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ABSTRACT

Research into treating drug dependence with hallucinogens, although promising, ended with questions still unanswered because of varying, in some cases skeptical, methodology and insufficient adherence to a double-blind, placebo-controlled design. Interest is again emerging, especially with the recent patenting in the United States of ibogaine for its apparent anti-craving properties. A review of the literature shows that these properties may be present across the entire family of hallucinogens. Potential efficacy may be tied to their agonism and antagonism at specific serotonin receptor sites. After the administration of a hallucinogen, there is a positive "afterglow" lasting weeks to months which might be extended through repeated dosing. Ibogaine and LSD both have lengthy periods of action, making their application unwieldy. However, tryptamines, such as N,N-Dimethyltryptamine (DMT), are so short-acting that they could easily be administered in an office setting. With numerous hallucinogens yet to be tested, a hallucinogen might well be discovered with superior anti-craving properties and non-deleterious side-effect profile.

KEYWORDS: LSD, Ibogaine, N,N-Dimethyltryptamine (DMT), Therapeutic Use, Drug Dependence, Serotonin

INTRODUCTION

In 1970, near the collapse of hallucinogen research in America, Walter Pahnke and several of his colleagues conducted research implicating a useful role for LSD in the treatment of addictions (Pahnke et al., 1970; Pahnke, Kurland, Unger, Savage, Wolf, and Goodman, 1970; Kurland et al., 1973; Savage and McCabe, 1973; Grof, Goodman, Richards, and Kurland, 1973). With the patenting of the indolealkylamine hallucinogen ibogaine by an entrepreneur (Lotsof, 1985), once again we may see the use of a hallucinogen for drug dependence. In this era where billions of dollars are devoted to addiction diseases, the search for efficacious management has been ongoing: therapy and counseling; AA and NA; voluntary and court-mandated drug-rehabilitation programs; drug-maintenance programs; and pharmacotherapy. Research has given us antagonists such as naltrexone and flumazenil, in addition to the medicating of alcoholics and opiate addicts with disulfiram, methadone, clonidine, and benzodiazepines. Other drugs are also under investigation (Meert and Clincke, 1992) and due to promising pre-clinical data ibogaine quite likely will be used in the United States to test its purported anti-addictive qualities. But are these properties novel to ibogaine, or could there be similar attributes to other hallucinogens? A review of the literature suggests that this may be the case.

The hallucinogens, overall, are viewed as a closed chapter of research within psychiatry. With the social upheaval of the 1960's and the claims of permanent health

risks, investigations into their therapeutic potentials ended by the mid-1970's. Various political and cultural influences also contributed to the rash placement of these drugs into the U.S. Food and Drug Administration's essentially inaccessible Schedule 1. Drugs so classified are labeled highly abusable with no proven application. Detailed historical reviews on why this occurred have already been offered (Brecher et al., 1972; Neill, 1987; Bravo & Grob, 1989; Grob, 1994). Moreover, serious health risks are now thought to be kept to a minimum by using a properly controlled environment for a screened population (Strassman, 1984). What is a proper environment, though, is subject to much debate. Generally it is regarded that *set*, the individual's frame of mind, and *setting*, the ambient surroundings, have significant bearing on the subject's experience (Grob, 1994; Grof, 1994). Despite such uncertainties and an ignoble past, there is now a slow reemergence of hallucinogen research in the United States (Strassman, 1991).

Is there a need, though, for effective anti-craving medications? One recent study (Moos and Moos, 1995) tracked a national sample of 1,070 substance abuse patients for four years following hospitalization for psychiatric and/or substance abuse conditions. High readmission rates were seen over this time (50 to 70%). Equally pressing, there is no evidence from well-designed, controlled studies that any available medication can by itself affect the long term

course of alcoholism (Meyer, 1989). It is theorized, however, that multiple, partial neurotransmitter blockade on a final, common reinforcement pathway could conceivably provide relief from drug effects that advance continued use (Kosten and Kosten, 1991). Agonist/antagonists of the neurotransmitter serotonin (5-hydroxytryptamine; 5-HT) have already been implicated in the attenuation of craving (Naranjo, Sellers, Lawin, 1986; Naranjo, Sellers, Sullivan et al., 1987; Naranjo, Sullivan, Kandler et al., 1989; Kranzler, Orrok, 1989; Kosten, 1990; Naranjo, Poulos, Bremner, Lanctot, 1992; Wang, Joharchi et al., 1995). In the 1960's, it was not known that LSD, for example, is also an agonist/antagonist at the discrete serotonin receptors $5\text{-}HT_{1a}$ and $5\text{-}HT_2$ (Winter, 1978; Sloviter, Drust, Damiano, Conner, 1980; Winter, Rabin, 1988; Glennon, 1990; Krebs, Geyer, 1994). In light of the above works showing that serotonin may mediate reward-related behavior, it then becomes reasonable to reconsider the evaluation of an entire class of serotonin modulators, the hallucinogens, for anti-craving features.

HALLUCINOGEN ADMINISTRATION IN THE TREATMENT OF ALCOHOLISM

As has previously been noted (Smart and Storm, 1964; Abuzzahab and Anderson, 1971; Mottin, 1973; Anonymous, 1966), there is difficulty in concluding that hallucinogens are ineffective against alcoholism from the (now aging) articles published. The LSD investigators of the 50's and 60's primarily used varying methodology, dosing, and criteria for improvement. Furthermore, most clinical studies of that era

lack adherence to the now-accepted standard: a double-blind, placebo-controlled protocol with proper statistical analysis. Indeed, in 1965 at the Second International Conference on the Use of LSD in Psychotherapy, a number of scientists who were involved in early research thought that this standard negated the many positive responses they elicited in hundreds of subjects (MacLean et al., 1967; see Panelist Discussions in Abramson, 1967).

If, as some believe, it is impossible to perform double-blind studies due to the powerful and obvious effects of these agents (for example Salzman CA, 1969), then a simple study should be devised to investigate this very point. A randomized, double-blind administration of a hallucinogen or placebo to a volunteer group with a follow-up administration of Strassman's Hallucinogen Rating Scale (1994) would provide such data. In addition, the question, "Was a hallucinogen administered?", could be posed to both subject group and physician/observer. If double-blind administration is circumvented by statistically significant observer and naive-subject identification, then hallucinogens can be given to the subject group with less fear of bias.

Abuzzahab and Anderson's 1971 review of 31 investigations from 1953 to 1969 on the effects of LSD on 1,105 alcoholics (variably defined, with a mean length of alcoholism of 19.4 years) did reach some interesting conclusions. There are five studies noted in which a single LSD dose (mean 342 μg) was given to alcoholics and control

groups (Jensen, 1962; Jensen et al., 1963; Johnson, 1969; Ludwig et al., 1969; Smart et al., 1966). Combined improvement in alcoholics is reported as 75% versus 43.7% of controls on a mean follow-up of about 10 months. As for the three studies in which multiple doses of LSD were given (MacLean et al., 1967; Osmond et al., 1967; Van Dusen et al., 1967) improvement was 57.5% for patients and 70.5% for controls after a mean follow-up of 20 months. The mean dose, unfortunately, could not be determined because MacLean et al. (1967) did not report the maximum total dose. Still it should be noted that the average follow-up in these three studies is twice as long as in the former five single-dose studies mentioned.

Again, differences in definitions of improvement and length of follow-up, make one suspicious of all these data. Moreover, none of the studies report if there are changes in psychosocial adjustment following LSD treatment. Still, the reviewers (Abuzzahab and Anderson, 1971) emphasize that "discrepancies in improvement might be related to longer follow-up; [for] the longer the follow-up, the less the improvement" was noted across the single dose studies. Indeed, this has been alluded to by others (Faillace, Vourlekis, and Szara, 1970; Mottin, 1973; Shaggas and Bittle, 1967; Soskin, 1973; Ulrich and Patten, 1991). Such a contention supports the hypothesis that lysergamide (ex. LSD), indolealkylamine (ex. DMT, ibogaine, psilocybin), and/or phenethylamine (ex. mescaline, MDMA) hallucinogens

offer anti-addictive properties that last an undetermined but finite average length of time. Thus, through repeated dosing at such intervals as deemed necessary, the addict could receive a continuous (steady-state) benefit. If true, then we should find a diminution of the addict's substance use with a quantifiable improvement in global adjustment and level of functioning. Indeed, Grinspoon and Bakalar's exhaustive review (1979) arrived at a similar conclusion:

> The obvious recourse of supplementary treatments every once in a while has been suggested but never taken seriously...By renewing the psychedelic experience every few weeks or months, the peyote [mescaline] ritual provides the kind of continuous follow-up implicitly suggested by the studies that indicate a short-term improvement after an LSD trip.

Smart, Storm, Baker, and Solursh (1967), also admit that there has been "little consideration of the role of multiple doses of LSD in the treatment of alcoholism....It is possible that a long series of administrations would have provoked more change."

When one weighs this literature, including the few double-blind, controlled studies, it can be seen that there could be anti-addictive benefits lasting one or two months. One of the better designed studies (Hollister, Shelton, and Krieger, 1969) had subjects (N = 72) randomly assigned to two groups in which one was given a single dose of 600 μg of LSD and the other 60 mg of dextroamphetamine. No psychotherapy was provided to either group, and LSD or amphetamine was administered double-blind. Both groups were independently rated for level of alcoholism on two and six month follow-up.

At two months the investigators report a statistically significant ($p<0.01$) improvement with the LSD treated group over the amphetamine group when comparing scores on a "Drinking Behavior Scale." This scale, formulated by the authors, is intended to be "based on the three general areas of drinking habits, social behavior, and occupational adjustment." At six months the two groups showed no difference. It is quite possible, then, that this hallucinogen had up to a two-month anti-addictive property with these alcoholics. If true, this would also explain why the single-dose LSD experiment of Smart, Storm, Baker, and Solursh (1967) found no improvement in alcohol consumption in their well-designed, double-blind, placebo and drug controlled experiment (N = 30): follow-up of all subjects occurred at six and 18 months.

In another well regarded paper, Ludwig et al. (1969) conducted a three-year study of 176 male alcoholics. The subjects were randomly assigned to four different treatment modalities operated under double-blind conditions. Their analysis of the study:

> Although the results indicated significant improvement from baseline to post-treatment and follow-up testing for all treatment conditions (including the no-therapy condition), no one treatment condition proved superior to any other. Therefore, we were forced to conclude that the dramatic claims made for the efficacy of LSD treatment in alcoholism were scientifically unjustified.

However, their own figure on the cumulative percentage of patients who returned to drinking shows a discrepancy in

their conclusion (Kantor, 1970). Namely, at one month follow-up fewer than 15% of those who had "psychedelic" therapy returned to drinking as opposed to 40% of the control group. Strangely, the authors maintain that this should not be construed as a "positive sign" (Ludwig, 1970).

HALLUCINOGEN ADMINISTRATION IN THE TREATMENT OF OPIATE DEPENDENCE

Human trials to study anti-addictive effects of hallucinogens on opioid dependency are sparse. Ludwig and Levine (1965) evaluated narcotic addicts (N = 70) after the completion of a detoxification program. Volunteers were randomly assigned to five different treatment sessions: "insight-interpretive" psychotherapy alone, hypnosis plus psychotherapy, LSD alone, LSD plus psychotherapy, and LSD with hypnosis and psychotherapy ("hypnodelic therapy"). A moderate dosage of 2 μg/kg of LSD was administered to those in the latter three groups. The authors report that on psychological testing, those who received LSD showed significant improvement at two weeks on scales testing for "Self-concept" and "Coping Attitudes" in comparison to those who did not. No differences were noted at two months, although the authors believe that the greatest improvements were seen in the hypnodelic group. This study actually provides quite limited conclusions since behavioral changes, including abstinence from drugs, were not tracked.

Savage and McCabe (1973) did, however, track 74 narcotic addicts for one year with daily urine monitoring for

continued abstinence. Subjects randomly assigned to the study group stayed for six weeks in a half-way house and were given several weeks of preparatory psychotherapy prior to being given a single moderate to high dose of LSD (200 to 500 μg). Controls were placed in an outpatient clinic program with weekly group psychotherapy. Other than the initial period of residential treatment culminating in LSD administration, study subjects and controls were treated identically. Their results after one year: 25% of the study group remained abstinent from opiates as opposed to only 5% of the control group ($p<0.05$). The authors cautiously note that LSD was only one component of the six week initial therapy and as such "one is not able to say that it was the drug factors alone which accounted for the therapeutic yield." Indeed, the residential treatment given to the study group may have skewed these results. Still, it would appear that LSD had a distinct effect on outcome. They encouraged further research with hallucinogens in the treatment of narcotic addicts, but by 1973, when their study was published, human research with these controversial substances had essentially come to an end in America.

THE EFFECT OF IBOGAINE

This past research on the treatment of addictions with hallucinogens does suggest a potential therapeutic effect. It would appear to offer a time-limited "afterglow" of days to months whereby an individual has an abatement in craving for addictive drugs. As noted, most of these studies focused only

on LSD treatments of alcoholism. Nevertheless, with this historical perspective, we can now focus on the research of recent years.

One hallucinogen that has lately been touted as an anti-craving agent for various chemical addictions is ibogaine ("Endabuse") (Lotsof, 1985; Lotsof, 1986; Lotsof, 1989; Lotsof, 1991). Extracted from the West African shrub Tabernanthe iboga, this indolealkylamine's effect is reported to last 24 to 38 hours (Sheppard, 1994). Contrastingly, Lotsof claims a duration of only 10-15 hours at 20mg/kg of body weight (1995). Anecdotal reports describe a lasting benefit of weeks to months in many human subjects given ibogaine. Although without controls, Sheppard (1994) reports that out of seven daily heroin users (mean length of addiction 7.4 years), two remained drug free for "a number of weeks" and three remained drug free for 14 weeks or more; this, after being given one dose of ibogaine (700-1800 mg).

Most of the research into ibogaine have been pre-clinical. A significant decrease in cocaine self administration by Wistar rats was found after receiving ibogaine (40 mg/kg IV) (Cappendijk and Dzoljic, 1993). This effect lasted for more than 48 hours, and the researchers found that a longer positive response would occur after three daily doses were given. Moreover, cocaine self-administration diminished in a consistent trend in those rats infused with one 40 mg/kg dose each week for three weeks. In another study (Sershen, Hashim, and Lajtha (1993), cocaine intake

diminished 38% for five days ($p<0.05$) after C57BL/6By mice were given two 40 mg/kg doses IV. This strain had been chosen for its noted susceptibility to cocaine dependence.

Similar findings have been obtained with opiate dependence. One research group (Glick et al., 1991) reported that Sprague-Dawley rats significantly decreased their self-administration of morphine after a single dose of ibogaine (2.5-80 mg/kg) lasting up to weeks. Other rats showed a similar response only after two to three weekly injections. In another study with Sprague-Dawley rats (Maisonneuve, Keller, and Glick, 1991), ibogaine was noted to cause a decrease in dopamine levels in the striatum ($p<0.05$) to near baseline (pre-opiate) levels. The dopamine metabolites, homovanillic acid and 3,4-dihydroxyphenylacetic acid, were similarly reduced in the striatum, prefrontal cortex and nucleus accumbens ($p<0.05$). Numerous studies (Heikkila, Orlansky, and Cohen, 1975; Wise and Bozarth, 1982; Mathems and German, 1984; Mereu, Gadda, and Gessa, 1984; Clarke et al., 1985; Parker and Cubeddu, 1986; Di Chiara and Imperato, 1988; Moghaddam and Bunney, 1989), as noted by Maisonneuve, Keller, and Glick (1991), have shown addictive drugs (opiates, stimulants, nicotine, and alcohol) to cause an increase in dopamine levels in certain discrete regions of the brain. These authors further suggest that this effect of ibogaine "may decrease the reinforcing efficacy of morphine" (1991).

Animal studies with ibogaine have also shown a decrease in some physical withdrawal signs from morphine (Dzoljic, Kaplan, and Dzoljic, 1988; Aceto et al., 1989; Glick et al., 1991; Glick et al., 1992; Maisonneuve et al., 1992; Sershen et al., 1992), cocaine (Cappendijk and Dzoljic 1993), and amphetamines (Maisonneuve, Keller, and Glick, 1992). There might, however, be a cause for some concern about ibogaine in a way that has not been demonstrated for the other hallucinogens. O'Hearn and Molliver (1993), for example, found ibogaine to cause degeneration of Purkinje cells in the parasagittal zones of the cerebellar vermis of Sprague-Dawley rats. These rats were given 100 mg/kg IV of ibogaine, which is four to five times greater than the suggested human dose. This invariably induced strong, high-frequency tremors, as well. The authors also admit they had yet to determine whether this toxicity is dose-related. Still, could such harm be avoided with a shorter acting, non-tremor inducing hallucinogen? No research has been published on other hallucinogens having any anti-withdrawal potential.

PSYCHEDELIC-PEAK THERAPY

> For reasons not sufficiently understood, alcoholics and drug addicts seem to respond better to large-dose psychedelic therapy than do the other diagnostic categories, which require repeated drug administrations with the systematic working through of problems (Grof, 1970).

Pahnke et al. (1970) describe this positive post-hallucinogen experience as an afterglow occurring in subjects

after they have a transcendent "psychedelic" event from relatively high dosing.

> If a psychedelic-peak experience has been achieved and stabilized during the session, a clinical picture which we have termed the psychedelic afterglow can be observed in the days after the session. Mood is elevated and energetic; there is a relative freedom from concerns of the past and from guilt and anxiety, and the disposition and capacity to enter into close interpersonal relationships is enhanced. These psychedelic feelings generally persist for from two weeks to a month and then gradually fade into vivid memories that hopefully will still influence attitude and behavior. During this immediate postdrug period, there is a unique opportunity for effective psychotherapeutic work on strained family or other interpersonal relationships.

Interestingly, Albaugh and Anderson (1974) attest to observing such an afterglow lasting seven to 10 days in Native American alcoholics who partake in the peyote meetings of the Native American Church. Others have also noted the anti-addictive potency of participation in this religion's peyote ceremonies (La Barre, 1970; Roy, Choudhuri, and Irvine, 1970; Roy, 1973).

Savage and McCabe (1973) noted in their study that of the 13 narcotic addicts who had perfect community adjustment scores after one year, 12 had psychedelic-peak responses to LSD. Furthermore, Pahnke et al. (1970) and Kurland et al. (1971) investigated whether improvement occurred to a greater degree in those alcoholic patients who reported a "psychedelic-peak" experience through high dose therapy. An actual randomly assigned, double-blind protocol with controls was conducted (N = 117). Subjects in the experimental group received a single 350 μg to 450 μg dose of LSD as opposed to

only 50 μg administered to controls. Independent evaluators observed a statistically significant ($p<0.05$) improvement in global adjustment and drinking behavior on six-month follow-up when comparing these two groups: 53% of the high-dosage group were "greatly improved" as opposed to only 33% of the low-dosage group. After 18 months no differences were found between these two groups. Once again we find a significant anti-addictive benefit lasting several months.

Pahnke and colleagues laid the groundwork for showing wherein may lie the therapeutic potential of the hallucinogens in the treatment of addictions. Namely, could it be the "afterglow" that is the source of therapeutic benefit? What would occur if a series of treatments were spaced to provide a sustained "afterglow"? Would the patient have the motivation to deal more effectively with his addiction? Are the positive results with ibogaine simply another example of the anti-addictive force of an afterglow from a peak experience induced by a potent hallucinogen? If such is true, then the anti-addictive qualities are not restricted to ibogaine or even LSD. Alternately, one must wonder if it is necessary for the subject to be conscious of the hallucinogenic experience for it to be efficacious. Whould an afterglow remain after an amnestic and hypnotic are used with a hallucinogen? It may also be prudent to question whether the positive results with ibogaine and other hallucinogens are due to their modulation at various 5-HT receptors or at other sites. Co-administration of a

hallucinogen with specific serotonin agonist/antagonists could refine our understanding, then, of 5-HT's role in addiction. And what of forms of psychotherapy beyond the psychedelic model (Grinspoon and Bakalar, 1986; Grof, 1994)? Much used to be made of psycholytic therapy in which a psychoanalytic approach was taken in conjunction with repeated, low-dose (25 to 100 μg) LSD sessions. Would a combination of therapies provide higher yields (Strassman, 1995)? Again, all such possibilities have yet to be explored.

The difficulty with LSD, from a clinical standpoint only, is twofold. First, its effects are lengthy: 10-12 hours with a 200 μg dose or more. Second, a high dose of LSD (450+ μg) does not consistently induce "profound, or marked psychedelic-peak reactions": only 68% (N = 82) of alcoholic subjects attained such a state (Pahnke et al., 1970). Kurland et al. (1967), through careful preparation of the patient and control of setting, were able to induce peak experiences with LSD 75% of the time (N = 69). If the therapeutic effect of hallucinogens is contingent on the induction of a "psychedelic" experience and resultant two-week to two-month "afterglow," then what is needed is a shorter-acting compound that can more consistently provide such a reaction. Ibogaine, as stated before, is even longer acting than LSD. Further, there have been no studies into an induction of a "peak experience" with ibogaine. The point, however, is that, whether or not ibogaine's anti-addictive effect is due to an induction of a peak experience, the related hallucinogens

might have anti-addictive properties with a better side-effect profile and duration of action.

THE POTENTIAL OF TRYPTAMINE HALLUCINOGENS

The tryptamine class of indolealkylamine hallucinogens could be therapeutic as well as possess these more ideal characteristics. Tryptaminergic agents known to have hallucinogenic activity include N,N-Dimethyltryptamine (DMT), N,N-Diethyltryptamine (DET), and N,N-Dipropyltryptamine (DPT) (Szara, Hearst and Putney, 1962; Rosenberg, Isbell and Miner, 1963; Rosenberg, Isbell, Miner and Logan, 1964; Faillace, Vourlekis, Szara, 1967). DMT has particularly attracted attention recently and is known to be the hallucinogenic ingredient of several indigenous potions of the Amazon (Schultes and Hofmann, 1992). Strassman and Qualls (1994), in a double-blind, placebo-controlled, randomized study (N = 12), generated dose-response values for DMT. Human doses can be fully hallucinogenic with as low as 0.2 mg/kg IV, and at 0.4 mg/kg IV it appears to induce marked psychedelic-peak experiences as noted with LSD (Strassman et al., 1994). Furthermore its effects almost completely wear off within 30 minutes, making it possible to easily treat someone in an outpatient setting. These dose-response studies show as well that DMT can be safely administered to experienced hallucinogen users. As for ibogaine, no comparable human data have yet been compiled.

DPT has also been examined in pilot work for the treatment of alcoholism (Grof, Soskin, Richards, and Kurland,

1973). DPT has a duration of action of four to six hours at 60 to 150 mg IM. Although virtually all of the patients (N = 51) reported "very profound and dramatic experiences," a later pilot study (Richards et al., 1977) found only 44% (N = 34) had a "psychedelic-peak" experience (mean dose 101.7 mg IM). Mean length of alcoholism in the former study was 10.4 years (range 2 to 25 years). Most impressive is that of the 47 patients found at six-month follow-up, a significant percentage was deemed "essentially rehabilitated" with 53.2% reported as abstinent. Although not randomized and without controls, the initial data give some additional indication of safety with this drug at the doses used. Its use in alcoholics was also found to be similar to the researchers' prior work with LSD (Pahnke et al., 1970; Kurland et al, 1971; Savage and McCabe, 1973; Grof, Goodman, Richards, and Kurland, 1973). It would appear then that the shorter acting tryptamine hallucinogens might be comparably efficacious or even more so than LSD in the treatment of alcoholism. In that they are so short acting, it may be possible to perform multiple inductions within the time frame of one session. The question arises, however, as to whether or not tolerance would ensue. Strassman (1995) and Gillin, et al. (1973) state that tolerance to DMT is not achieved, although there are reports that claim otherwise (Kovacic B, Domino EF, 1974; Domino EF, 1976). Much, of course, needs to be done.

CONCLUSION

Addiction, as a disease defined by DSM-IV (1994), often has a chronic and cyclical nature. The problem addict, diagnosed with moderate to severe psychoactive drug dependence, is committed to his substance use: he faces the world with a deep drive to seek out what he needs. It can be a long road that spirals ever downward before death or abstinence is attained. Attempts at quitting frequently end in failure because there is no treatment that effectively curbs craving for an extended period of time. Merely wishing to quit quickly turns out to be unavailing when one feels powerless over a drug dependence, be it heroin, cocaine, or alcohol. Were it possible to moderate chemically this sense of craving, the addict could be provided with an additional, independent tool to help regain some measure of control and perhaps achieve abstinence. With continued abstinence, craving hopefully diminishes to a manageable level. Hallucinogen therapy might bridge this time gap by lessening the craving which can be so overpowering in early efforts at recovery. Indeed, our review of the literature reveals a potential that is perhaps mediated through serotonin modulation resulting in a time-limited afterglow. The research with ibogaine should continue, but other agents with a more useful profile, such as DMT, should be tested as well. There are numerous hallucinogens to be examined and many yet to be discovered. Future research could also lead us to a clearer understanding of the mechanisms of craving in addiction. In a nation that has for over 20 years made

available to opiate addicts the alternative of methadone, is it not reasonable to again investigate hallucinogens for an antidote to the underlying affect that drives substance addiction?

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