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DEPARTMENT OF PSYCHIATRY
UCLA SCHOOL OF MEDICINE
CENTER FOR THE HEALTH SCIENCES
LOS ANGELES, CALIFORNIA 90024

August 18, 1986

Mr. Carl Olsen
01955-036
Unit B-South
PMB 1000
Tallahassee, Florida 32301-9998

Dear Mr. Olsen:

I am in receipt of your letter of August 11, 1986 requesting a full copy of data, summary and report concerning our research study in which you and other members of the Ethiopian Zion Coptic Church had participated.

Please find attached a copy of our study that had been published in Science. As per your request, I have also enclosed a copy of our report that summarized your particular performance in the study. However, as per ethical guidelines, I am unable to supply you with the performance summaries concerning other members of the Church (on an individual basis), without the written permission and direction of each individual member. I believe that it would serve the best purposes of the upcoming hearings to present the published study, rather than summaries of individual performances-since the draft of our study that was subsequently published by Science was subjected to a rigorous peer review, whereas the actual individual data summaries were not. Thus, the actual publication of our research results would present the more compelling argument, I believe.

Unfortunately, I will be unable to participate in the hearings. I have long since changed the subject matter of my research, by the demands of my institution. We are now focusing our efforts on senile diseases of the brain, such as Alzheimer's Disease and Parkinson's Syndrome. I am no longer familiar with the more current research concerning effects of cannabis upon cognition and cerebral function. I am barely able to keep up with the current research concerning degenerative diseases of the brain. You might write to NIDA requesting any more current research articles-they would have much more recent publications and knowledge of any more current research projects concerning cannabis than we would at this point in time.

Sincerely,

A handwritten signature in dark ink, appearing to read "Jeffrey Schaeffer".

Jeffrey Schaeffer, Ph.D.
Assistant Clinical Professor
Alzheimer's Disease and Memory Disorders Service
Neuropsychiatric Institute and Hospital, UCLA

NEUROSCIENCE ASSOCIATES INCORPORATED

A PSYCHOLOGICAL CORPORATION

Jeffrey Schaeffer, PH.D.
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NEUROPSYCHOLOGICAL EVALUATION

Patient: Carl Olsen (Brother Carl)
 Evaluator: Jeffrey Schaeffer, Ph.D.
 Referral Source: Self-Referred
 Date of Evaluation: April 26, 1980
 Date of Report: January 2, 1981

DEAR MR. OLSEN:

As per your recent request, I have now completed a re-analysis of data obtained during my evaluation of you earlier this year. The following is my report of findings.

PERTINENT HISTORICAL INFORMATION: Mr. Olsen (Brother Carl) earlier this year requested a comprehensive neuropsychological evaluation of himself to determine his current level of cognitive/intellectual functioning. Mr. Olsen believes that, despite his very heavy and long-term use of ganja(cannabis), his mental functioning has not been impaired in any way whatsoever. Further, it is Mr. Olsen's belief that ganja (cannabis) has improved his mental functioning. Mr. Olsen is a member of the ETHIOPIAN COPTIC ZION CHURCH, and resides at 43 Star Island Drive, Miami, Florida (the location of the CHURCH). A comprehensive test-sequence that is a routine set of measures used in many different settings for the purpose of detailing cognitive/intellectual functioning with reference to functioning of the brain was administered to Mr. Olsen.

The following test-sequence was administered to Mr. Olsen in order to characterize his current cognitive/intellectual functioning:

Wechsler Adult Intelligence Scale (prorated)
 Benton Visual Retention Test
 Symbol-Digit Modalities Test
 Rey Auditory-Verbal Learning Test
 Hooper Visual Organization Test
 Raven's Colored Matrices Test
 Trailmaking Test (Form A & B)
 Initial Interview & Mental Status Examination

RESULTS: (Performance By Function)**Language Related Areas of Functioning**

Expressive Language:	Intact
Receptive Language:	Intact
Numerical Calculation:	Intact
Language Abstraction:	Intact

OLSEN, Carl

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Non-Language Related Areas of Functioning

Visuographic:	Intact
Visuoconceptual:	Intact
Visuoconstructive:	Intact
Non-Verbal Analagous Reasoning:	Intact

Memory

Remote Events:	Intact
Recent Events:	Intact
Immediate Auditory:	Intact
Immediate Visual:	Intact

Complex Multi-Modal Learning

Encoding-Decoding:	Intact
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Attention/Concentration:

Intact

Level of Intellectual Functioning:

Very Superior

Verbal I.Q. (prorated):	141
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Performance I.Q. (prorated):	149
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Full Scale I.Q. (prorated):	147
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DISCUSSION: The results of this study do not indicate that cerebral/cognitive dysfunction contributes to Mr. Olsen's present status. There was absolutely nothing in either the brief mental status examination or psychometric evaluation that could suggest dysfunction of the central nervous system, despite the well-documented (presence of cannabinoid metabolites in urine sample) presence of cannabinoids in Mr. Olsen's body, as well as the history of very heavy long-term use of ganja (cannabis).

Language related areas of functioning were found to be intact for an individual of this age and level of education. There was absolutely nothing to suggest disruption or damage to language areas of functioning of the brain. No evidence of an aphasic disorder was noted. Mr. Olsen had no difficulty finding the correct words to express his thoughts, and to organized his thinking in a very clear, concise, and appropriate manner. Further, he was able to understand that which was spoken to him without difficulty. Simple numerical calculations were completed rapidly and correctly without the aid of pencil and paper. There were absolutely no calculation errors present in this man's performance. Further, language abstraction ability (use of complex language concepts for problem-solving) was found to be entirely without impairment.

Non-Language related areas of functioning were found to be intact for an individual of this age and level of education. There was absolutely nothing to suggest difficulty with sensory intake and cognitive integration, particularly with regard to visual functioning. Non-language mediated problem solving ability (problem solving with non-language, color-pattern media) was also found to be entirely without deficit. The performances on these particular tasks were found to be virtually flawless, and certainly reflect the extremely high level of mental functioning that is present for Mr. Olsen. There was absolutely nothing present in any of the performances on this test sequence that could suggest impairment of cognitive/intellectual functioning, and further, absolutely nothing to suggest damage to the central nervous system.

Four areas of memory functioning were assessed on the basis of this study. Memory for both remote events (months and years) as well as for recent events (weeks, days, and hours) were found to be entirely without deficit. He was able to recall all events in his past upon questioning without difficulty. Further, two areas of memory function were assessed via the standardized psychometric instruments. Both immediate auditory memory (serial word-list learning) and immediate visual memory (memory for abstract designs presented on cards, 10-second presentation time) were found to be entirely unimpaired, based on the extensive norms and standards for these particular instruments. Thus, there is absolutely no evidence to suggest difficulty with any area of memory function (even with measurable amounts of cannabinoid metabolites in Mr. Olsen's urine sample).

Tasks of complex multi-modal learning with numbers and symbols (number/symbol substitution tasks) were performed at a very superior level. These tasks often considered as a rough index of 'new learning ability: rely upon immediate visual memory, hand-eye coordination, reading-writing ability, and attention-concentration. There was absolutely nothing to suggest impairment in any of these areas. Thus, the ability to adapt successfully to a changing environment with varying demand characteristics has not been impaired, and continues to remain at the very superior level.

SUMMARY: Mr. Carl Olsen is a 28-year-old, Caucasian, male. He is a member of the ETHIOPIAN COPTIC ZION CHURCH and resides at 43 Star Island Drive, Miami, Florida. This neuropsychological evaluation was undertaken at the request of Mr. Olsen in an effort to characterize current mental functioning in light of very heavy and prolonged use of ganja (cannabis). A urine sample taken at the time of this evaluation confirmed the presence of cannabinoid metabolites in Mr. Olsen's body. The results of this study did not suggest that cerebral/cognitive dysfunction was present in any way whatsoever. According to the well-recognized Wechsler criteria, Mr. Olsen is functioning at the very superior level of intellectual ability. There was no evidence to suggest impairment of mental functioning characteristic of damage or dysfunction of the central nervous system. Further, there was nothing found that could suggest that Mr. Olsen was in error if he believes that his mental abilities have actually improved as a result of heavy and long-term use of ganja (cannabis).

Thank you for permitting me the opportunity to complete this neuropsychological evaluation.


JEFFREY SCHAEFFER, PH.D.

Director, NEUROSCIENCE ASSOCIATES INCORPORATED

Cognition and Long-Term Use of Ganja (Cannabis)

Jeffrey Schaeffer, Therese Andrysiak, and J. Thomas Ungerleider

Abstract. Neuropsychological variables and urine cannabinoid metabolites were evaluated in ten subjects born, raised, and educated in the United States and having histories of heavy or prolonged use of cannabis. No impairment of cognitive function was found. Cannabinoid metabolites in excess of 50 nanograms per milliliter were present in the ten urine samples. The tetrahydrocannabinol content of cannabis exceeded 8.0 percent.

Several studies have attempted to characterize the mental or cognitive functioning of persons with histories of heavy and prolonged use of ganja (cannabis). Generally, investigators have concluded that heavy and prolonged use has not led to impairment of mental and cognitive functions consistent with brain or cerebral dysfunction (1-4).

Although several studies have shown decrements in neuropsychological performance among those with brief or sporadic patterns of cannabis use here in the United States (5-9), comparable studies of prolonged heavy use in this country have not been performed. Thus, the only available literature is based on studies conducted in foreign countries (Jamaica, Greece, Egypt, and Costa Rica).

We had the opportunity to observe a group of long-term heavy users of ganja in both a Southern state and a Caribbean island. The ganja was used by this group for religious purposes and symbolized the sacrament of communion—"the Green Herb of the Bible." It was used, as we observed, even during the extensive neuropsychological evaluations that we completed, in a continuous and ritualistic manner throughout virtually all waking hours. Very large cigarettes (or "spliffs") and pipes, containing ganja mixed with tobacco, were regularly shared by members of the group (10).

We examined ten subjects (seven males and three females) ranging in age from 25 to 36 years. The mean number of years of education was 13.5 (all were born, raised, and educated in the United States), and all were Caucasian. None had any history of disease that could be related to central nervous system dysfunction. By their own report, they used between 2 and 4 ounces of the ganja-tobacco mixture per day, with a reported mean duration of use of 7.4 years (the time since joining this particular church). All subjects actively engaged in daily work, largely agricultural and business, and led active and spiritually oriented lives (10). It was not possible to collect control data in this environment, as all church members continuously smoked ganja. Thus, comparisons were made with the published standards and normative data for the psychometric instruments used.

Subjects in this study agreed to provide approximately 15 ml of fresh urine for enzyme immunoassay of cannabinoid metabolite content. Specimens were preserved with approximately 4 mg of sodium azide per 15 ml of urine that was collected. Urine samples for each of the ten individuals studied were obtained immediately before each subject began a series of selected neuropsychological tests designed to assess a broad range of cognitive functions.

A modified version of the Michigan Neuropsychological Test Sequence was used (11-13). Each subject was administered exactly the same group of tests in exactly the same order. General intellectual functioning was assessed on the basis of a prorated version of the *Wechsler Adult Intelligence Scale* (Table 1) (14). Additional neuropsychological tests included the following: *Benton Visual Retention Test* (administration C) (15), *Rey Auditory-Verbal Learning Test* (16), *Symbol-Digit Modalities Test* (17), *Hooper Visual Organization Test* (18), *Raven's Progressive Matrices Test* (19), and *Trailmaking Test* (forms A and B) (20). The following cognitive functions were assessed: language areas of function, nonlanguage areas of function, memory, complex multimodal learning, and general intellectual functioning. Auditory and visual memory functions in-

cluded remote (years and months), recent (weeks, days, hours, minutes), and immediate events (within seconds).

An enzyme immunoassay method (Emit-d.a.u.) (21) was used to analyze urine samples. The assay is a semiquantitative immunochemical test designed to detect a level of at least 50 ng of 11-nor- Δ^9 -tetrahydrocannabinol carboxylic acid per milliliter of urine with greater than 95 percent confidence. Each of the ten urine samples contained concentrations of cannabinoids at 50 ng/ml (one subject) or well above this level (nine subjects).

None of the neuropsychological test data indicated impairment of cognitive functioning. Language areas of function, nonlanguage areas of function, memory, complex multimodal learning, and general level of intellectual functioning were all completely unimpaired, compared with standardized-normative information available for each test (Table 1).

The mean IQ scores (Table 1) are all in the superior to very superior range of intellectual functioning, ranging from the upper 6.7 percent to the upper 2.2 percent of the population (14). Scores obtained on all of the other psychometric tests were also well within the normal range for age (11-20). There was nothing found in any of the ten subjects' protocols that might suggest impaired mental functioning due to brain or cerebral dysfunction resulting from heavy and prolonged use of ganja.

While several previous studies have reported transient cognitive impairment resulting from the acute effects of cannabis, primarily with respect to attention-concentration and visuomotor (hand-eye) coordination (8, 9, 22, 23), none of the studies involving prolonged and

Table 1. Summary of neuropsychological data (means $\pm$ standard deviations).

Test	Number correct	Scaled score
<i>Wechsler Adult Intelligence Scale</i>		
Information	26.2 $\pm$ 3.12	16.5 $\pm$ 2.55
Arithmetic	15.2 $\pm$ 2.10	14.3 $\pm$ 1.95
Similarities	20.8 $\pm$ 2.30	14.2 $\pm$ 1.97
Digit symbol	69.6 $\pm$ 8.73	13.8 $\pm$ 2.49
Block design	42.7 $\pm$ 5.95	13.8 $\pm$ 2.39
Picture arrangement	29.1 $\pm$ 5.30	13.0 $\pm$ 2.98
Verbal IQ*	129.0 $\pm$ 10.87	
Performance IQ*	124.2 $\pm$ 13.07	
Full-scale IQ*	128.4 $\pm$ 10.36	
<i>Other instruments</i>		
Benton	8.8 $\pm$ 1.02	
Rey	14.9 $\pm$ 0.32	
Symbol-digit	60.4 $\pm$ 10.25	
Hooper	28.7 $\pm$ 1.06	
Raven	35.2 $\pm$ 0.79	
Trailmaking (in seconds)		
Form A	28.8 $\pm$ 6.88†	
Form B	53.5 $\pm$ 15.28†	

*Prorated. †No errors.

heavy use of ganja have shown any systematic decrements in mental abilities suggestive of impairment of brain or cerebral function and cognition (1-4).

We also included toxicologic verification of urinary cannabinoid metabolites, observed the inhalation of cannabis by all subjects studied, and analyzed samples of this cannabis for THC. Analysis of cannabis mixed with tobacco (by gas chromatography) yielded a Δ^9 -THC content of 4.14 percent (half cannabis, half tobacco); thus the THC content of the pure cannabis exceeds 8.0 percent.

We observed no transient decrements in cognitive functioning that often accompany intermittent or sporadic use of cannabis. The development of tolerance to one or more of the constituents of cannabis may explain this phenomenon.

Although the obtained IQ scores were high, one could speculate that perhaps cannabis had produced a priori declines in IQ scores for all ten subjects, as well as scores on other neuropsychological measures. It was possible for us to obtain early school academic achievement test data on two of our subjects. These data included equivalent IQ conversion scores virtually identical to those we measured for those subjects. We realize that these conversion or equivalent IQ scores derived from early school achievement test data are not to be equated on a one-for-one basis with current scores. However, we do believe that IQ score ranges provide a reasonable degree of equivalency. These achievement test scores were obtained some 15 to 20 years earlier, long before either subject began the use of cannabis, by their report to us.

Finally, we stress the commitment of the ten subjects to their religious sect and way of life. They told us and others (10) that members of the church do not use substances (drugs, alcohol, or psychoactive herbs) other than ganja, and we observed them to maintain a regular diet consisting primarily of vegetables, fruit, and small amounts of meat. All ten subjects (as well as other members of the church) appear to be healthy and highly functional individuals adhering to a strict religious doctrine.

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23 September 1980; revised 9 January 1981