Psilocybin at the End of Life

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DISCLOSURE OF FINANCIAL RELATIONSHIPS

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  - National Institute for Mental Health

- None of my slides and/or handouts contain any advertising, trade names or product-group messages. Any treatment recommendations I make will be based on clinical evidence or guidelines.

LA BioMed
Los Angeles Biomedical Research Institute at Harbor-UCLA Medical Center

Overview

- Ethnobotany
- Anthropology
- Chemistry and toxicity
- Clinical research
- Using hallucinogens with cancer patients
- Current research
- Methodology & approval process
- Study Results

The Ethnobotany of Psilocybin

Psilocybe zapotecorum Heim

Psilocybe cubensis (Earle) Singer

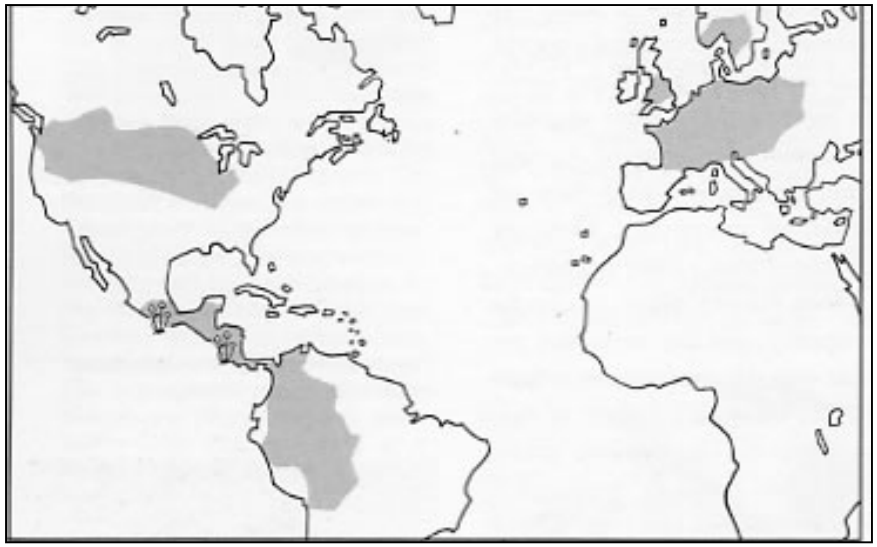
Psilocybe caerulescens Murrill var. *nigripes* Heim

Conocybe siligineoides Heim

Psilocybe caerulescens Murrill var. *mazatecorum* Heim

Psilocybe mexicana Heim

Psilocybe aztecorum Heim



- 186 known psilocybin species
- Increasing distribution

Distribution of Psilocybin Mushrooms

Found in most parts of the world

- Affection for “disturbed areas”
- Follow human expansion
- Found where people congregate

Co-evolved with humans

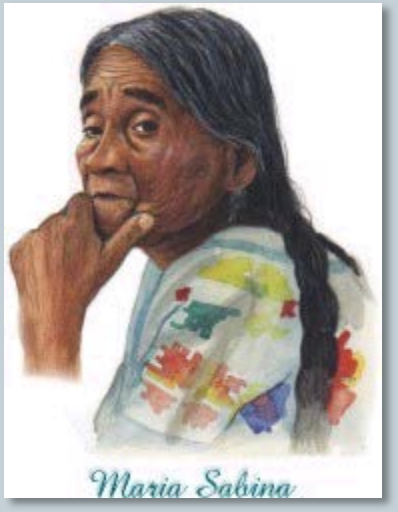
(Domestication of cattle)

The Anthropology of Psilocybin

Gold Pectorals from the Sinú culture of Colombia
(1200 - 1600 c.e.)

The Anthropology of Psilocybin

- Mesoamerican healers



"The course of human history has been dramatically affected by the use of psilocybin mushrooms and will continue to be for years to come."

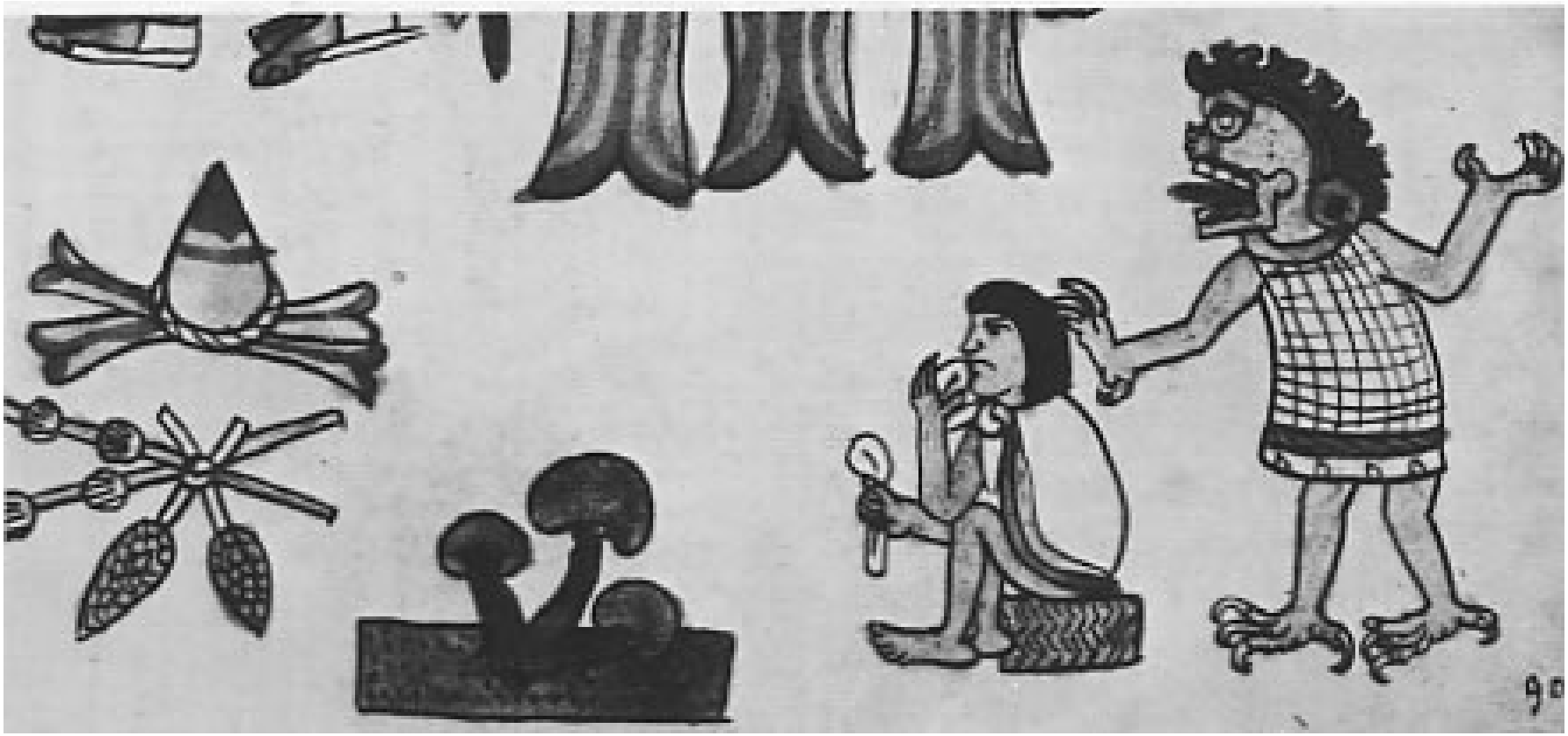
— Paul Stamets

The Anthropology of Psilocybin

"And when the effects of the mushrooms had left them, they consulted among themselves and told one anther what they had seen in vision."

From *The Florentine Codex* by Bernardino de Sahagún (circa 1600)

Repression of Plant Hallucinogens



The Holy Inquisition of Mexico (1616)

Proclamation condemning the use of plant hallucinogens in the new world

Repression of Plant Hallucinogens

Then in 1629, Hernando Ruiz de Alarcon (a Spanish Inquisitor), wrote of the idolatries he had observed when the native Indians consumed their ritual hallucinogens: "which when drunk **deprive of the senses**, because it is very powerful, and by this means they **communicate with the devil**, because he talks to them when they are **deprived of judgment** with the said drink, and **deceive them** with different hallucinations, and they attribute it to a god they say is inside the seed . ."

The Anthropology of Psilocybin

Sacramental use for 7,000+ years

- Religious and medicinal uses
- Used by widely diverse cultures
- Influenced religion, philosophy, art

The Anthropology of Psilocybin

Seeking The Magic Mushroom
by
R. Gordon Wasson

"A New York banker goes to Mexico's mountains to participate in the age-old rituals of Indians who chew strange growths that produce visions."

The Anthropology of Psilocybin

R. Gordon Wasson

A New York Banker and a
Mexican Shaman
bring psilocybin into the modern age.

Maria Sabina gives Wasson a mushroom

The Anthropology of Psilocybin

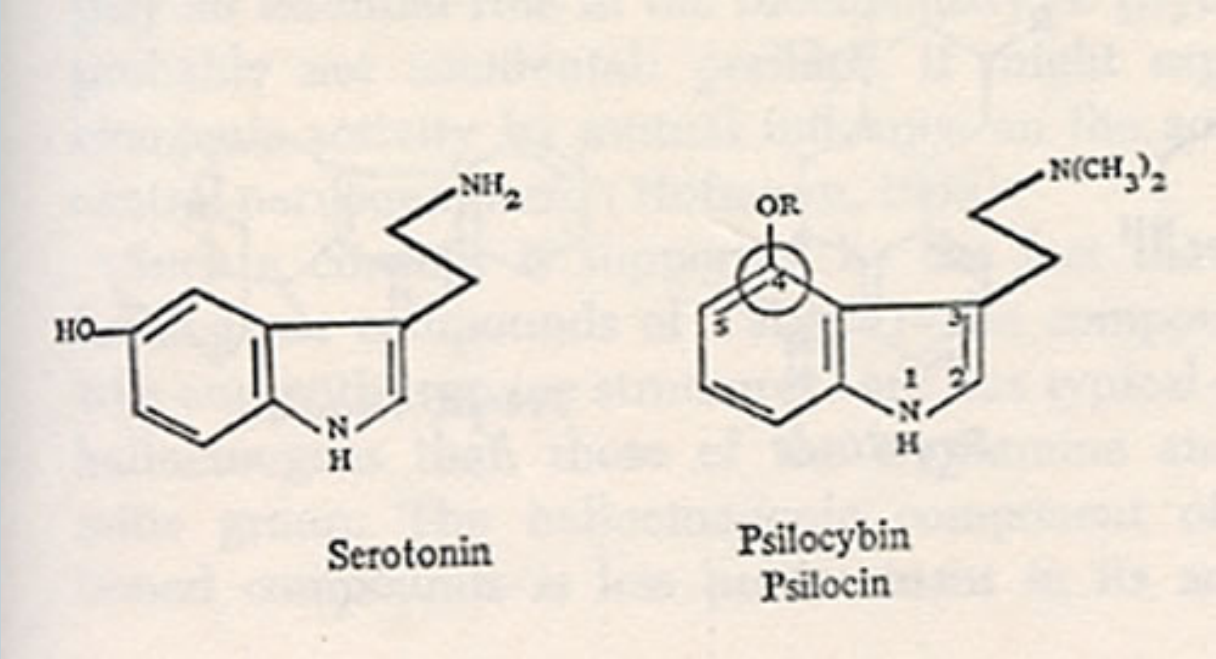
"Geometric patterns, angular not circular, in richest colors, such as might adorn textiles or carpets. Then the patterns grew into architectural structures, with colonnades and architraves, patios of regal splendor, the stone-work all in brilliant colors, gold and onyx and ebony, all most harmoniously and ingeniously contrived, in richest magnificence extending beyond the reach of sight, in vistas measureless to man . . . They seemed to belong . . . to the imaginary architecture described by the visionaries of the Bible".

- Wasson in *Life* Magazine, 1957

Range of Effects

"Mental effects of mushroom poisoning"
by the mycologist Worthington Smith, published in
The Graphic, 15 November 1873.

The Chemistry of Psilocybin



The Chemistry of Psilocybin

- $C_{12}H_{17}N_2O_4P$
- Tryptamine family of indoles
- Close resemblance to serotonin
- Low toxicity

The Chemistry of Psilocybin

- 4-phosphoryloxy-N,N-dimethyltryptamine
- Substituted indolealkylamine/hallucinogenic tryptamine
- 5-HT 2A and 5-HT 2C receptor agonists
- Medium dose psilocybin (12-20 mg.) produces a well-controlled altered state of consciousness.
- Effects last from 4 to 6 hours

The Chemistry of Psilocybin

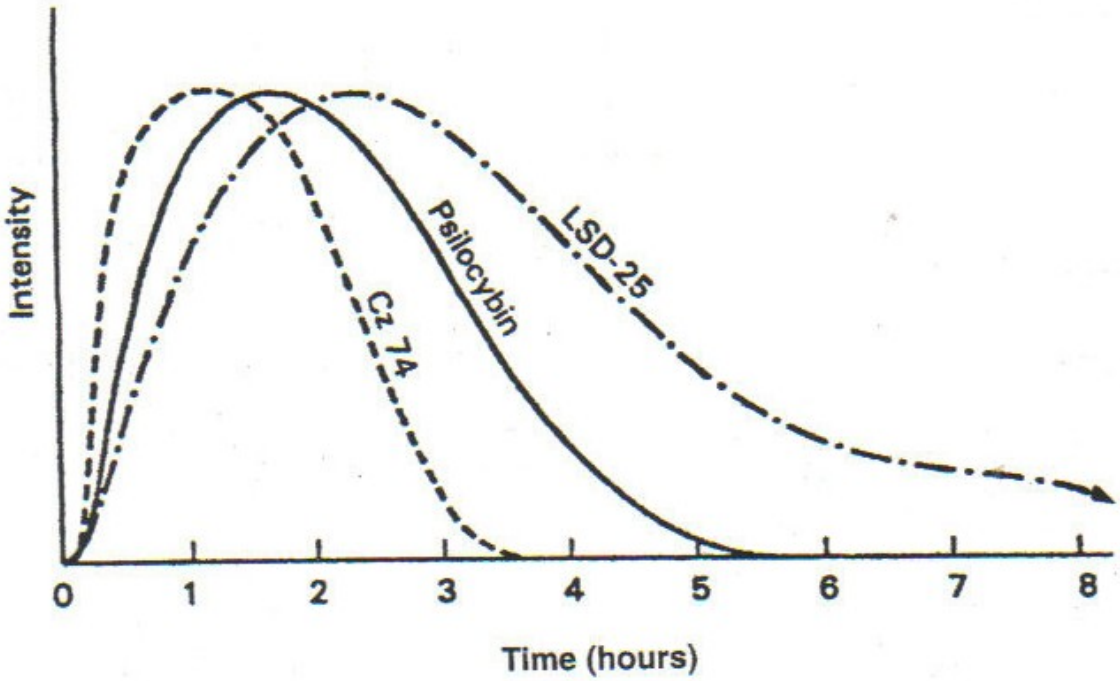


Figure 3. *Course of clinical effects of LSD, psilocybin and CZ-74 (a psilocybin-derivative).*[13]

The Chemistry of Psilocybin

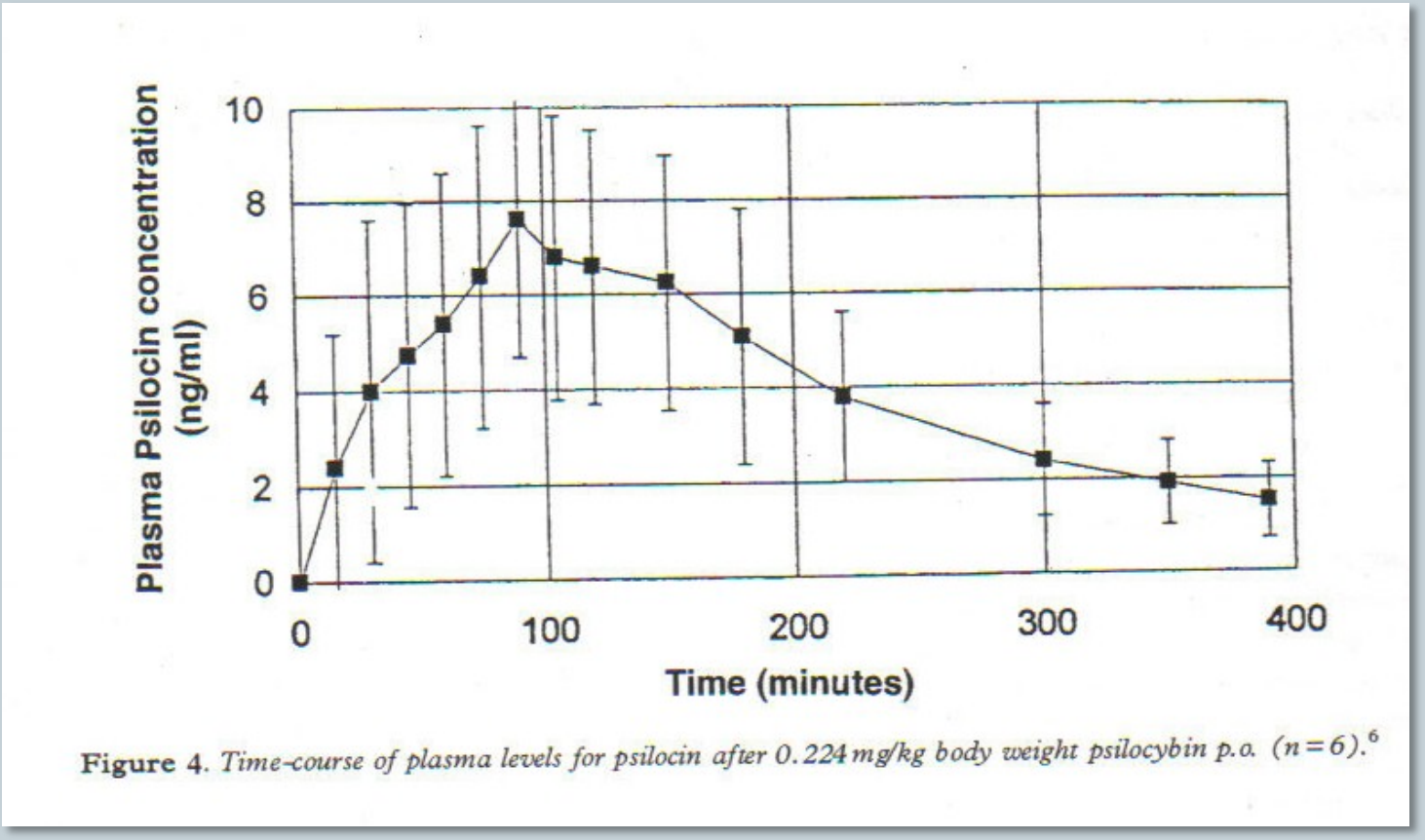


Figure 4. *Time-course of plasma levels for psilocin after 0.224 mg/kg body weight psilocybin p.o. (n = 6).*[6]

The Chemistry of Psilocybin

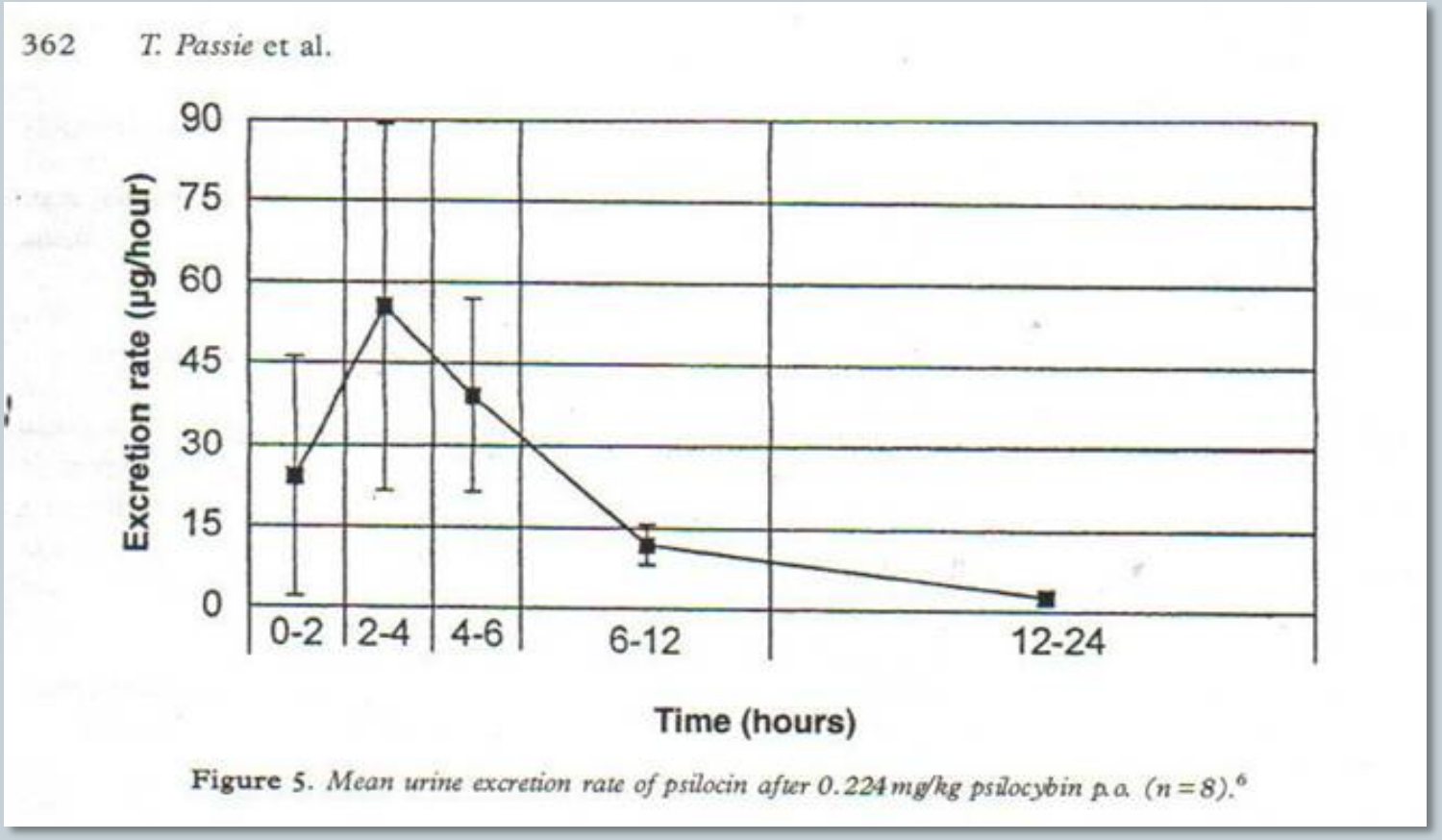


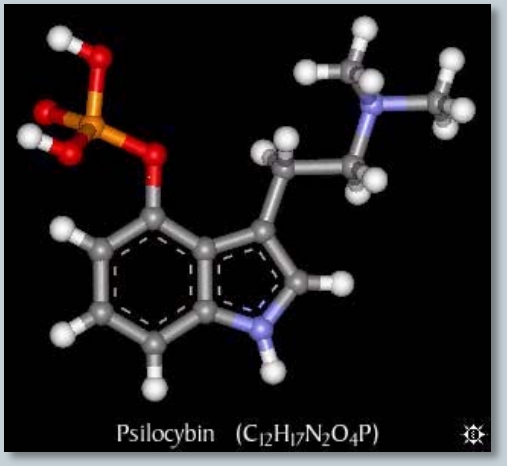
Figure 5. *Mean urine excretion rate of psilocin after 0.224 mg/kg psilocybin p.o. (n = 8).*[6]

The Chemistry of Psilocybin

The psilometric scale of comparative potency of selected *Psilocybe* mushrooms

SPECIES	% PSILOCYBIN	% PSILOCIN	% BAEOCYSTIN	REFERENCE
P. azurescens	1.78	.38	.35	Stamets and Gartz 1995
P. bohemica	1.34	.11	.02	Gartz and Muller 1989; Gartz (1994)
P. semilanceata	.98	.02	.36	Gartz 1994
P. baeocystis	.85	.59	.10	Repke et al. 1977; Beug and Bigwood 1982(b)
P. cyanescens	.85	.36	.03	Stijve and Kuyper 1985; Repke et al. 1977
P. tampanensis	.68	.32	n/a	Gartz 1994
P. cubensis	.63	.60	.025	Gartz 1994; Stijve and de Meijer 1993
P. weilii (nom. prov.)	.61	.27	.05	
P. hoogshagenii	.60	.10	n/a	Heim and Hofmann 1958
P. stuntzii	.36	.12	.02	Beug and Bigwood 1982 (b); Repke et al. 1977
P. cyanofibrillosa	.21	.04	n/a	Stamets et al. 1980
P. liniformans	.16	n/d	.005	Stijve and Kuyper 1985

The Toxicity of Psilocybin



- Mice survived 200 mg/kg
- ED50:LD50 ratio of 641 (compare with aspirin - 199, nicotine - 21)

"You would have to eat your own body weight in one sitting to ingest a toxic dose of psilocybe mushrooms."

— Paul Stamets

Subjective Effects of Psilocybin

This state is marked by:

- Stimulation of affect
- Enhanced ability for introspection
- Similar to dream and hypnogogic states
- Perceptual changes (e.g., illusions, synaesthesias, affective activation and alterations of thought and time)

Subjective Effects of Psilocybin

Characteristics Of The Psychedelic Peak Experience (Pahnke and Richards, 1966)

- Sense of unity or oneness
- Transcendence of time and space
- Deeply felt positive mood
- Sense of awesomeness and reverence

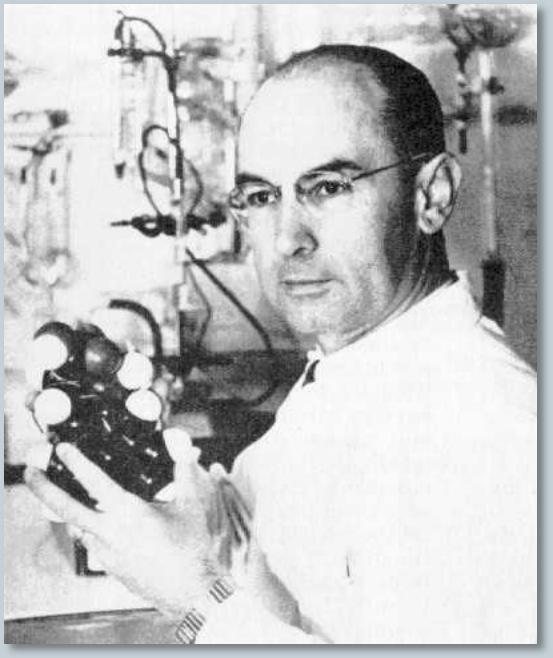
Subjective Effects of Psilocybin

Characteristics Of The Psychedelic Peak Experience (Pahnke and Richards, 1966)

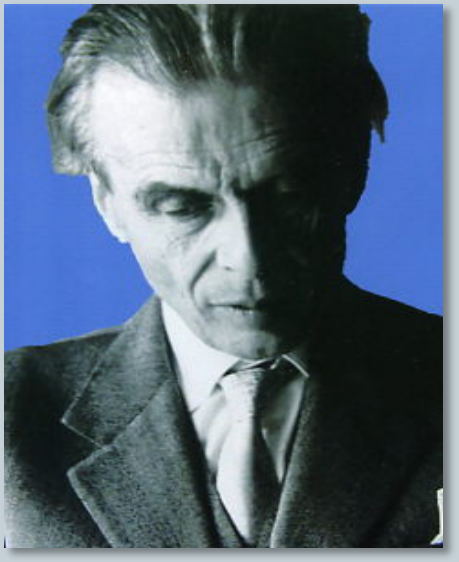
- Meaningfulness of psychological and/or philosophical insight
- Ineffability
- Paradoxicality
- Transiency

Clinical Research: 1943 - 1973

Dr. Albert Hofmann



Aldous Huxley



Clinical Research

"Over a thousand clinical papers were published in the professional literature discussing the experiences of 40,000 patients treated with hallucinogens."

— Grinspoon and Bakalar, 1979

Clinical Research

Treatment applications included:

- Alcoholism and drug addiction
- Psychosomatic disorders
- Chronic post-traumatic stress
- Obsessive-compulsive disorder
- Anti-social behavior
- Autism
- Existential anxiety in terminal cancer

Hallucinogens for Advanced-Stage cancer anxiety

Patients with Advanced-Stage cancer

- The final months of life are marked by increasing physical and emotional suffering.
- As the patient approaches death, he/she usually experiences various degrees of depression, anxiety, and psychological isolation.

Patients with Advanced-Stage cancer

- The prospect of death often leads to feelings of defeat, helplessness, and despair in members of the patient's family and attending medical personnel.
- Heroic efforts are frequently undertaken in an attempt to increase the ***quantity*** of days in the patient's life.
- Little may be done to enhance the ***quality*** of intrapersonal and interpersonal life during the final months.

Patients with Advanced-Stage cancer

Kast, Eric C. 1964.
Lysergic acid diethylamide as an analgesic agent in cancer patients, *Anesthesia and Analgesia*, 43:285-291.

- Several hundred advanced-stage cancer patients studied
- No preparation
- Superior analgesia compared to hydromorphone and meperidine (several days as opposed to several hours)
- Pain reduced for several weeks
- Theory of “attenuation of anticipation”
- Additional findings included: relief of depression, improved sleep, lessened fear of death
- The occurrence of “happy, oceanic feelings” lasting up to 12 days following treatment.

Patients with Advanced-Stage cancer

Pahnke, Walter N. 1969.
The psychedelic mystical experience in the human encounter with death. *Harvard Theological Review,* 62:1-21.

- 17 dying patients administered LSD after appropriate therapeutic preparation.
- Variables examined included “tension”, depression, pain and fear of death.
- One-third improved “dramatically”.
- One-third improved “moderately”.
- One-third unchanged.

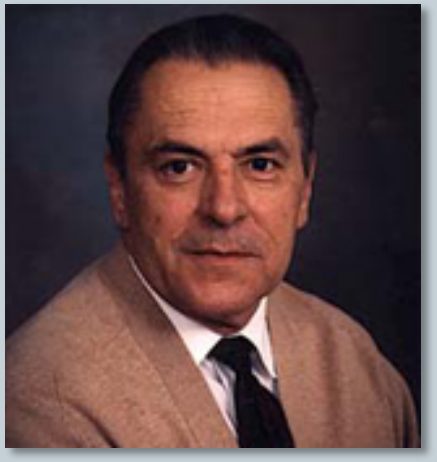
Patients with Advanced-Stage cancer

Pahnke, Walter N. 1969.
The psychedelic mystical experience in the human encounter with death. Harvard Theological Review 62:1-21.

"The most dramatic effects came in the wake of a . . .mystical experience."

- Decrease in fear, anxiety, worry and depression
- Sometimes, need for pain medications lessened mainly because the patient was able to tolerate pain more easily
- Increase in serenity, peace, and calmness
- Decrease in the fear of death

Patients with Advanced-Stage cancer



Grof, Stanislav et al. 1973.
LSD-assisted psychotherapy in patients with terminal cancer.
International Pharmacopsychiatry , 8:129-144.

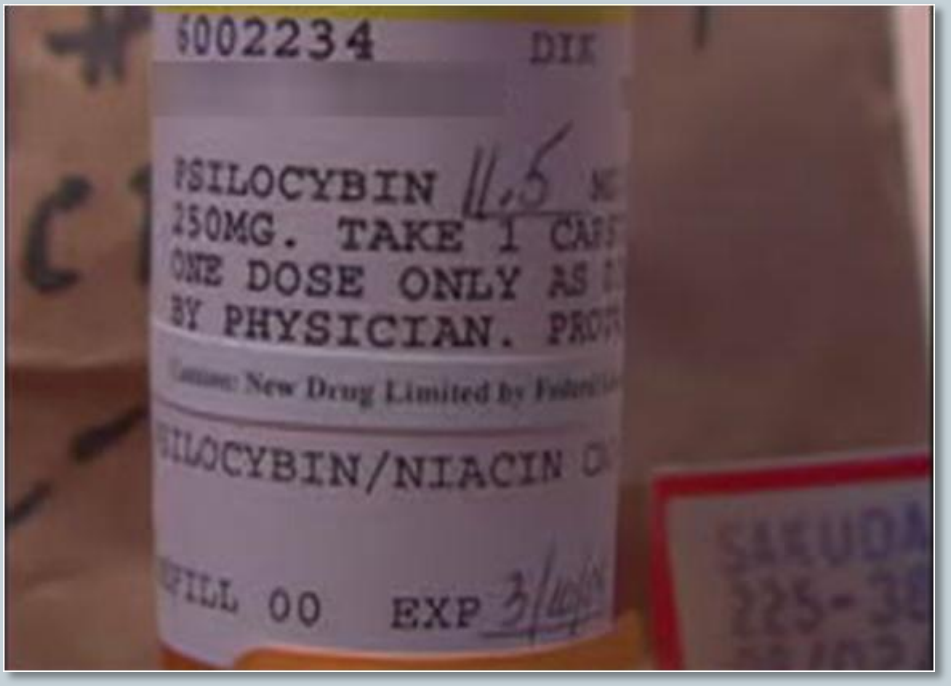
- 60 terminal cancer patients studied pre and post-treatment.
- 29% dramatically improved
- 41.9% moderately improved
- 22.6% unchanged
- 6.4% had global indexes showing a decrement in post-treatment ratings

Patients with Advanced-Stage cancer

Grof, Stanislav et al. 1973.
LSD-assisted psychotherapy in patients with terminal cancer.
International Pharmacopsychiatry 8:129-144

- Changes in the attitude toward and concept of death
- Increased acceptance of death usually followed sessions in which the patients reported deep religious and mystical experiences
- Improvement of the emotional condition and relief of pain frequently observed even after sessions with predominantly psychodynamic content

Current Research with Psilocybin



Clinical Effects of Psilocybin

Positron Emission Tomography and Fluorodeoxyglucose Studies of Metabolic Hyperfrontality and Psychopathology in the Psilocybin Model of Psychosis

F. X. Vollenweider, M.D., K. L. Leenders, M.D., C. Scharfetter, M.D., P. Maguire, Ph.D., O. Stadelmann, Ph.D., and J. Angst, M.D.

The effects of the indolehallucinogen psilocybin, a mixed 5-HT_2 and 5-HT_1 agonist, on regional cerebral glucose metabolism were investigated in 10 healthy volunteers with PET and [F-18]-fluorodeoxyglucose (FDG) prior to and following a 15- or 20-mg dose of psilocybin. Psychotomimetic doses of psilocybin were found to produce a global increase in cerebral metabolic rate of glucose (CMRglu) with significant and most marked increases in the frontomedial and frontolateral cortex (24.3%), anterior cingulate (24.9%), and temporomedial cortex (25.3%). Somewhat smaller increases of CMRglu were found in the basal ganglia (18.5%), and the smallest increases were found in the sensorimotor (14.7%) and occipital cortex (14.4%). The increases of CMRglu in the prefrontal cortex, anterior cingulate, temporomedial cortex, and putamen correlated positively with psychotic symptom formation, in particular with hallucinatory ego disintegration. The present data suggest that excessive 5-HT_2 receptor activation results in a hyperfrontal metabolic pattern that parallels comparable metabolic findings associated with acute psychotic episodes in schizophrenics and contrasts with the hypofrontality in chronic schizophrenic patients.

[Neuropsychopharmacology, 16:357-372, 1997]

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Clinical Effects of Psilocybin

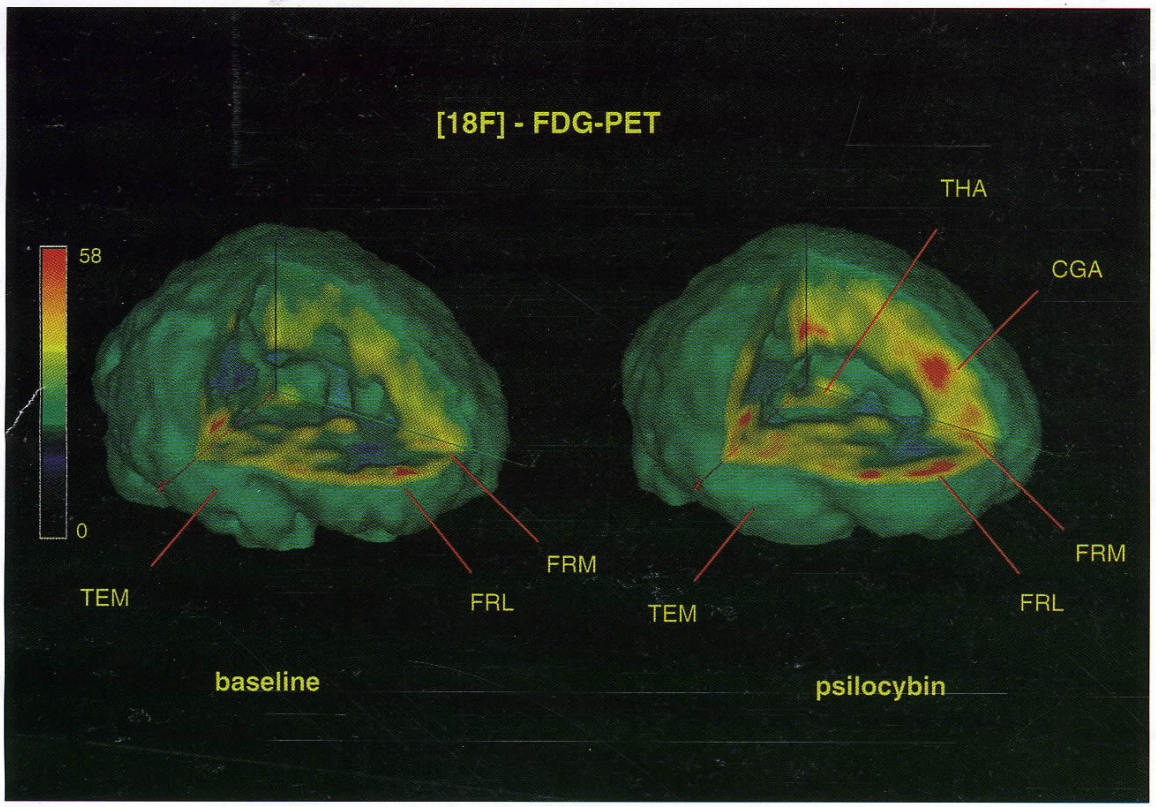


Figure 3. Two [18F]-FDG-PET images of the same subject under baseline (*left*) and psilocybin (*right*) conditions. Psilocybin administration (15–20 mg PO) resulted in a global increase of absolute cerebral metabolic rates of glucose (CMRglu: μmol/100 mg/min) with most marked increases in the frontomedial (FRM), frontolateral (FRL), cingulate anterior (CGA), and temporomedial cortices (TEM). Subcortical structures such as the caudate nucleus, putamen, and thalamus were less stimulated than cortical regions. No significant changes were observed in either temporal pole. Red > orange > yellow > green = lowest value of CMRglu; note that the surface of the brain is not color-coded.

Clinical Effects of Psilocybin

Figure 1: Mean Y-BOCS: Baseline & Lowest Score

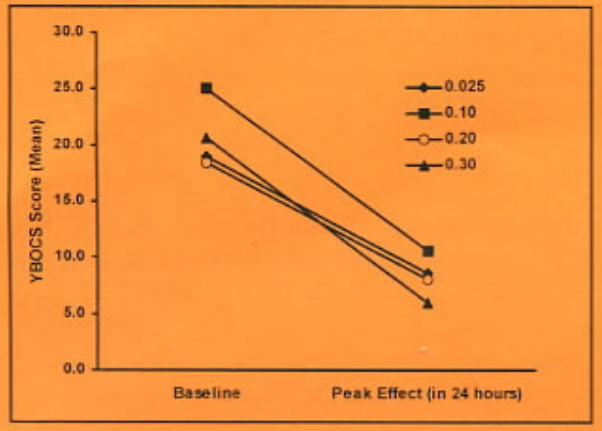


Figure 2: Mean Y-BOCS vs. Time (all points)

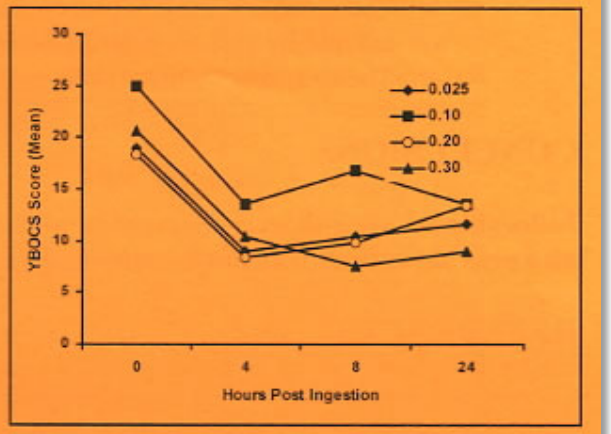


Figure 3: Mean VAS: Baseline & Lowest Score

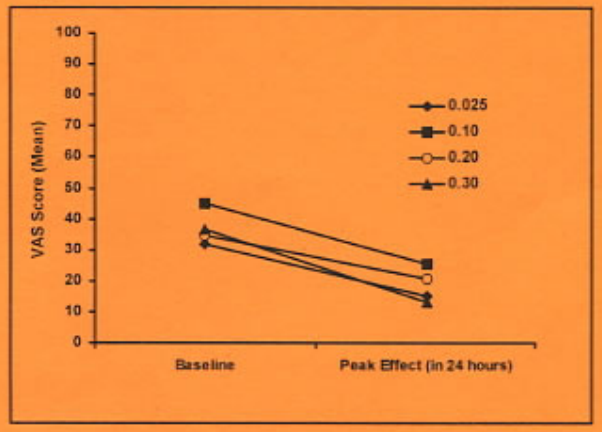
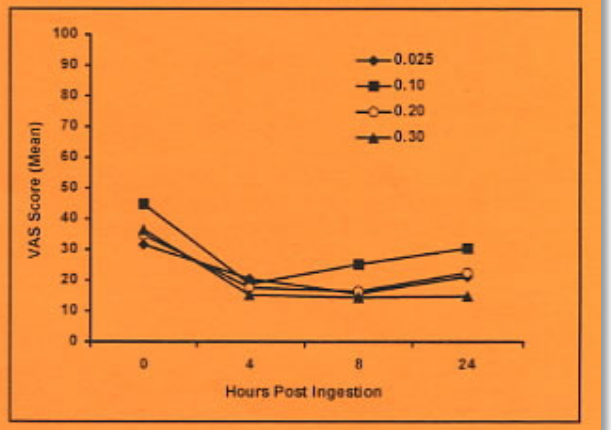


Figure 4: Mean VAS vs. Time (all points)



Clinical Effects of Psilocybin

Psychopharmacology
DOI 10.1007/s00213-006-0457-5

ORIGINAL INVESTIGATION

Psilocybin can occasion mystical-type experiences having substantial and sustained personal meaning and spiritual significance

R. R. Griffiths · W. A. Richards · U. McCann · R. Jesse

Received: 20 January 2006 / Accepted: 27 May 2006
© Springer-Verlag 2006

Results Psilocybin produced a range of acute perceptual changes, subjective experiences, and labile moods including anxiety. Psilocybin also increased measures of mystical experience. At 2 months, the volunteers rated the psilocybin experience as having substantial personal meaning and spiritual significance and attributed to the experience sustained positive changes in attitudes and behavior consistent with changes rated by community observers.

Conclusions When administered under supportive conditions, psilocybin occasioned experiences similar to spontaneously occurring mystical experiences. The ability to occasion such experiences prospectively will allow rigorous scientific investigations of their causes and consequences.

Study Methodology & Approval Process

Study Methodology & Approval Process

- 12 subjects
- Metastatic cancer
- Anxiety
- Ages 18 – 70

Study Methodology & Approval Process

Exclusion criteria included:

- CNS involvement
- Severe cardiovascular illness
- Treated baseline B.P. > 140/90 mm Hg.
- Abnormal hepatic and renal function
- Diabetes
- Lifetime hx. schizophrenia, bipolar disorder, other psychotic illness
- Anxiety or affective disorder within one year prior to onset of cancer

Study Methodology & Approval Process

Experimental treatment:

- Preparatory psychotherapy
- Double-blind, placebo-controlled methodology
- Niacin 250 mg.
- Psilocybin 0.2 mg/kg
- GCRC setting
- Follow-up evaluation and integration

Study Methodology & Approval Process

Hospital room used for study

(Before decorating)

Study Methodology & Approval Process

Hospital room used for study

(After decorating)

Study Methodology - Instruments

Instrument Chart Schedule	2 wks before	1 day before	Just before drug	4 hrs after	6 hrs after	1 day after	2 wks after	monthly X 6 mos
POMS-SR (Profile of Mood States-Brief)		X			X	X	X	X
STAI (Strait Trait Anxiety Inventory)		X			X	X	X	X
BDI (Beck Depression Inventory)		X				X	X	X
SDS (Symptom Distress Scale)		X				X	X	X
5D-ASC (Dittrich)					X			
BPRS (Brief Psychiatric Rating Scale)					X			
BPI-SF (Brief Pain Inventory-Short Form)	X	X				X	X	X
MSAS (Memorial Symptom Assmt Scale)	X	X				X	X	X

Study Methodology - Instruments

Instrument Chart Schedule	2 wks before	1 day before	Just before drug	4 hrs after	6 hrs after	1 day after	2 wks after	monthly X 6 mos
MSKCC (Sloan Kettering Pain Card)	Daily	Daily	X	X	X	Daily	Daily untill 2 wks after	
WHO QOL Bref 26 Qs		X					X	
WHOQOL-SRPB 32 Qs Additional-SRPB 12 Qs Importance-SRPB 11 Qs		X					X	
KAST 5Qs					X		X	
Extra Questions		X					X	

Advantages Of Psilocybin Over LSD

Psilocybin compared to LSD is:

- Gentler and less intense
- Induces an experience of shorter duration (4-6 hours, compared to LSD's 8-12 hours)
- Has a stronger visual component
- Induces more euphoria

Advantages Of Psilocybin Over LSD

Psilocybin compared to LSD is:

- Associated with fewer panic reactions
- Less chance of paranoia
- Less negative publicity
- Less likely to impede subject recruitment

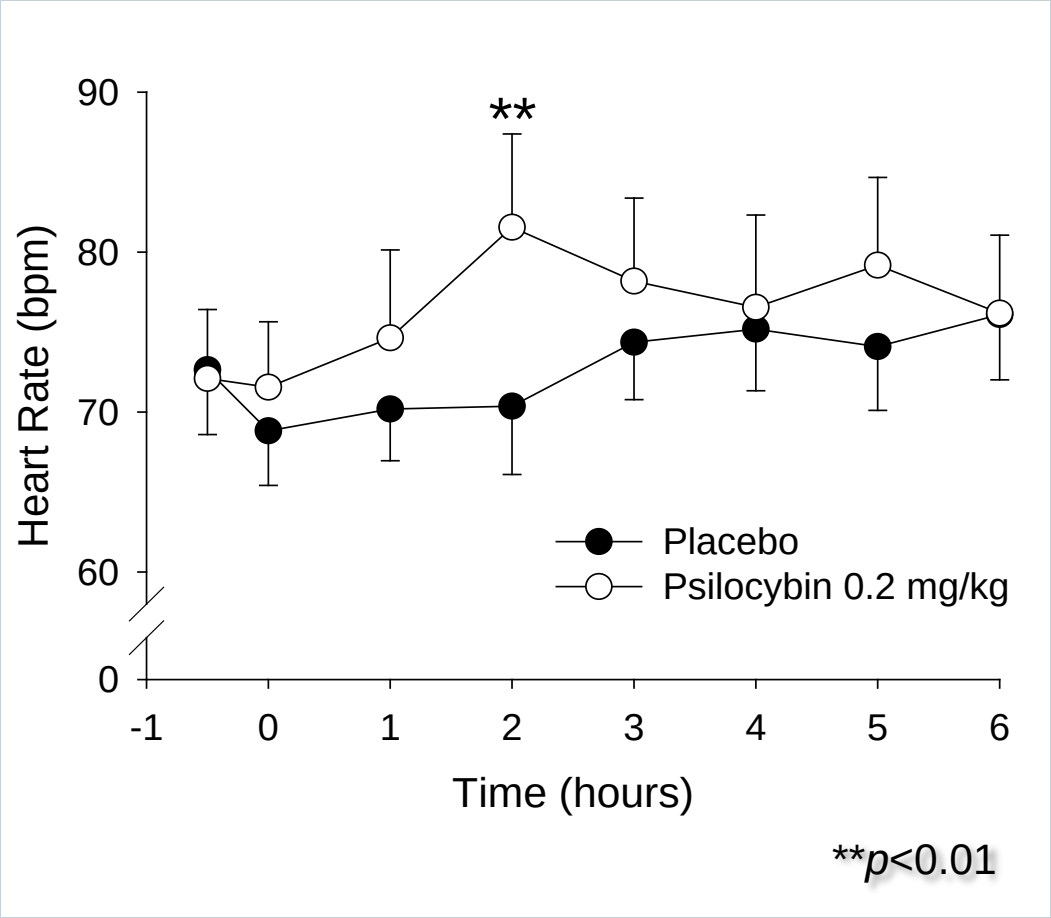
Regulatory Hurdles

- FDA
- DEA
- California Research Advisory Panel
- Harbor-UCLA IRB
- Harbor-UCLA GCRC

Demographics

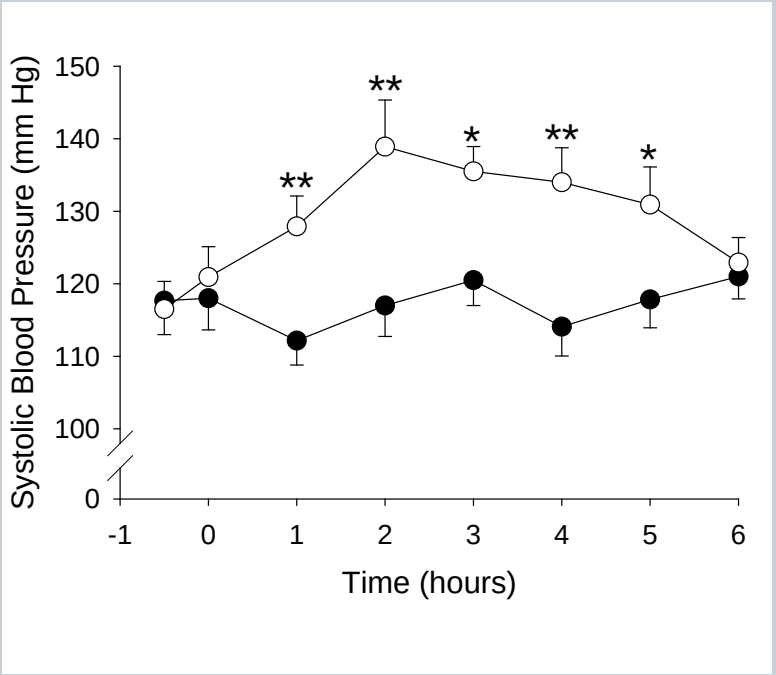
Subject #	Age	Gender	Primary Diagnosis	Duration Cancer	Metastatic Disease
1	54	Female	Peritoneal Cancer	2 yrs	Liver
2	58	Female	Colon Cancer	1 yr	Liver
3	57	Female	Colorectal Cancer	3 yrs	Lymphatic, Liver
4	52	Female	Ovarian Cancer	12 yrs	Lung, Liver
5	47	Female	Breast Cancer	2 mos	Bone, Eye
6	53	Female	Breast Cancer	17 yrs	Liver, Lung, Bone
7	49	Female	Breast Cancer	6 yrs	Lung, Bone
9	53	Female	Salivary Gland Cancer	18 yrs	Lung, Bone, Lymphatic
10	53	Female	Ovarian Cancer	5 yrs	Abdomen
11	54	Female	Breast Cancer	2 yrs	Liver, Lung, Bone
12	36	Male	Colon Cancer	1 yr	Liver, Lymphatic
13	49	Female	Multiple Myeloma	8 yrs	Abdomen, Tongue, Vagina

Heart Rate and Blood Pressure

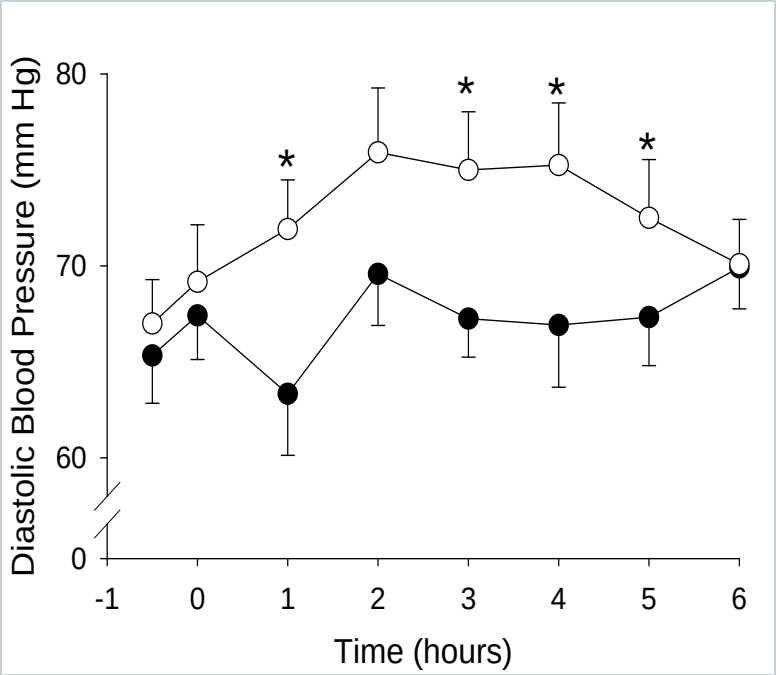


Heart Rate and Blood Pressure

Systolic



Diastolic



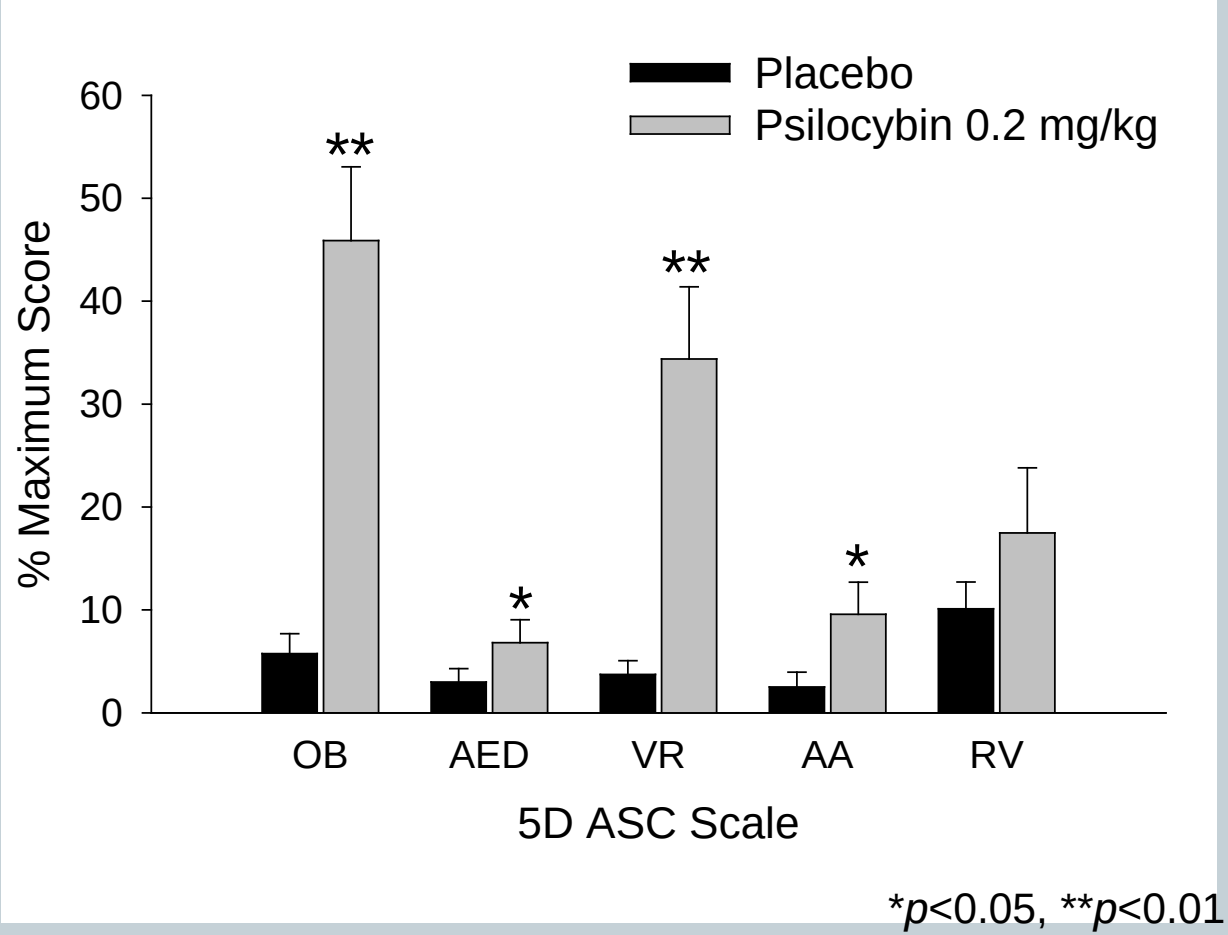
- ● Placebo
- ○ Psilocybin 0.2 mg/kg

*p<0.05, **p<0.01

24-Hour Cardiac Monitor

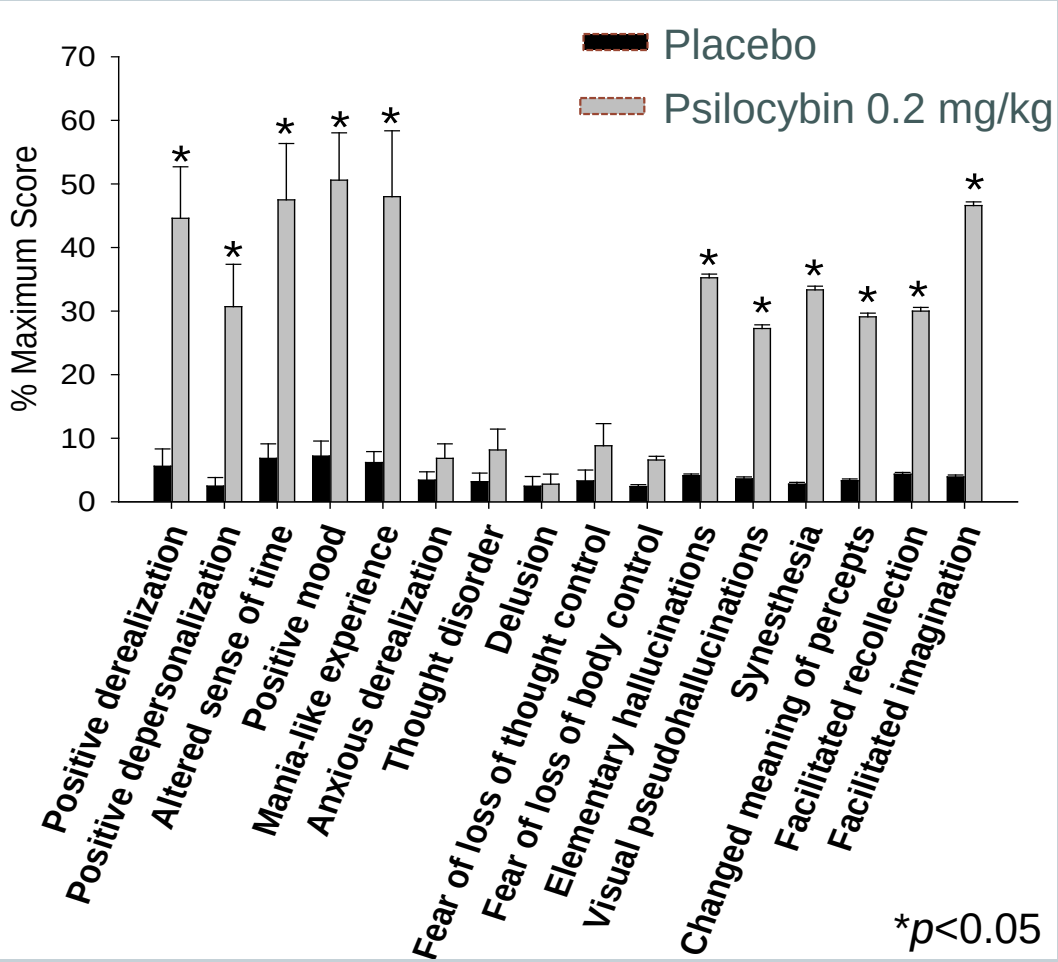
Subject #	Placebo (Niacin 250 mg)	Placebo (Niacin 250 mg)	Psilocybin (0.2mg/kg)	Psilocybin (0.2mg/kg)
	PACs	PVCs	PACs	PVCs
1	0	1	2	0
2	150	27	16	27
3	243	0	332	6 (one 5-beat run @11:11)
4	5	7	24	0
5	13	0	12	0
7	192 (one 7- beat run @11:32)	3	364	4
9	35	2	49	29
10	8	30	1	50
11	875	470	1764	62
12	3	1	5	0
13	11	2	10 (one 3-beat run @ 15:27)	0

5D-ASC

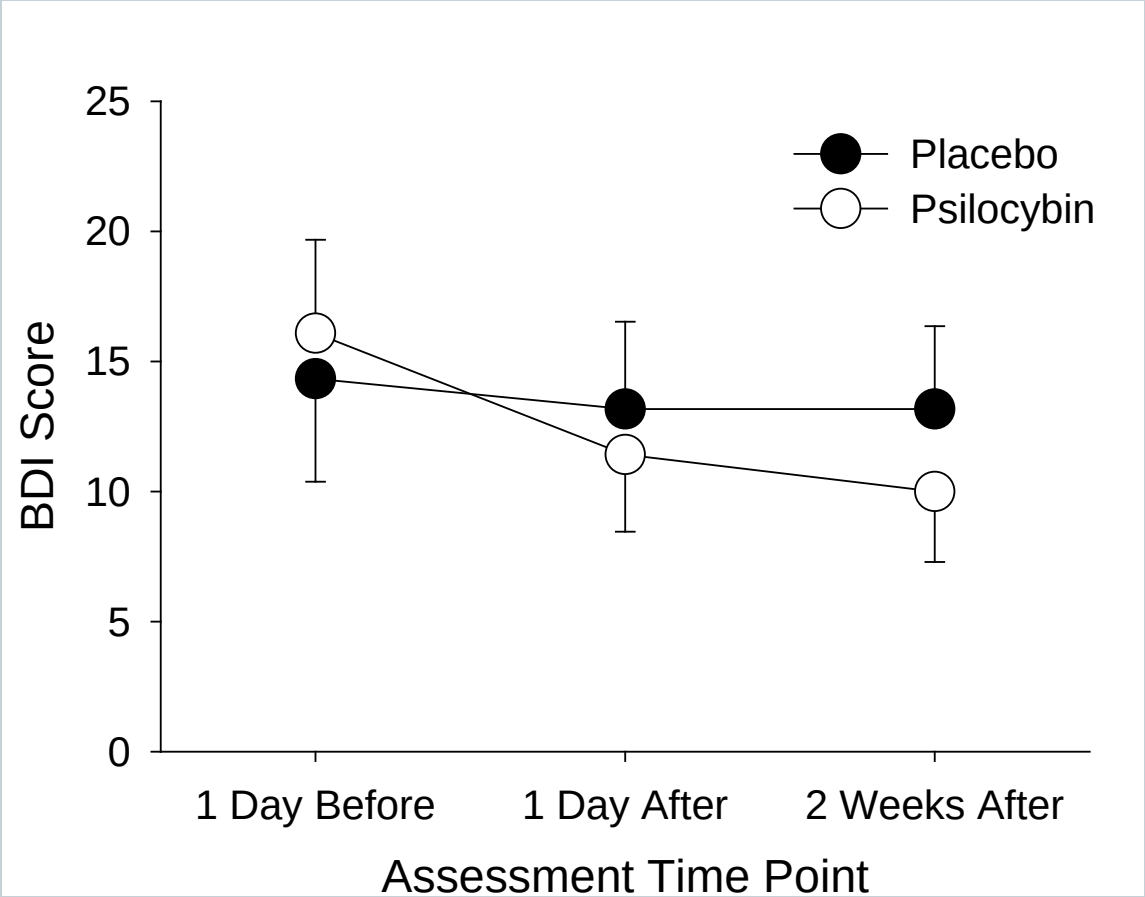


*p<0.05, **p<0.01

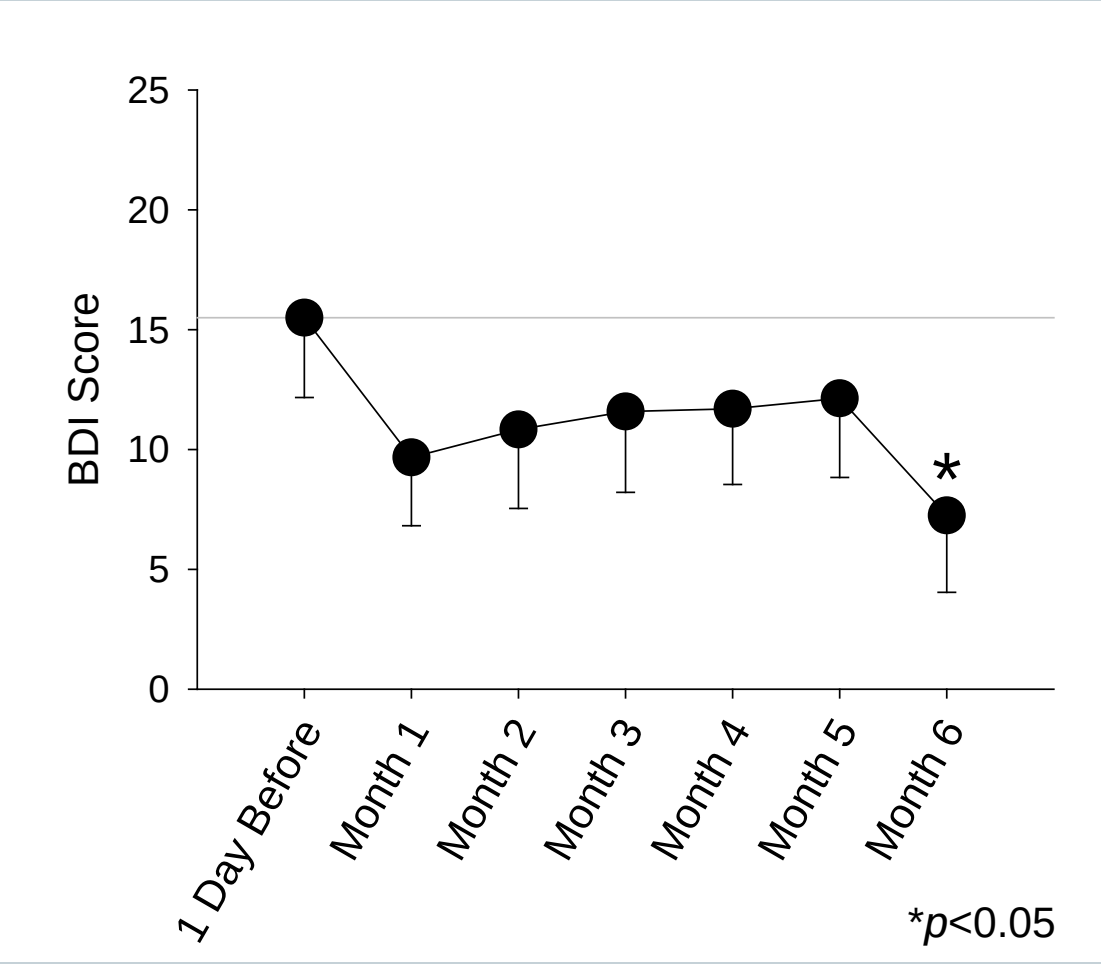
5D-ASC Subscales



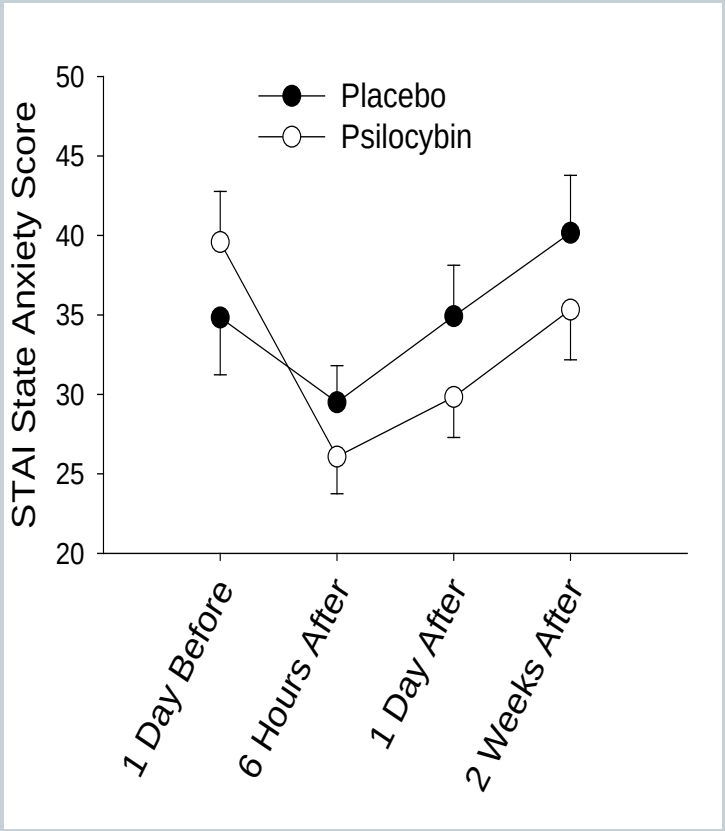
Beck Depression Inventory

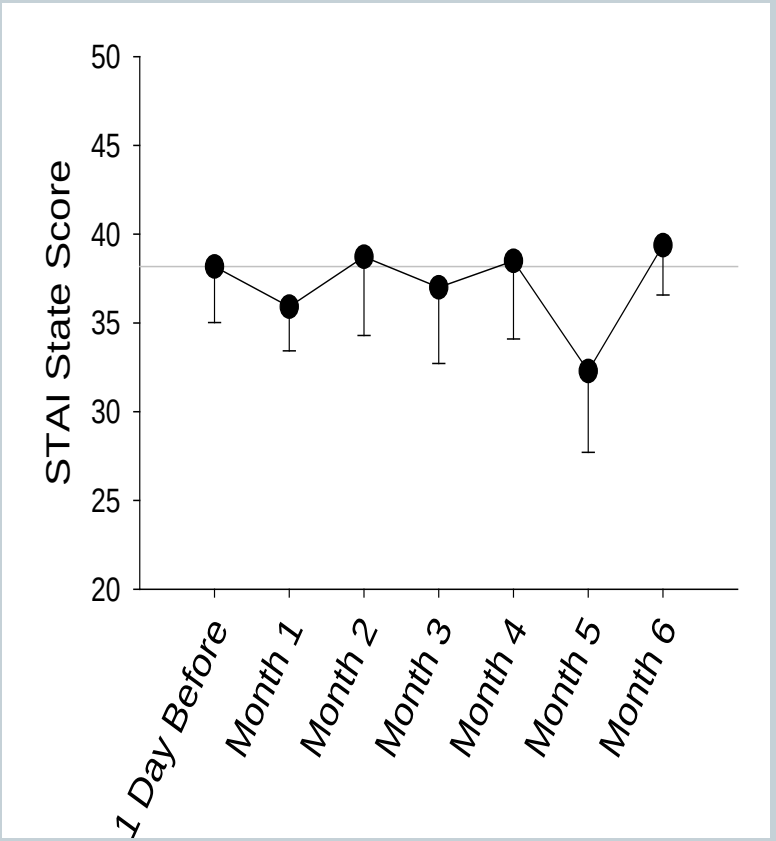


Beck Depression Inventory

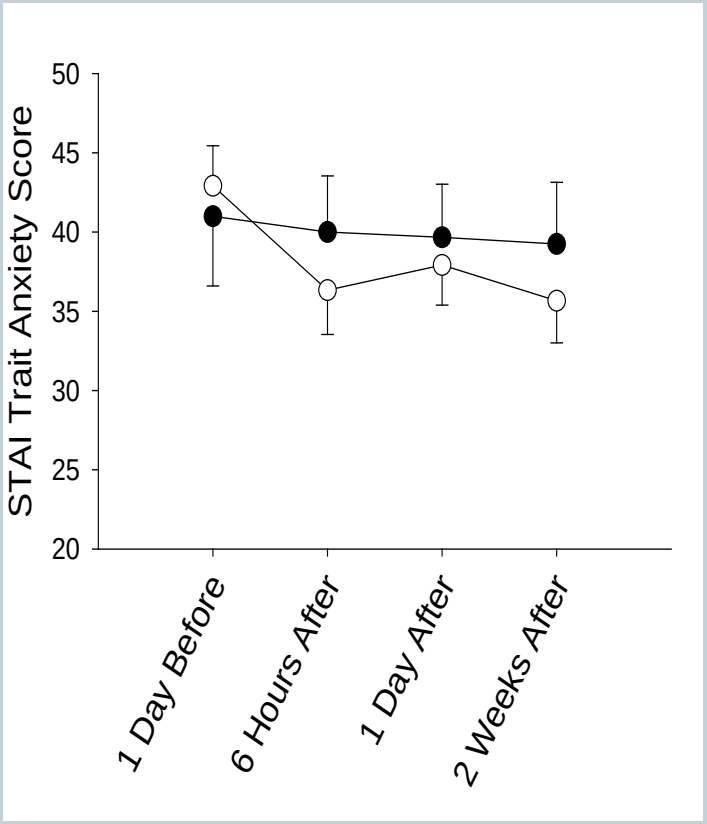


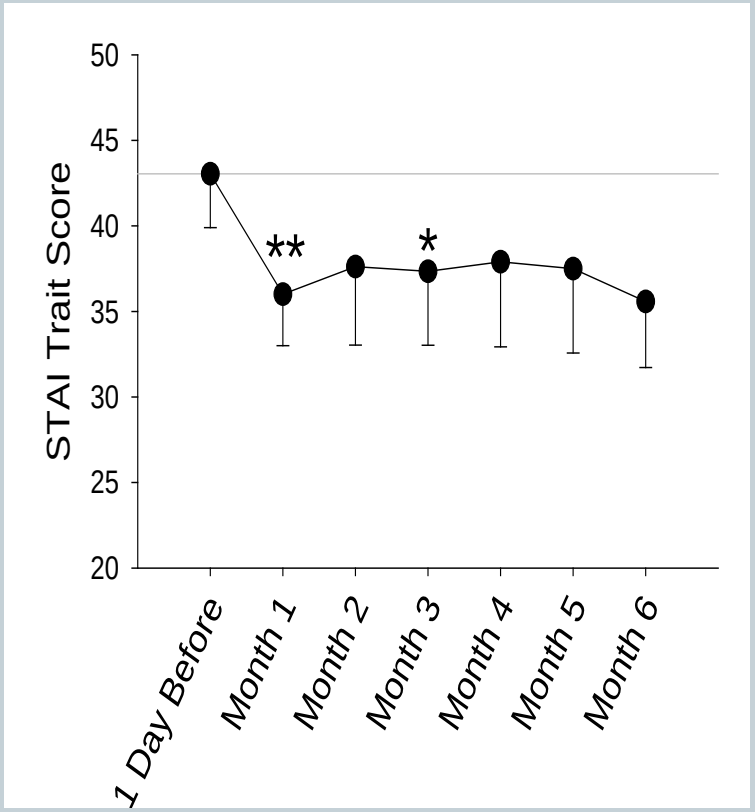
STAI State


STAI State Anxiety Score
50
45
40
35
30
25
20
Placebo
Psilocybin
1 Day Before
6 Hours After
1 Day After
2 Weeks After


STAI State Score
50
45
40
35
30
25
20
1 Day Before
Month 1
Month 2
Month 3
Month 4
Month 5
Month 6

STAI Trait





- ● Placebo
- ○ Psilocybin 0.2 mg/kg

*p<0.05, **p<0.01

Study Results

ORIGINAL ARTICLE

ONLINE FIRST

Pilot Study of Psilocybin Treatment for Anxiety in Patients With Advanced-Stage Cancer

Charles S. Grob, MD; Alicia L. Danforth, MA; Gurpreet S. Chopra, MD; Marycie Hagerty, RN, BSN, MA; Charles R. McKay, MD; Adam L. Halberstadt, PhD; George R. Greer, MD

Context: Researchers conducted ex
tions of hallucinogens in the 1950s and
1970s, however, political and cultura
the cessation of all projects. This inv
ines a potentially promising clinical
lucinogens in the treatment of anxie
vanced-stage cancer.

Objective: To explore the safety and efficacy of psilocybin in patients with advanced-stage cancer and reactive anxiety.

Design: A double-blind, placebo-controlled study of patients with advanced-stage cancer and anxiety, with subjects acting as their own control, using a moderate dose (0.2 mg/kg) of psilocybin.

Setting: A clinical research unit within a large public sector academic medical center.

Participants: Twelve adults with advanced-stage cancer and anxiety.

Main Outcome Measures: In addition to monitoring safety and subjective experience before and during experimental treatment sessions, follow-up data including results from the Beck Depression Inventory, Profile

psilocybin. The State-Trait Anxiety Inventory trait anxiety subscale demonstrated a significant reduction in anxiety at 1 and 3 months after treatment. The Beck Depression Inventory revealed an improvement of mood that reached significance at 6 months; the Profile of Mood States identified mood improvement after treatment with psilocybin that approached but did not reach significance.

Conclusions: This study established the feasibility and safety of administering moderate doses of psilocybin to patients with advanced-stage cancer and anxiety. Some of the data revealed a positive trend toward improved mood and anxiety. These results support the need for more research in this long-neglected field.

Trial Registration: clinicaltrials.gov Identifier: NCT00302744

Arch Gen Psychiatry. Published online September 6, 2010. doi:10.1001/archgenpsychiatry.2010.116

Archives of General Psychiatry*. (2011); *68(1):71-78.
doi:10.1001/archgenpsychiatry.2010.116

Clinical Effects of Psilocybin

Original Paper

Rapid and sustained symptom reduction following psilocybin treatment for anxiety and depression in patients with life-threatening cancer: a randomized controlled trial

Stephen Ross[1,2,3,4,5,6], Anthony Bossis[1,2,4], Jeffrey Guss[1,2,4], Gabrielle Agin-Liebes[10], Tara Malone[1], Barry Cohen[7], Sarah E Mennenga[1], Alexander Belser[8], Krystallia Kalliontzi[2], James Babb[9], Zhe Su[3], Patricia Corby[2] and Brian L Schmidt[2]

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Abstract

Background: Clinically significant anxiety and depression are common in patients with cancer, and are associated with poor psychiatric and medical outcomes. Historical and recent research suggests a role for psilocybin to treat cancer-related anxiety and depression.

Methods: In this double-blind, placebo-controlled, crossover trial, 29 patients with cancer-related anxiety and depression were randomly assigned and

Clinical Effects of Psilocybin

Original Paper

Psilocybin produces substantial and sustained decreases in depression and anxiety in patients with life-threatening cancer: A randomized double-blind trial

Roland R Griffiths[1,2], Matthew W Johnson[1], Michael A Carducci[3], Annie Umbricht[1], William A Richards[1], Brian D Richards[1], Mary P Cosimano[1] and Margaret A Klinedinst[1]

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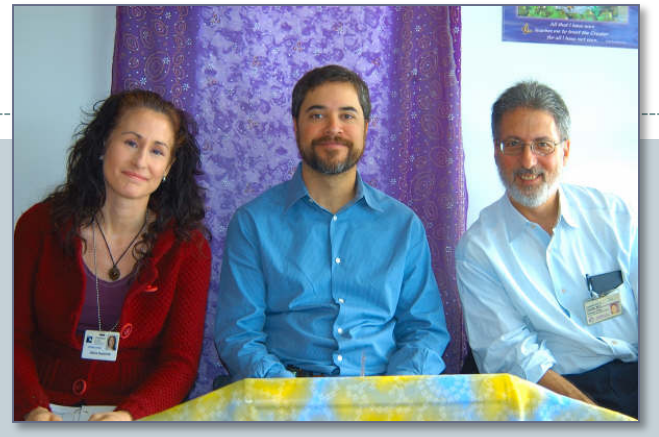
Abstract

Cancer patients often develop chronic, clinically significant symptoms of depression and anxiety. Previous studies suggest that psilocybin may decrease depression and anxiety in cancer patients. The effects of psilocybin were studied in 51 cancer patients with life-threatening diagnoses and symptoms of depression and/or anxiety. This randomized, double-blind, cross-over trial investigated the effects of a very low (placebo-like) dose (1 or 3 mg/70 kg) vs. a high dose (22 or 30 mg/70 kg) of psilocybin administered in counterbalanced sequence with 5 weeks between sessions and a 6-month follow-up.

Final Thoughts

"Death must become a more human experience. To preserve the dignity of death and prevent the living from abandoning or distancing themselves from the dying is one of the great dilemmas of modern medicine".

Cohen, Sidney. 1965.
LSD and the anguish of dying.
Harpers Magazine, 231:69-77.



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www.heffter.org

FUTURE CHALLENGES

- Implement the lessons of the past
- Optimize safety
- Strengthen ethical standards
- Prioritize public health implications
- Respond to need for greater diversity
- Navigate regulatory obstacles
- Assess funding options carefully