respect to THC percentages, use cannot be scaled. Congress wants to protect America from ingesting the danger that inheres in drugs — there is no room for use continuums.

“Manufacture” and “distribution” are also mentioned in the introductory text of the Act. Congress, perhaps to preempt constitutional challenge, explicitly embeds its authority to control the danger of drug use in the Commerce Clause of the Constitution, suggesting in the CSA that “[a] major portion of the traffic in controlled substances flows through interstate and foreign commerce.” By situating drugs within its most extensive arena of power — commerce

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99 See 21 U.S.C. § 802(1) (Supp. 2009) (describing addicts as users who pose a danger to society while failing to distinguish between the terms “use” and “abuse”).
100 See Robert A. Mikos, On the Limits of Supremacy: Medical Marijuana and the States’ Overlooked Power to Legalize Federal Crime, 62 VAND. L. REV. 1421, 1453 (2009) (arguing how a state’s tolerance of any “use” of marijuana would likely lead people to believe it is not harmful and encourage the use of the drug).
— Congress gains wide regulatory latitude. But by framing its legal authority in this manner, Congress also ties the issue of drugs explicitly to commerce and thus to the trading and possession of physical commodities. This language shifts the discussion from the theme of psychotropic danger to the physical presence of an object, which can be bought, sold, or traded. In other words, the locus of control shifts from intoxication to physicality or from ingestion to possession. The inability to scale use translates in this shift as well, because, again, it is unacceptable to possess any amount of marijuana.

In its section on scheduling (i.e., hierarchy of prohibition), Congress underscores this by forbidding “any quantity” of proscribed substances. Rather than delineating amounts acceptable per person or levels of acceptable intoxication, the CSA states that “any material, compound, mixture, or preparation, which contains any quantity of the following . . . substances” is prohibited. The language is plain: a given substance, in any physical manifestation and in any quantity, is illegitimate. The regulatory shift in concern from amorphous moral danger to quantifiable physical presence is complete. Moreover, by hanging its hat on the immorality of marijuana, Congress can reach no other conclusion and is imposing a kind of black and white

\[105\] See Gonzales v. Raich, 545 U.S. 1, 18–19, 22 (2005) (describing the reach of the Commerce Clause, why its power extended to the CSA, and that the Constitution only requires a rational basis that home-consumed marijuana would “substantially affect interstate commerce”).

\[106\] See id. at 25–28 (defining the CSA as a regulatory statute, controlling the “production, distribution, and consumption of commodities” in an established inter and intrastate market).

\[107\] See id.


morality.\textsuperscript{112} There can be no acceptable ("moral") levels of marijuana use, just as there can be no acceptable ("moral") amounts of marijuana to possess.

In the case of marijuana, the CSA regulates both the plant ("Marihuana") and the proposed psychoactive ingredient THC (mentioned as "Tetrahydrocannabinols").\textsuperscript{113} Again, the CSA stipulates that "any material, compound, mixture, or preparation, which contains any quantity of [these] hallucinogenic substances" is illegal.\textsuperscript{114} No levels or limitations are mentioned — the language "any quantity" would seem to prohibit any discussion thereof.\textsuperscript{115} However, the CSA explicitly defines the term "marihuana": "The term ‘marihuana’ means all parts of the plant Cannabis sativa L., whether growing or not; the seeds thereof; the resin extracted from any part of such plant; and every compound, manufacture, salt, derivative, mixture, or preparation of such plant, its seeds or resin."\textsuperscript{116}

A plain reading makes clear what is prohibited — "all parts of the plant."\textsuperscript{117} In an apparent contradiction, however, the CSA continues:

Such term does not include the mature stalks of such plant, fiber produced from such stalks, oil or cake made from the seeds of such plant, any other compound, manufacture, salt, derivative, mixture, or preparation of such mature stalks

\textsuperscript{112} See 21 U.S.C. § 801(2) (2006) (finding that possession of controlled substances has "a substantial and detrimental effect on the health and general welfare of the American people").


\textsuperscript{115} Id.


\textsuperscript{117} Id.
(except the resin extracted therefrom), fiber, oil, or cake, or the sterilized seed of such plant which is incapable of germination.\textsuperscript{118}

“[A]ll parts of the plant” notwithstanding, the second sentence of the quote excludes the parts of the plant encouraged in hemp cultivation, although the law does not state this explicitly.\textsuperscript{119} If this is true, hemp — not the flowering tops of the cannabis plant, but the stalks, fiber, edible seed oil, and related material — are not included in the definition of “marihuana.”\textsuperscript{120} Although unclear in its discussion of danger and use, the CSA is relatively straightforward in its delineation of marijuana: all of the marijuana plant is illegal, but parts of the hemp plant are not.\textsuperscript{121} As we have seen, however, scientists concerned with issues of the law have demonstrated that, taxonomically, they are the same plant.\textsuperscript{122}

Congress has seen fit to ground its motivations and justifications for prohibiting marijuana in a moralistic understanding of drugs and use.\textsuperscript{123} The moralistic use/non-use dichotomy this creates maps squarely on the marijuana/hemp dichotomy.\textsuperscript{124} Yet, contradictions are embedded within the CSA itself, as it attempts to regulate the whole marijuana plant while leaving untouched the useful parts of the hemp plant.\textsuperscript{125} The clean lines of moralism that infuse

\textsuperscript{118} Id.

\textsuperscript{119} See id.; Duppong, supra note 28, at 407–09 (explaining that while marijuana and hemp are derived from the same plant, the flower or leaves are used for the former, and stalks grown for fiber are used to produce the latter).

\textsuperscript{120} See 21 U.S.C. § 802(16) (Supp. 2009); Hemp Indus. Ass’n v. DEA (Hemp II), 357 F.3d 1012, 1013, 1017–19 (9th Cir. 2004).


\textsuperscript{122} Duppong, supra note 28, at 407.


\textsuperscript{124} See DAVID P. WEST, N. AM. INDUS. HEMP COUNCIL, HEMP AND MARIJUANA: MYTHS & REALITIES, 5 (1998) (explaining how the conflation of the terms hemp and marijuana has proven problematic for policy makers who believe “that by legalizing hemp they are legalizing marijuana”).

the legal categorization of cannabis become less clear, however, when juxtaposed with the science of forensics and the potential messiness that it entails.\textsuperscript{126}

\section*{V. Legal and Regulatory Framework}

Momentarily bracketing ontological questions in favor of practical concerns, this apparent contradiction has not gone undetected by regulatory agencies. In 2003, the Drug Enforcement Agency (DEA) issued a final rule that banned the sale of consumable products containing hemp, recognizing explicitly the arguments present above:

\begin{quote}
[T]o ignore the foregoing considerations [ambiguities in the scheduling of THC] and to treat natural THC as a noncontrolled substance would provide a loophole in the law that might be exploited by drug traffickers. If natural THC were a noncontrolled substance, those portions of the cannabis plant that are excluded from the CSA definition of marijuana (the stalks and sterilized seeds of the plant) would be legal, noncontrolled substances — regardless of their THC content.\textsuperscript{127}
\end{quote}

Consistent with the moral framing of the CSA, the DEA interprets all THC as illegitimate, rather than resolve the tension by interpreting the CSA to require levels of acceptability.\textsuperscript{128} Correctly identifying this “rule change” as a clear threat to their commodities, the Hemp Industries Association, a business conglomerate representing various hemp interests, sued the federal government in \textit{Hemp Industries Association v. DEA (Hemp I)}.\textsuperscript{129} The ultimate ruling was issued by the Ninth Circuit Court of Appeals, which officially ruled on the nature and

\begin{itemize}
\item \textsuperscript{126} \textit{See supra} text accompanying notes 34–52.
\item \textsuperscript{128} \textit{Id.}
\item \textsuperscript{129} 333 F.3d 1082, 1085 (9th Cir. 2003).
\end{itemize}
legality of the rule change, rather than the relative morality of cannabis.\textsuperscript{130} Yet, as we have seen, the discussion of taxonomy cannot escape implicit moralizing.

At issue in the case was the nature of the rule change.\textsuperscript{131} The DEA argued that it made only an “interpretive” rule change.\textsuperscript{132} This amounts basically to an administrative procedure, well within the powers of the organization and requiring only internal approval.\textsuperscript{133} Such a rule would not have the “force of law,” and would merely be clarifying an existing statute.\textsuperscript{134} The DEA, in its accompanying document, declares that its “rule clarifies that, under the CSA and DEA regulations, the listing of ‘Tetrahydrocannabinols’ in Schedule I refers to both natural and synthetic THC.”\textsuperscript{135} Further, DEA claims that this is evident from the “plain language of the CSA and DEA regulations” that this is the case.\textsuperscript{136} Indeed, the text of DEA’s accompanying document contains barely suppressed irritation that anyone could have misread this “plain language”:

Despite the wording of the statute, \textit{some members of the public were under the impression (prior to the publication of the interpretive rule) that the listing of ‘Tetrahydrocannabinols’ in schedule I includes only synthetic THC — not natural THC. To eliminate any uncertainty, DEA is hereby revising the wording of its regulations to refer \textit{expressly} to both natural and synthetic THC.}\textsuperscript{137}

\textsuperscript{130} See id. at 1085, 1087, 1091 (holding that the DEA’s rule was procedurally invalid without giving any consideration to the morality of the marijuana prohibition generally).
\textsuperscript{131} Id. at 1086–87.
\textsuperscript{132} Id. at 1084.
\textsuperscript{133} Id. at 1086–87.
\textsuperscript{134} See id. at 1090 (noting the distinction between a legislative rule which carries the force of law and an administrative interpretation of statutory law which does not).
\textsuperscript{136} Id.
\textsuperscript{137} Id. (emphasis added).
DEA argues that it is simply clarifying the rule regarding THC, making more obvious what previously was plain enough to read. Therefore, DEA argued, it is only an interpretive rule, making no substantive change to the law.

The Ninth Circuit disagreed, finding that DEA had made an unauthorized legislative rule change without following the proper — and considerably more arduous — external procedure specified under the Administrative Procedures Act. The court found that DEA would be well within its rights to make this an interpretive rule if there had been no prior regulatory or case history regarding naturally-occurring THC. But there had been — DEA’s own regulatory decisions from the 1970s recognize the awkward legal status of naturally-occurring THC.

Consistent with the scientific isolation of the THC terpenoid of marijuana, DEA added the “Tetrahydrocannabinols” category to the CSA in 1971, noting that the term referred to “[s]ynthetic equivalents of the substances contained in the plant . . . and/or synthetic substances, derivatives, and their isomers . . . .” Indeed, the Ninth Circuit remarks “if naturally-occurring THC were covered under THC, there would be no need to have a separate category for marijuana.”

Ultimately, the court plays out its logic regarding the narrow legal distinction in a 2004 decision (Hemp II) regarding the DEA’s Final Rules. There, the Court held

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138 Id.
139 Hemp I, 333 F.3d at 1084.
141 Id. at 1090.
142 See id. at 1089–91 (articulating the various ways in which DEA has attempted to categorize naturally occurring THC).
143 Id. at 1089–90.
144 Id. at 1089.
The DEA’s Final Rules purport to regulate foodstuffs containing ‘natural and synthetic THC.’ And so they can: in keeping with the definitions of drugs controlled under Schedule I of the CSA, the Final Rules can regulate foodstuffs containing natural THC if it is contained within marijuana, and can regulate synthetic THC of any kind. But they cannot regulate *naturally-occurring THC* not contained within or derived from marijuana — i.e., non-psychoactive hemp products — because non-psychoactive hemp is not included in Schedule I. The DEA has no authority to regulate drugs that are not scheduled, and it has not followed procedures required to schedule a substance.\(^\text{145}\)

By not appealing the decision to the Supreme Court, the DEA appears to have accepted the ruling of the Ninth Circuit: the marijuana plant is illegal, but at least some parts of the hemp plant which contain THC are legal, such as the stalks, fiber, seed oil, cake, and ungerminated seeds.\(^\text{146}\) But the tortured path by which the court arrives at this conclusion elides important congruencies between hemp and marijuana in their collective enumeration as *Cannabis sativa*.\(^\text{147}\) When the court speaks of “non-psychoactive hemp” or “naturally-occurring THC not contained within or derived from marijuana” it creates an impossible category unknown to science — THC without psychoactive properties.\(^\text{148}\) Hemp and marijuana both contain THC, albeit different

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\(^{145}\) Hemp Indus. Ass’n v. DEA. (*Hemp II*), 357 F.3d 1012, 1018 (9th Cir. 2004) (emphasis in original).

\(^{146}\) *Id.* at 1017–18.

\(^{147}\) *See id.* at 1017 (applying the definition of “marihuana” as provided in the CSA).

\(^{148}\) *See id.* at 1018 (emphasis omitted); Holler, *supra* note 5, at 428; Gareth Pryce & David Baker, *Emerging Properties of Cannabinoid Medicines in Management of Multiple Sclerosis*, 28 TRENDS IN NEUROSCIENCES 272, 273 (2005) (showing that THC is largely responsible for the psychoactive effects of cannabis).
Small amounts of THC are non-psychoactive in the same manner as small amounts of alcohol — increased dosage provides increased intoxication. The Ninth Circuit’s decision in Hemp II is carefully worded, since to refer to “non-psychoactive THC” would be expressly nonsensical, but the issue under review is not hemp per se, but THC. The legally constructed category of “non-psychoactive hemp” combines the perceived harmlessness (or, morality) of hemp with the admission that, in tiny doses, THC is not only non-psychoactive — not a “drug” per se, in its social meaning — but even safe, perhaps even “moral.” One can imagine the ultimate extension of that logic—normalization, or potentially redefining moderate THC use as moral. The Court’s silence on the issue of morality not only avoids condemnation of hemp-based products, but it may in fact provide an argument for the morality of objects like hemp rope or sandals.

One obvious irony in this delicately balanced legal framework is the inconvenient legal status of dronabinol as a Schedule III drug. Approved by DEA in 1986 as a Schedule II drug, and rescheduled as a Schedule III drug in 1999, dronabinol is synthetic THC marketed under the

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149 Holler, supra note 5, at 428 (explaining that while hemp and marijuana are both members of the genus Cannabis sativa, hemp contains less than one percent THC and marijuana can be cultivated to contain between one and twenty percent THC).


151 Hemp II, 357 F.3d at 1012, 1019 (enjoining the enforcement of the DEA’s “Final Rules with respect to non-psychoactive hemp”).

152 See id. at 1013 n.2, 1018.

153 See Hemp Indus. Ass’n v. DEA (Hemp I), 333 F.3d 1082, 1084–85, 1091 (9th Cir. 2003) (concluding that the DEA regulation was invalid due to lack of administrative authority, as opposed to any public policy issue related to the use of marijuana); see also Hemp II, 357 F.3d at 1018 (holding that the DEA had no authority to regulate unscheduled drugs).

trade name Marinol, and is used to treat various gastrointestinal issues in chemotherapy and AIDS patients. As made clear above, at no time was the Schedule I status of synthetic THC in question, but dronabinal is listed as a Schedule III substance, although it is not mentioned in the CSA, or any of its Congressional amendments. Schedule III drugs are available by prescription, which can be refilled without a new medical appointment. Apart from THC (DEA code number 7370), dronabinal has its own separate DEA code number (7369) although they are defined identically as “synthetic” THC. Perhaps expressly to remove it from law enforcement suspicion, dronabinol escapes scrutiny in “sesame oil in soft gelatin capsule[s],” presumably in plastic pill blister packaging for easy identification as “not marijuana.”

The Hemp II decision throws the issue of marijuana identification into sharp relief. To maintain the legal fiction that marijuana and hemp are somehow ontologically distinct, the court is forced to create a biologically fictitious category — non-psychoactive THC. Indeed, to further confuse the issue, the CSA already recognizes a version of ostensibly non-psychoactive

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159 21 C.F.R. § 1308.13(g); U.S. DEP’T OF JUSTICE, supra note 159, at 5.

160 See Hemp II, 357 F.3d at 1017–19.

161 See id. (holding non-psychoactive hemp is not included in Schedule I).
THC — dronabinol.\textsuperscript{162} Although the legal prohibition on marijuana remains protected as ever, the list of conditions under which prohibition is void is growing longer.\textsuperscript{163}

VI. But How Shall We Know Them?

Ultimately, none of this legal maneuvering answers satisfactorily the basic practical question: If any of the aforementioned legal versions of cannabis come under law enforcement scrutiny, which forensic test can successfully demarcate the boundaries of illegal cannabis/marijuana from its legal cannabis/hemp counterpart? In a word, none. The judicial process has created a legal fiction, that not only are they different, but that we can tell them apart forensically. The single consideration that might make this distinction viable would be a government statement regarding “safe” (or perhaps, more appropriately, “moral”) levels of THC. GC/MS or DNA testing could then help determine what category a suspect sample falls into based on clearly defined lines of THC content.\textsuperscript{164} But this seems unlikely, since, as the Ninth Circuit points out, “DEA has failed to indicate any limit of detectable amounts for THC” and “a true zero level of [tetrahydrocannabinols] THC in hemp seed and oil [products] is not achievable.”\textsuperscript{165}

The overlapping categories here are socio-moral, scientific, and legal. The legal framework has thus drawn lines between that which is fundamentally morally dangerous and that


\textsuperscript{165} Hemp Indus. Ass’n v. DEA (\textit{Hemp I}), 333 F.3d 1082, 1086–88 (9th Cir. 2003). The Court conveniently ignores its own failings in this regard as well as similar problems in the original CSA.
which is fundamentally not. Because the social danger of drugs inheres so deeply in this issue, my reading of the Court’s implicit reasoning is that to allow even a small amount of the prohibited THC is to make a moral compromise and potentially open the door to the slippery slope of decriminalization, legalization, or to recognize the potential for non-dangerous moderate marijuana use.\(^\text{166}\) It is far better to avoid this and maintain moral clarity by classifying these as different objects. In essence, to have medical value or be a useful commodity for textiles or nutrition is to be “not marijuana.”\(^\text{167}\) Thus, the division remains fundamentally social and not chemical.

However, forensic science has not signed on to the operationalization of this set of legal compromises. In determining the identity of an unknown substance in the course of a criminal investigation, any of the tests previously mentioned are likely to be employed. Should a legal cannabis object fall under suspicion, it will be tested according to accepted protocol and likely come up positive for the illegal substance marijuana.\(^\text{168}\) That this situation has not yet become its own court case is perhaps only due to the nature of science with regard to legal decisions and law enforcement. The Ninth Circuit is entitled to cite sophisticated scientific studies in its rulings regarding science that “a ‘THC Free’ status is not achievable,”\(^\text{169}\) but a suspect sample instead

\(^{166}\) See id. at 1089–91.

\(^{167}\) Id. at 1085, 1088-89.

\(^{168}\) See Whitehurst, supra note 28, at 118–19. The contested error rates are notwithstanding, of course, in regard to the tested objects. Perhaps more importantly, practically and culturally speaking, it seems plausible that a person under suspicion for marijuana possession might conceivably possess items defined legally, and marketed as, hemp. How this will be dealt with, remains an open question.

\(^{169}\) Hemp I, 333 F.3d at 1085 (citation omitted).
receives microscopy and the D-L field test from a lab technician or law enforcement official who may possess little or no formal scientific training.  

Forensic science, as “the handmaiden of the legal system,” and prosecutors, as the enforcers of the same public morality embedded in the CSA, are in the business of suspicion. Law enforcement arranges tests for several reasons beyond simply the legal necessity to establish identity chemically. First, samples are often non-obvious botanicals, comprising residue or other indistinguishables. A test must then separate probative cannabis material from, say tobacco residue, kitchen garbage gunk, or coffee grounds. Second, the purpose of forensic science, in practice, is often to demonstrate guilt, rather than objectively test hypotheses. In the world of forensic law enforcement, a sample, like a suspect in the hands of police, is not really innocent until proven guilty, but the reverse — law enforcement suspects, and relies on the lab to confirm their suspicions. In a manner of speaking, the unknown sample is guilty until proven innocent in this respect. By way of this suspicious gaze of law enforcement, a sample is moved from the potential hemp category to the potential marijuana category, shifting the burden of

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170 COMMITTEE ON IDENTIFYING THE NEEDS OF THE FORENSIC SCIENCES COMMUNITY, NATIONAL RESEARCH COUNCIL, STRENGTHENING FORENSIC SCIENCE IN THE UNITED STATES: A PATH FORWARD 36 (2009), available at https://www.ncjrs.gov/pdffiles1/nij/grants/228091.pdf (explaining that forensic science is sometimes performed by untrained law enforcement officers who have no scientific training).

171 Id. at 85 (citation omitted).

172 See KELLY, supra note 70, at 4 (examining a variety of forensic tests used by law enforcement).

173 See id. at 8 (2008) (describing what other matter may be identified as marijuana in forensic testing).

174 See id. at 8–9 (indicating that a determinative forensic test is a process that must isolate the unknown compound from all other matter and that some tests will give a false positive for marijuana when testing coffee or aspirin).


176 See id.
proof along with it. Once a sample tests as an illegal object, the burden of proof is on the defendant to “prove” that it is hemp or contains only “naturally-occurring” hemp THC (or, potentially, dronabinol, which carries with it lesser penalties for misuse as a Schedule III substance), and is thus not illegal. An uphill battle, certainly, and as we have established, empirical testing only muddies these waters.

This analysis suggests that the only thing between a consumer of hemp products and prosecution for marijuana possession is suspicion, a purely social distinction. This legal battle, though clearly involving social distinctions and moral judgments, ropes science into its purview. Science is implicit in the move from discussions of “the drug” in marijuana from the Marihuana

177 See Jones v. State, 74 So.2d 427, 430 (Miss. Ct. App. 1998) (noting the defendant’s claim that his plants were hemp plants was ignored by the court, and the plants were accepted as marijuana based on law enforcement testimony and evidence).

178 See Peppers v. State, 304 So.2d 39, 40–42 ( Ala. Crim. App. 1974) (holding that the burden is on the defendant to show that he possessed or sold legal marijuana and therefore was included in the exemption provided for in the statute); State v. Wind, 208 N.W.2d 357, 360–61 (Wis. 1973) (holding that while the State still needed to prove beyond a reasonable doubt that the substance sold was marijuana, a chemical test does not need to be specific to marijuana for it to be probative); State v. Greene, 161 N.W.2d 239, 240–41 (Wis. 1968) (holding that a positive chemical test for marijuana was sufficient evidence for a jury to find beyond a reasonable doubt that defendant sold Cannabis sativa L., even though there was no evidence presented that the test could distinguish Cannabis sativa L. from Cannabis indica); 21 C.F.R. § 1308.13(g) (2011) (listing dronabinol as a Schedule III drug).

179 See Christine A. Kolosov, Comment, Evaluating the Public Interest: Regulation of Industrial Hemp Under the Controlled Substances Act, 57 UCLA L. Rev. 237, 251 (2009) (describing the difficulty in differentiating cannabis plants that contain high amounts of THC and plants that contain low amounts of THC when the plants are young in age).

180 And not all suspicion is created equal. The issue of morality and drugs is clearly tied up with political decision making regarding race, class, and their perceived danger to the normative order. Drugs offer law enforcement powerful tools that can be used with wide discretion — marijuana in particular can be used this way, given its near-ubiquity in contemporary American society. For excellent in-depth treatment of the issues surrounding drugs, discretion, arrest, and racism, see Doris Marie Provine, Unequal Under Law: Race in the War on Drugs 81–83 (2007) (linking marijuana’s criminalization with its use by Mexican communities); David F. Musto, The American Disease: Origins of Narcotic Control 219–222 (Oxford University Press 3d ed. 1999) (1973) (associating marijuana use and association with Mexican immigrants); Katherine Beckett et al., Race, Drugs, and Policing: Understanding Disparities in Drug Delivery Arrests, 44 Criminology 105 (2006) (describing the connection between race and drug arrests); Marisa K. Omori, Wendy Reyes, Aaron Roussell, Matthew A. Valasik, Rachel Diggs, and Mona Lynch, Policing in the “Progressive” City: Racial Disparities in San Francisco Drug Arrests (forthcoming technical report for the American Civil Liberties Union).
Tax Act to a seemingly blanket prohibition of THC in the CSA. Yet it is a social understanding of danger to public morality that continues to motivate the definition of marijuana under the law. As sociologist of science Bruno Latour suggests, the thrust of science in society in contemporary times may in fact proliferate these cultural and biological “hybrids,” leaving us with theoretical complications regarding the purification of science and culture. But apart from these theoretical concerns, the mobilization of morality through the lens of science in this particular manner renders the law problematic at best and incoherent at worst.

181 See Hemp Indus. Ass’n v. DEA (Hemp I), 333 F.3d 1082, 1088–91 (9th Cir. 2003); Marcia Tiersky, Comment, Medical Marijuana: Putting the Power Where It Belongs, 93 NW. U. L. REV. 547, 548–550 (1999) (detailing the history of cannabis and marijuana in the United States from the 1800s until its classification in the CSA in the 1970s).
