HEALTH CONSEQUENCES OF MARIHUANA ABUSE: RECENT FINDINGS

HEARINGS

BEFORE THE

SELECT COMMITTEE ON NARCOTICS ABUSE AND CONTROL HOUSE OF REPRESENTATIVES

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CONTENTS

HEALTH CONSEQUENCES OF MARIHUANA ABUSE: RECENT FINDINGS

TUESDAY, JULY 17, 1979

HOUSE OF REPRESENTATIVES,
SELECT COMMITTEE ON NARCOTICS ABUSE AND CONTROL,
Washington, D.C.

The Select Committee met, pursuant to notice, at 9:40 a.m., in room 2212, Rayburn House Office Building, Hon. Stephen L. Neal (acting chairman of the Select Committee) presiding.

Present: Representatives Lester L. Wolff, E de la Garza, Billy L. Evans, Tom Railsback, Robin L. Beard, Benjamin A. Gilman, Tennyson Guyer, and Daniel K. Akaka.

Staff present: Robert Hundley, deputy chief of staff—demand; Roscoe Starek, minority counsel; Daniel Stein, Elliott Brown, Gerry Dubin, and David Martin, professional staff members; James Marotta, staff counsel.

Mr. NEAL. The Select Committee will come to order.

This morning we are beginning a series of hearings on marihuana. Our intention in these hearings is to focus on the potential health hazards of using marihuana. Today, we will hear from a distinguished panel of scientists, who will present a broad overview of current health findings. At later hearings, we will concentrate on more specific categories of health research.

The Select Committee on Narcotics Abuse and Control would like to provide a forum wherein a fair and objective examination of existing data can occur. Rather than debate the politics of the marihuana issue, we would like to determine the extent, the adequacy, and the reliability of our present knowledge about marihuana.

I think none of us would disagree that when young people smoke marihuana—something that appears to occur daily for up to 16 percent of all high school students—there is the potential of impeded learning and impaired health development.

Additionally, I don't think any of us would disagree that no one should smoke marihuana and drive. Not only do I think we all agree on these issues, but I believe also that we need to continue to make these concerns clear to both parents and students.

Beyond our common ground of agreement about marihuana, there is a broad area of debate. A recent International Marihuana Conference at Rheims, France—sponsored in part by the National Institute on Drug Abuse and led by Dr. Gabriel Nahas of the American Council on Marihuana—reports a range of recent findings on marihuana and health.

We are told that marihuana has health consequences in a variety of areas: brain damage, testosterone levels, effects on the embryo, links to epilepsy and psychosis, pulmonary and respiratory disease hazards, harm to the reproductive system, and a number of other possible hazards. These findings have been widely reported by the news media as having been confirmed, although they continue to be debated within the scientific community.

What we would like to establish today, in our initial hearing, is an overview of the health issues and the degree of certainty that we can attach to various findings.

Unfortunately, in the past the Federal Government has lost the attention of the young on the issue of marihuana by attempting to act persuasively from a base of inadequate scientific evidence. We have not, by the use of this tactic, diminished the use of marihuana. Rather, I think, we have only made it more difficult to establish credibility for scientific evidence which otherwise would be quite convincing.

The increasing use of marihuana makes it apparent that whatever the health consequences, they must be known by all who make the choice, or counsel those who choose, whether to use this drug. In the past 4 years, the use of marihuana prior to reaching the 10th grade level has increased 60 percent, or from 17 percent to 28 percent of all youngsters in this group. Studies from Maine and Maryland indicate that 16 percent of all high school students smoke marihuana daily—an increase of 167 percent in the past 4 years.

This, we are reminded, is in spite of the national effort to control supplies and discourage the use of marihuana. In light of this glaring inadequacy, I don't believe that we can afford more of the "reefer madness" kind of talk about marihuana. We need to minimize the rhetoric, and attempt to establish evidence which can be honestly and reliably told to our parents and young people about the health hazards of marihuana.

We may not be able to establish the health issues with scientific certainty, but perhaps we will be able to get a feel for the reliability of the current data and the implications they portend. One thing we'll be looking at, I'm sure, is the correlation between tests on animals and effects on humans. Can we assume that findings on mice can produce accurate equivalence in humans? Are dosages and usages in animal tests reasonably representative of human consumption? Are the health hazards of marihuana dependent upon the quality of the substance and the method by which it is consumed?

At this time, I am pleased to introduce our distinguished panel of three scientists who are uniquely equipped to provide the committee an overview of marihuana and its relationships to health. They are: Dr. Gabriel Nahas, of Columbia University Medical School; Dr. Sidney Cohen, of the University of California at Los Angeles; and Dr. Norman Zinberg, of Harvard University Medical School.

Sitting with our panel will be Dr. William Pollin and Dr. Robert Petersen, of the National Institute on Drug Abuse, who will be our witnesses when we continue these hearings on Thursday.

Mr. Chairman, do you have a statement?

Mr. WOLFF. No.

Mr. NEAL. Are there others who have opening statements?

[No response.]

Mr. NEAL. It is customary for this committee to swear the witnesses, and if you gentlemen would stand, I would like to ask you this question.

[Whereupon, Dr. Gabriel Nahas, Dr. Sidney Cohen, and Dr. Norman Zinberg were duly sworn by Mr. Neal.]

Mr. NEAL. Let the record show that all three witnesses answered in the affirmative.

It is a pleasure to welcome you to our hearing this morning, and if it is the will of the committee, it might be most helpful to hear from all three witnesses, and then engage in the questioning.

I think it might be most helpful if we could hear from Dr. Nahas first, Dr. Zinberg second, and then Dr. Cohen. And gentlemen, if you would like to place your entire statements in the record and summarize for this purpose, that is certainly permissible; or if you would prefer, please feel free to read your entire prepared statement. Dr. Nahas, I would like to recognize you.

TESTIMONY OF DR. GABRIEL NAHAS, COLUMBIA UNIVERSITY

Dr. NAHAS. Mr. Chairman and members of this committee, I am going to attempt in a few minutes to summarize the pharmacological and scientific——

Mr. NEAL. Without objection, we will put your entire statement in the record at this point.

[Dr. Nahas' prepared statement appears on p. 53.]

Dr. NAHAS. I will just present a summary of this testimony.

Mr. NEAL. Dr. Nahas, could you move your microphone just a little bit? Thank you, sir.

Dr. NAHAS. It is a difficult task, since it does involve attempting to give a general perspective of 10 years of intensive research which has been carried out in many laboratories of the United States and abroad. I have been able to keep up with this work through studies at Columbia University, at the University of Paris, and at the University of Oxford, in the department of pharmacology of Professor Paton, with whom I have worked very closely in organizing two international meetings over the past 5 years. The last one, as you mentioned, was in Rheims.

What do we know today about marihuana? Certainly much more than we did 10 years ago. We know that it is a common name for the plant cannabis savita, the flowering tops of which contain over 380 identical chemicals, 60 of them being the cannabinods which are specific to the cannabis plant.

Among these cannabinoids some are psychoactive, meaning that they rapidly induce a state of intoxication. The best-known psychoactive cannabinoid is THC. However, other cannabinoids are not psychoactive, such as cannabinol, cannabidiol, and cannabichronene, et cetera.

However, all of these substances, cannabinoids, which can be isolated specifically from the plant share a common property. They are fat-soluble, and have a prolonged retention in the body. It takes, indeed, 30 days to eliminate a single dose of THC; and after 27 days of daily intake the amount of THC accumulated in the body is tenfold greater than from a single dose.

All of these measurements have been very clearly established through the use of radioactive tracers.

Now, the target organ for marihuana, or more specifically for THC, is the brain. It takes an amount of THC as small as a billionth of a gram to act on a very specific area of the brain, which is called the "brain reward system," and which produces euphoria and detachment.

I believe that Chairman Wolff once asked why people were using marihuana. I believe that there are many reasons, but there is a common reason for it; namely, that it produces euphoria and pleasure by activating this very center in the brain, as shown by many scientists, especially by Dr. Robert Heath.

At the same time as it activates this brain reward system in the hypothalamus, the same very small amount of marihuana is going to disrupt the production of very important substances in the brain, which are certain brain transmitters in the hypothalamus, discovered by Professor Guillemin, who obtained the Nobel Prize for this discovery. These regulators in the brain control all of the hormones which regulate sexual function. And these hormones, LH, FSH, and prolactin, in turn control the maturation of the germ cells, ovum or sperm, both of which are impaired by the use of cannabis.

In addition to the specific effects of the psychoactive ingredient of cannabis, this plant also produces other substances which are not psychoactive, and these substance also have a general effects on all cells.

THC, as I mentioned, is not very rapidly eliminated from the body, as such. It is biotransformed into other compounds which have a very similar structure, and which linger a long time in the body.

And all of these cannabinoids, psychoactive or not, will have general effects on all cells of the body. At a concentration, of a millionth of a gram these substances will impair the ability of the cell to produce protein and nucleic acids, thereby inhibiting cell function and cell division. This is the area in which I have specialized at Columbia University.

Our studies have been duplicated in many other laboratories. However, one must add, that such a concentration of a millionth or a gram in different body cells can only be reached as a result of chronic, repetitive consumption. So therefore, with this background, we can see that we are dealing with substances which have profound pharmacological activity on the brain in very small concentrations, and in many other cells of the body at a higher concentration.

These pharmacological facts are a good basis to understand the multiple biological effects which have been reported by the scientists in the past few years.

And now I would like to summarize the main effects which have been observed in three main areas—the lung, male and female reproductive function, and the brain.

The effects on the lung have been described in a number of studies. Clinical evidence does indicate that chronic marihuana smoking, in a controlled environment, is associated with abnormal lung function tests, and early symptoms of airway obstruction.

These clinical observations have been accompanied by experimental studies. Such studies do indicate that marihuana impairs the immunity defense that protects the lung against bacteria.

Other studies have shown that 6 months' exposure to marihuana smoke produces disseminated, organized lesions of the lung and cholesterol deposits, which are signs of tissue destruction. So there is now

ample evidence to indicate that the smoking of marihuana induces some changes in the lung which, on a long-term basis, might be accompanied by organic alterations. These alterations can only be detected through long-term epidemiological studies, such as those that have been done on tobacco smoke; but right now, there is evidence which does indicate that abnormal pathology might develop.

This pathology might include destruction of lung tissue, and increased incidence of carcinoma of the bronchi. Since it has been established that the tar from cannabis smoke is more carcinogenic than tar from tobacco smoke.

The next area which has been very extensively studied is the effect of marihuana on reproductive function. Marihuana does affect male and female reproductive functions.

The effect of marihuana on reproductive function results from the effect of the drug on the brain, and the effect of the drug on the sexual glands itself.

In male subjects studied in a controlled environment heavy smoking of marihuana is associated with a decrease in sperm count, a decreased sperm motility, and increased appearance of abnormal forms of sperm.

These studies have been confirmed by studies of animals subjected either to marihuana smoke, or to cannabinoids in the laboratory. It would appear that the mechanism of action to explain such changes is quite complex.

There might be a direct effect of marihuana on the hypothalamus and the pituitary, which would disrupt the production of testosterone. As a result, the maturation of the sperm cells might be impaired, explaining the decreased formation of sperm and the increased formation of abnormal forms.

In addition, especially in heavy smokers, the byproduct, at least, and other cannabinoids might accumulate in the testes, and impair, right in the germ epithelium of the testes.

Mr. WOLFF. Mr. Chairman, might I ask whether in the definitions the doctor makes we could in some way define what we mean by "heavy use," so that we know where we are at when we are talking about the question of use and abuse, and the effects that they might have?

Dr. NAHAS. Yes, Mr. Chairman. I am dealing with regular daily use of marihuana.

Mr. WOLFF. Does this mean one joint a day or what?

Dr. NAHAS. I just am going to qualify the statement; anywhere from 1 to 10 cigarettes a day. In this respect, one has to keep in mind two laws of pharmacology. The first law is the one of the distribution curve, which indicates that no individual responds in the same way. For a given dose, the response of an individual will be broadly distributed over a large area.

However, there is an average, and I think it is the average which concerns us.

I am mentioning this distribution curve to point out that there is a great variability about individuals, and their response to heavy or small dosages of marihuana.

In addition, there is a second law of pharmacology, which is the dose/response curve, meaning that for the same individual the higher the dose, the greater the response. These two laws explain the unpre-

dictable side effects which result from daily use of marihuana for a given individual, and I say, from 1 to 10, because this might cover the whole range of individual variability.

There are some individuals who are able to take a lot of marihuana and present relatively minimal side effects, while others with small doses would have very marked effects. But let's just speak of daily doses; and this is especially true when one considers the spectrum of the population you are dealing with.

We are not only dealing with a single, healthy population of young individuals, or older individuals; we are dealing with a population which is growing. And it appears that growing individuals, or growing animals, are much more sensitive to the effects of marihuana than adult animals, probably due to the fact that their central nervous system is developing, is structuring itself, and the disruption caused by the drug in the central nervous system would be much more far-reaching in the young than in the adult. Is that clarified by my exposé?

Mr. WOLFF. Yes.

Dr. NAHAS. So I was just saying that the disruption of male reproductive function can be attributed to two different mechanisms: a direct, acute mechanism, which would be produced by very small amounts in the brain, and a secondary mechanism which would be due to the chronic accumulation in the sex glands. The meaning and consequences of these abnormalities in male reproductive function are not known.

The effect of cannabis on female reproductive function has been the subject of extensive investigation, mostly in animals. The Food and Drug Administration, because of the potential risk of females to cannabis forbids the use of this drug in a woman of child-bearing age.

Therefore, primates have been used, right here in Bethesda, and these primate experiments have been very clear. They do indicate that a single dose of THC will produce a decrease in the basic hormones which control the ovarian cycle of an individual. And a disruption of the production of this hormone is intermittent, short-lived, but it can be clearly measured.

Furthermore, it has been shown that daily administration of THC to these primates at the start of their cycle will be followed by a cycle without ovulation. The egg is not produced.

In addition, these experiments on primates, which present a menstrual cycle like women do, have been to some extent corroborated by observations on young women studied in St. Louis by the group of Dr. Kolodny and Dr. Bauman. They have reported that young women who smoke daily, or at least 3 times a week, marihuana, have a 36 percent incidence of irregularities of their menstrual cycle; and a decrease in the production of prolactin, which is one of the hormones controlling female reproduction and cycling, and also an increase in testosterone.

So there is now ample evidence to indicate that marihuana does disrupt male and female reproductive function. The disruption of male and female reproduction function by marihuana raises the problem of a potential damage to an offspring if this would come to pass, because so far, it would appear that marihuana might have the potential to decrease fertility. But one can imagine that maybe there might

be also a chance, if an impaired ovum or sperm were fertilized, of some damage to the offspring.

Such studies in man can only be done over a long period of time. That is why many experimental studies on animals have been sponsored by NIDA. It does appear now that marihuana products are not teratogenic—that is to say, do not produce marked birth defects similar to those which occurred with thalidomide, such as stunting of the limbs—however, marihuana products administered to pregnant females, will result in embryo toxicity and fetal toxicity, which means that marihuana impairs the development of the embryo and of the fetus.

These studies have been performed in rodents, rats, mice, rabbits, and also in primates. And it seems that all of the results are now concurring to the same conclusion.

This is a problem which has to be further investigated, especially in view of the fact that the surviving offspring of those animals treated with cannabis are "hypertrophic," meaning that they have lower body weight, and also lower brain weight.

It has also been shown that the brains of these animals are deficient in certain nucleic acids. So there are a lot of unanswered questions which do indicate that the offspring of animals treated with marihuana may have, during the course of their development, a deficit. This deficit has even been observed in animal experiments which were recently presented at Ardley House, at a meeting organized by NIDA.

Professor Tuchman-Duplessis, who was the chairman of the Rheims conference on reproductive function concluded this session in saying that, indeed, the use of marihuana was associated with risk to female reproductive function and that, therefore, a warning should be issued.

Finally, there is an effect of marihuana on the brain, and on behavior. This is an area which is very difficult to document and study, because behavior of man is subjected to so many variables.

But observations performed in the laboratory on primates, as well as on lower animals, indicate that marihuana acts on this brain reward system which is in the limbic area of the brain, and which controls emotional behavior and endocrine function.

In this area, persistent brain wave changes, have been recorded in monkeys exposed to marihuana smoke. These experiments were performed by Dr. Heath, and have been published in different scientific journals.

Furthermore, Dr. Heath has shown that tissue removed from this area and viewed under the electron microscope presents structural changes in the synapses. The synapse is a "switch" through which signals are transmitted through the nerve cell.

He has also indicated there are other alterations of structure, alterations in this area. Again, the meaning of these studies, have to be confirmed by clinical observations which have not been performed, and which are very difficult to perform. But there is some evidence that some structural changes seem to appear in the brains of monkeys treated for 3 to 6 months with marihuana smoke.

Furthermore, it was reported that group and individual behavior of primates fed this chronically is markedly perturbed, especially

when the animals are exposed to stress. Rodents chronically fed THC exhibit specific impairment of learning a specific motor skill.

It also has been established that a great deal of tolerance—which is a necessity to increase dosage in order to obtain initial effect—develops as a result of marihuana usage. This is contrary to the so-called "reversed tolerance" which was reported by earlier workers. And such tolerance has been observed in all animal species and in man. At Columbia University, our volunteers were able to smoke anywhere from 5 to 15 marihuana cigarettes a day containing 2 percent THC which should put them in the category of those men in the Rif Mountains of Morocco, or in Greece who smoke hashish, with an equivalent amount of THC, of up to 300 milligrams THC a day.

It has also been reported that withdrawal symptoms are observed in subjects given large amounts of THC. Dr. Reese Jones in California has reported irritability, discomfort, hyperkinesia, nausea, and abdominal distress.

However, it has been underlined that these symptoms are very mild when compared to the withdrawal from opiates or from alcohol.

It has also been reported that THC triggers epileptic seizures in experimental animals while another compound, CBD, which is not psychoactive, protects against seizures. And since marihuana contains mostly THC, it should not be used by epileptics.

Now, I will discuss briefly the problem of the status of marihuana as a medicine. Indeed, marihuana has been advocated as a medicine; and the "cures" and beneficial effects have been widely disseminated by the press.

The potent pharmacological properties of THC, have led researchers to use it in the experimental treatment of asthma, glaucoma, and of nausea associated with cancer therapy.

A recent symposium held in New York reviewed the applications of THC for these different ailments. I mention "THC." Indeed, it is somewhat misleading to speak of marihuana as a medicine, because marihuana is a concoction of over 350 chemicals, some of which are really toxic. Fortunately, they are contained only in small amounts in the plant.

And when one speaks of the potential medical use of marihuana, one is, in reality, referring to the use either of THC or of one of the synthetic cannabinoids which has been developed from this molecule, such as Nabilone.

The consensus of this panel of medical experts was that marihuana is not a medicine, and should not be used as such, but that THC and Nabilone might become medicine, if they are proven in controlled clinical trials to be more effective than presently-used drugs.

In this respect, in the treatment of glaucoma, Dr. Walter Jay, from the University of Chicago, did report studies that they had performed on a group of patients with glaucoma using Nabilone; and he indeed reported that these patients did present a decrease in intraocular pressure.

However, the problem is that the drug has to be given locally, not by general oral route, or by inhalation and there is a problem of using the proper vehicle. And there is the problem of showing that this drug is more effective than those previously used, which are pilocarpine and a beta blocker called timolol. This has not yet been proved.

In the treatment of asthma, the conclusion was very clear and finally indicates that THC, although capable of causing significant bronchodilation when given as an aerosol with minimal systemic side effects, has a locally irritating effect on airways which makes it unsuitable for this use.

Finally, there was a controlled study from the Mayo Clinic performed by Dr. Frytak, who compared the use of the 9–THC with that of phenothiazine, prochlorperazine, in patients who were having cancer chemotherapy. And his conclusion was that while THC shows evidence of antiemetic activity, this is not superior to a standard phenothiazine antiemetic. THC, however, induces significantly more toxicity, to the point of rendering such treatment undesirable for patients of this age group.

Furthermore, another recent study published in the New England Journal of Medicine indicates that the synthetic Nabilone is quite effective in treating the nausea of patients undergoing chemotherapy, though it has profound side effects in a number of patients. However, the Lilly laboratory has discontinued the clinical trials with Nabilone because of the toxic effects of this compound given chronically in dogs and in cats.

So it seems, today, that the whole problem of marihuana as a medicine is wide open. Marihuana is not a medicine; it is a crude drug. Some of its specific compounds with pharmacological activity, might have therapeutic application. But these studies have to be limited to the laboratory, to the experimental, the clinical pharmacologist, so that he may find out how effective these drugs might be.

In conclusion it would appear that marihuana, in addition to its well-known acute and reversible psychotropic properties, associated with THC, has certain other properties which are just beginning to be described.

First, there is the effect of THC on the brain hypothalam pituitary axis, and the intermittent inhibition which this compound can produce in the secretion of LH, FSH, and prolactin, which control the sexual glands. Such disturbances will have repercussions on the formation of the sexual hormones, testosterone, folliculin, and progresterone, and maturation of the germ cells.

Second, there are the inhibitory effects of all cannabinoids on cell anabolism, and on the formation of macromolecules which are essential for proper cell function and division. At this cellular level, the cannabinoids act on the plasma membrane and the nuclear membrane, interfering with the synthesis of nucleic acids and chromosomal proteins.

When the formation of proteins and nucleic acids is impaired in the brain, and if a brain cell is destroyed, it will not be replaced. However, this impairment of cell metabolism and division by THC in other cells of the body is less dangerous, since these cells reproduce.

Only longitudinal, epidemiological studies of marihuana-smoking populations may document the pathological effects of long-term cannabis usage. Therefore, the human pathology of marihuana cannot be written before two or three decades. And it took 60 years to establish the pathology of tobacco smoking.

Meanwhile, the observations on animals and man reported at Rheims and other recent meetings suggest that such pathology might involve the lung, reproductive function, and brain.

But right now, there are four groups who should be warned, forthwith, of the health risks associated with marihuana usage:

Adolescents, whose neurohormonal regulatory systems in the brain are in the process of development and integration. Indeed, a single dose of marihuana can affect the secretion of the pituitary hormones which control reproductive function. This is especially serious in a young woman.

The other groups to be warned are epileptics. The central stimulating effects of THC may induce epileptiform seizures.

Also, persons with a tendency to schizophrenia and mental illness, and finally, women who wish to have children.

And all of these harmful effects of marihuana, I must stress again, are long-term effects in daily usage. This means that we are dealing with long-term effects.

I believe a mechanism should be established so that these long-term destructive effects could be recognized at the earliest possible stage. Thank you.

Mr. NEAL. Dr. Nahas, thank you for your testimony. I would like to say to the witnesses, if you would like to remove yours coats feel free to do so.

Mr. GILMAN. Mr. Chairman, would you yield?

Mr. NEAL. Mr. Gilman, I would be happy to yield.

Mr. GILMAN. I thank the chairman for yielding. We have a special guest. For several months, our good chairman from New York, Congressman Wolff, has been trying to encourage members of the stage and screen and television to take part in helping us educate the public with regard to some of the narcotics problems we are confronted with. And I am pleased to have with us this morning one of the leaders of that group of stage, screen, and film personalities who is here in Washington for a short stay and taking time out of his busy schedule to take an interest in our work.

And I am pleased to introduce to the committee Mr. Morty Guntie, a constituent of mine, and a very great entertainer. Morty, would you just say "hello"?

Mr. GUNTIE. Good morning.

Mr. NEAL. Welcome, Mr. Guntie. Thank you for coming.

Mr. GILMAN. Thank you, Mr. Chairman.

Mr. NEAL. Dr. Zinberg, we would like to hear from you at this time. If you would like, without objection, we will put your entire statement in the record. It has been suggested that we try to keep the summaries as brief as possible.

We, in no way, want to cut anyone short, but we do want to leave adequate time for questioning from the panel. If you will keep it within maybe a half hour, that would be a big help.

TESTIMONY OF DR. NORMAN ZINBERG, HARVARD UNIVERSITY

Dr. ZINBERG. I will do it in less than that. At the moment, in discussion with the staff of the committee, I was told I was to participate in a panel, so I have not prepared a statement. The letter asking for a statement only arrived on Thursday, and I haven't had a chance to do so; but I will prepare one and send it in afterwards.

I would, first of all, like to say that I am a physician, a psychiatrist, and have done a lot of research in this area, mostly in psychosocial areas, some experimental work. I am not a neurophysiologist or a pharmacologist or a botanist. I have tried to keep up with the literature in these areas because of my other research interests; but there, I have to rely, to a certain extent, on secondhand data, as you all will, too. And I will try to differentiate between where I am personally authoritative, and where the data is secondhand.

I wanted to say, first, something in my guise as somebody interested in psychosocial aspects of the historical aspects of this hearing, and the whole question of the historical use of intoxicants.

I have to say that I am very tired of testifying in this area, and I really have great questions about the worthwhileness of my continuing to testify in this area. I think I have a feeling that I have said what I had to say. I have said it in print too many times, and repeating it is hardly useful.

It is true that certain things come up, a new study here, a new study there, but it is highly questionable whether repetition serves a useful function.

And I think one tends to be put into a slot: You stand "pro," you stand "con," and the whole issue of objectivity, reasonableness, and so on gets lost when people are labeled and when the situation becomes as highly politicized as I think the marihuana situation has become.

As I am sure all of you have heard too many times, every culture known to man, with the possible exceptioin of the Eskimoes, have used intoxicants. And the White file at Harvard, the anthropological file, of all the cultures that have been studied, they all use intoxicants—Africa, South America, Western Europe, Asia—they all have used intoxicants.

Marihuana, over the millenia, has been one of the most used intoxicants. I am sure you know that, too. And there has been, particularly in this country, a very complex moral prejudice against the use of intoxicants.

It is very clear that in this country—not always, but in the last, I would say, century—the notion has been that it is a great error to use any intoxicants; and that if we could get away without using them at all, we would be better off. I think that is a debatable proposition myself, but it is indeed a debatable proposition. And whether, life being as hard as it is, an idea of relaxants, a pleasure-production system, and so on is reasonable if the health hazard is within reasonable bounds, is a philosophical debate. It really is very hard to understand.

Now, what has happened in this culture, and the reason I think that the marihuana debate is so hot and heavy, is that we have seen in a very short time, in 15 or 16 years, the introduction, essentially, of a third intoxicant in a culture that had just discovered that one of the other two intoxicants was extremely dangerous; much more dangerous than had clearly been understood. And as a result, the study on marihuana has been very hot and very heavy.

Now, I think that we have to try to separate certain things. We have to try to separate the effects of the illicitness of marihuana per se from the effects of the drug itself; and that is not an inconsiderable

problem, because, as certainly all of us know, while everybody who uses marihuana isn't sort of "flaky" and vaguely delinquent, and so on and so forth, I assume almost every delinquent in the United States has used marihuana, because of its illicitness.

So you have a psychosocial emphasis where you certainly have a significant fraction of the users who are people with other difficulties. And also, as a result of our concern about not repeating what has gone on with tobacco and nicotine and so on, there has been an enormous amount of research to be absolutely sure, to find anything possible that may have caused harm with marihuana.

Now, as far as I know, no other drug has been subject to such a searching examination, looking for any possibility that harm may be caused by the drug. I think, given the psychosocial situation, given the fact that we have discovered what we have about tobacco recently, I think that is a very reasonable search.

But I also think it contains a significant bias. It tends to make certain findings look different from what they are because of the way the search has been approached. And I think that has to be kept in mind, when people look at the scientific objective data, because it does seem to me that many of the things that have been turned up about marihuana simply prove the fact that it is active; it is an active substance. It is an active intoxicant. It is an obvious strong intoxicant.

Now, one of the words that I will use in my testimony is the word, "substantiality." I suspect some of you are lawyers. I don't know what percentage of the Congress now are lawyers, but it is a word that lawyers savor a lot; and I like it. It indicates whether something is very pertinent in that matter.

So the question that marihuana is active is substantially true. There is no question about it. And the fact that a drug is a powerful, active intoxicant will cause something in the body; I have no doubt about it. And I can't imagine anybody else having any doubt about it, either.

So what has to be differentiated is what it actually does, if it is active, and whether or not this activity is, per se, a health hazard.

For example, I think it is absolutely true that THC does not dissolve in aqueous solution, and stays in the body longer than other substances. There are other substances that stay in the body. Whether or not the fact it stays in the body, per se, causes any difficulty is another issue entirely. The fact that it happens, we agree. What it does is another matter again.

I guess I think that the most significant thing that one can say about marihuana, these past 16 years—and again, I am sure you have heard enough testimony to know—that the numbers game is wild; whether it is 51 million or 35 million people who have used marihuana over these last 16 years, I don't know. And I don't think anybody else does, either. But it is a substantial number, again.

As the Schaffer commission pointed out in 1973, and continues to be true, there is not a single know fatality that has been caused by marihuana alone in that 16-year period, with that 35 or 50 million people. That is a remarkable record. I don't know of any other active substances about which that could be said. Aspirin, as you all know, causes 1,000 deaths a year.

So you are comparing something like that, and I do think that has to be underscored.

Personally, I think that the American public, particularly the young in this country, have been extremely lucky about the low toxicity of marihuana. If marihuana had the toxicity of aspirin, for example, can you imagine the carnage that would have been brought about by that kind of heavy use?

So I think, as the Schaffer commission understood, I would like to again underscore that particular fact.

Then I would like to say also that the question of whether the findings are essentially replicable, in some reasonable way, also has to be underscored. I wrote a review of the literature article in "Psychology Today" in December of 1977, in which, with the help of Ms. Hilary Mayo, we went over, really, all that we could find of the research that had been reported at that time.

And what I found, and what I reported, was a typical see-saw under what I regarded as correct search for harm, correct search for health hazards, which I think is absolutely appropriate. Somebody would report something. It would receive an enormous amount of publicity, and it might not be replicated, or it might be conducted, and you had this characteristic see-saw. And every time somebody reported a fresh health hazard, so far, whether or not it is replicable, and what the significance of the hazard is has remained questionable in certain areas.

And I am going to do this very quickly, because I think you know all these things.

As far as I am concerned, marihuana causing psychoses is not any longer a major issue. A few years ago—I am very bad on names—2 psychiatrists in Philadelphia reported terrible things about marihuana. There have been any number of psychiatric studies since that have not borne out their findings; and they have been wasting time.

Crime—The Tinkerburg stuff from Stanford, it is very clear that marihuana, besides being a drug-related problem, does not cause crime.

Testosterone changes, drug related—again, you have that see-saw. Kolodny and other people found, locally, testosterone links, low sperm, and other people have not found that.

The question of which work is more definitive is a very hard one to know. I happen to be very closely associated with Dr. Mendelssohn at Harvard. He has done the other side of the work. I regard his work as definitive. Somebody else might argue the Kolodny work has something to be said.

Above all, I would argue, from my understanding of the field, that we don't know what lowered testosterone rates mean. And there are lots and lots of things, again, that lower testosterone rates for short periods, long periods, what-have-you. So the findings, one of the things all of the researchers agree, the change in rates of testosterone are within normal limits. So I don't know what you do with that.

Chromosome damage, the same way: Even Stenchever, or whatever his name is, found chromosome breaks. And a prospective study, and I'm sure by now you have learned that prospective studies are better than retrospective, by Nichols, has been replicated, and found no chromosome breaks.

So brain damage, again, has been presented after an article in the "Lancet" a number of years ago. There have been any number of soft scan studies of brains, and so on, which have not found anything.

I am aware of the piece of work by Dr. Heath that Dr. Nahas refers to. It has not been replicated in any way. It is on monkeys, and who knows? But certainly, again substantially, the idea that marihuana causes brain damage, over 16 years, there certainly is very little substantial evidence. This is an important area. Again, it certainly continues to require study.

Today, motivational syndrome, the same: Certainly, initially, when that phrase was coined, there was a lot of concern that marihuana was going to cause people not to work, and so on and so forth. Then the study by Hoffman and Brill, ULCA, where they found there was no reduction in grade point scores of college students who used marihuana as opposed to nonusers. And that has been replicated again and again.

The Jamaica study, Costa Rica study, other cultures, where man's work is used as the motivator—in other words, it seems fairly clear whether people are motivated or not motivated by marihuana is not the drug itself. It is within other cultural and personality responses.

Now, we come to three areas which are relatively recent and which require, obviously, very careful thought and study. One which Dr. Nahas refers to, the question of its impact on immune bodies, on the T-lymphocytes, and a variety of other aspects of immune studies.

Well, again, you have the research going back and forth. You have some work which certainly shows that marihuana, in vitro, has an impact on the T-lymphocytes. You have other studies—I don't remember; is it Silverstein?—which indicate, at least in vivo, with people, that nothing much happens.

You also have a study by a man named Richelovski or something, which indicates that over a period of time, the immune responses returned, even if nothing else is done.

A great deal of work remains to be done, but you don't have a definitive statement. It is something one ought to be concerned about.

The same with the lung tissues: Just what impact the lung has—I've said many times, in print, that I have no doubt that drawing hot substances and so on and so forth into your lungs is bad for your lungs. I don't think there is any question about that. And just exactly what it does, as far as carcinogenesis goes, that seems to be highly debatable.

But the idea that smoking a great deal of anything would be bad for your lungs, I think, is absolutely true; and I have no question about it, et cetera. And that is something that we are going to have to do something about, just as we are concerned about that with tobacco. and so on.

Then the other big item of the moment is the epidemiological, and that is the question of the drop in age of first use; and that is very important, very serious. And I feel impelled to tell you something that I said in print in the paper 6 years ago.

In 1973, I said that if you wished to interfere with the dropping of the age of first use, you would have to legalize marihuana. In fact, you would have had to legalize it in 1970. If you had legalized marihuana in 1970—and incidentally, I am not for legalization; not then, and not now—but if you had done that, you would have established a formal social control. You could have said "18 is a formal social control."

Any studies of the use of a variety of intoxicants indicate that first use tends to cluster around the formal social control. If you have an

18-year-old formal social control, the bulk of use will cluster around 16, 17, dropping to 15, but moving back and forth around that formal control. You will find very few adults that will give a drug to a 12-year-old, even an older brother or sister—17-year-olds, maybe, but a 12-year-old, no. The gap is too great. And it becomes very clear we have a formal social situation.

I don't think you could legalize marihuana. I think if you tried to legalize marihuana, you would have another gun control issue, another abortion issue. You would have a tremendous polarization; and I think polarization only leads to heat. It doesn't lead to light.

And therefore, I said that one of the things that was going to happen if you kept marihuana illicit, illegal, and did not establish a formal social control, was that you would have a drop in the age of first use. I said this in 1973; and I said that that was inevitable, it had to happen, and that it was a very bad happening, very sad, but it was a tradeoff, now; and that if it did happen, I suggested that people not panic, because if you tried to reproduce—this is now moving into a policy area, which I am sure you are not interested in, and I won't go into any further——

If you tried to reproduce the conditions that brought about the drop in age of the first use, in the first place, it would not help it; and it would have negative aspects. But it does lead to what we are all worried about.

I don't think there is anybody here, I, certainly, who does not deplore the use by 12-year-olds, 11-year-olds, 13-year-olds, of anything. I don't want them using marihuana, drinking, smoking; I don't want them doing anything. I feel very clear about that. I doubt if there is anybody who would disagree with that.

The question is: How do you stop them? The fact, to me, is crucial; the fact we all deplore is, we don't want any use, and God knows, any use, and we all agree. But what do you do? How do you understand how it came about, and what do you do about it? And that, to me, becomes the crucial issue.

And I think in using that figure, that the epidemiological aspect of changed. Everybody comes out for the "motherhood issue," and nobody can say, of course, but then the issue is how you go about shifting that. That is where you come to policy studies; and that is where you find areas of disagreement and what-have-you.

And I think the worst thing that can happen, when you get to that level of disagreement, is not to pretend that somebody is against 12-year-old use, or somebody else is for it, because I think that would be a great misconception.

I will just mention very briefly, and then I will stop, the Nabilone business, because I think that is like the Paraquat business, and what have you. It is where you have to be very careful that in this tremendous concern about the addition of third intoxicant, that in our search for harm, and ways not to have harm, and what-have-you, you run into a lot of trouble. Nabilone is more toxic than marihuana. There is no question about that.

Now, I think that is really an obvious fact; so in our research to reduce the toxicity of marihuana, we got into more trouble. It is like we developed heroin because we were concerned about morphine. It is a very touchy and difficult thing.

I see high schools where, again, as a psychiatrist, in order to discourage kids from using marihuana, they set up classes in a variety of Zen, meditation, this and that, as alternatives to use. I have certainly seen many people who I wish hadn't been in those classes. I don't think they were so good for them, either.

So in your search for other things, the first rule of medicine is, you don't give a patient anything he didn't have before. I think that has to be very carefully attended to when we think about this business.

And so I would like to say again, as I started, I would like you to think very carefully about the drug itself, the real evidence about the drug; separate that from the problems of the morality and illicitness, and when you look at the research, recognize the research quite correctly, set out to find out what was harmful, and put that back in a larger perspective, if we can. Thank you very much.

Mr. NEAL. Thank you, Dr. Zinberg. Dr. Cohen?

TESTIMONY OF DR. SIDNEY COHEN, THE UNIVERSITY OF CALIFORNIA AT LOS ANGELES

Dr. COHEN. Well, it is a pleasure to disagree with both Dr. Nahas and Dr. Zinberg. They are somewhat polar in their opinions.

For example, Dr. Nahas has just told us, essentially, that THC and marihuana are cellular poisons, and Dr. Zinberg has told us there isn't a reported death from marihuana in this country, except from intravenous use. Isn't that odd? I think the facts will turn out to be in between, something more reasonable even at our present level of ignorance.

Dr. Nahas says that marihuana is not a medicine. I don't know whether I agree with that, either. I think it is a medicine, and calling it "not a medicine" doesn't help the situation.

In fact, if we think of it as a medicine that has a potential for harm and a potential for good, we might be on the right track in resolving this biased impasse that we are at.

Dr. Zinberg said that there is an enormous amount of research on marihuana. Good marihuana research has only existed for the past dozen years, and there are great gaps in our research knowledge. This is the problem. This is why we have debates of this sort; that is why we cannot give specific answers to your important questions.

We have conclusions from test tube and Petrie dish work and small animal work, but we don't have many answers for the human situation.

The trouble with the high school surveys that show that marihuana doesn't harm students is that they don't count the dropouts, the people who have fallen away from high school. Unfortunately, these are the ones that are never counted in such studies.

As for the replicability that Dr. Zinberg complained of, this is the nature of the scientific process. If half a dozen people do the same piece of work, four will agree, and two will disagree, invariably; but eventually, a consensus will be achieved.

Well, it is a delight to be here today to listen to these gentlemen; and I would like to contribute, hopefully, to deconfuse the issue, but maybe not.

I would like to review shifts in my position about marihuana. It may give you a feeling what my prejudices are.

Before 1960, I didn't have much much personal knowledge of the drug, and I accepted the scientific opinions of the day, which were that: "prolonged use may result in mental deterioration, a fact known for centuries in Egypt and the Orient." It is also believed to be "a breeder of crime and violence." This comes from the standard book on pharmacology by Goodman and Gilman, first edition, 1941.

During the 1960's, I revised my posture about the drug. I was seeking casualties from LSD, amphetamine, and heroin use, and very few ascribable to marihuana. I wrote, then, and spoke of it as "a trivial weed," and perhaps it was, at that time. The domestic stuff had practically no THC in it. The Mexican material had about a 1-percent THC content, and this was no big deal.

Adults were using it a couple of times a week, and as far as I could see, very few people were getting hurt.

Now, during the 1970's, my impressions about the harmfulness of marihuana have changed again; and this latest shift has been brought about by emerging research reports, including my own, and by an unhappy change in the street scene.

Concerning the latter, the new patterns of usage include younger and younger children becoming involved, increased numbers who smoke daily, and often many times a day, and a much more potent product ranging from 5 to 7 percent THC readily available from Colombia, Thailand, and from our own country.

These trends compel a reevaluation of our attitudes of the hazards involved. This heavy use of more potent material by increasingly younger persons make the marihuana issue a whole new ball game.

The occasional smoking of cannabis by adults is a vastly different matter than consistent preteenage consumption. I say this for two reasons:

First, the preadolescent and adolescent is involved in an intensive learning process, struggling to develop techniques of coping with life's frustrations and stresses. If this period is spent in an intoxicated state (from marihuana or any other substance) nothing is learned, and the youngster remains psychologically immature.

Second, this early developmental period is one in which the habits of a lifetime are laid down. To establish a career of smoking pot during grade or junior high school, provides a lengthy period of exposure that places such people at greatest risk.

I intend to focus on three areas of concern: the pulmonary, the hormonal, and the mental. These are areas that are sufficiently suspect that we have to press forward in the immediate future for more precise answers.

First, the pulmonary considerations: Our earlier work with cannabis and THC at UCLA indicated that dilation of the bronchi occurred after the acute smoking or eating of marihuana or THC.

Dr. Tashkin and his associates explored their possible usefulness as an antiasthmatic medication, but the irritant effects of the crude drug on the lungs, and other problems with THC makes it improbable that they will ever be used for asthma.

Since then, we have found that chronic smoking, daily smoking, will eventually produce a narrowing of the medium and large sized airways. This results in a decrease in the diameter of the bronchial tubes. It

cause increased airway resistance of about 25 percent as compared to a nonmarihuana smoking control group.

Such a reduction in airflow should not produce symptoms except during maximal exercise, so nobody will notice anything until they try to exert themselves.

The narrowing is apparently secondary to an inflammation of the lining of the trachea and bronchi. It has long been recognized clinically that sustained smoking of marihuana or hashish results in chronic bronchitis and pharyngitis.

Medical officers with the U.S. Army in Europe took biopsies of cannabis-smoking soldiers with bronchitis, and metaplastic changes of the mucous membranes were seen. Bronchitis is not a pleasant or desirable condition, and it may contribute to a decreased resistance to infection and a decreased exercise tolerance, but it is not, in itself, life-threatening.

The long-term complications of chronic inflammation of the airways might be. They include emphysema and fibrosis of the lungs. Have these conditions been detected in this country? Not to my knowledge, but in countries with a long history of cannabis smoking, some cases have been reported.

The ingredients in marihuana that produce inflammatory changes are, as Dr. Nahas said, the coal tars. They are present in marihuana smoke as in tobacco smoke. Perhaps marihuana tars can be compared to tobacco with a high tar content. Selective breeding of tobacco has reduced tars in tobacco in recent years.

Two points must be made. A heavy tobacco smoker would be someone who smokes 30 or more cigarettes a day. A pothead is someone using one or more "joints" a day. This difference would seem to decrease the risk for the marihuana user.

On the other hand, the technique of inhaling marihuana is quite different than smoking a cigarette of tobacco. The smoke is deeply inhaled, kept in the lungs as long as possible, and then exhaled. This method of smoking exposes the hundreds of substances in the coal tar to direct contact with the cells of the tracheobronchial system for much longer periods during each inhalation than tobacco smoking does.

A related pulmonary problem is that of possible cancer production, also the result of chronic coal tar exposure. Hoffman suggests that due to its poorer combustibility, cannabis smoke contains about 50 percent more cocarcinogens, tumor initiators, and cilia-toxic agents than tobacco smoke.

As you may know, it is extremely difficult to produce a lung cancer in an experimental animal with tobacco smoke. Instead, when an extract of tobacco tars is painted on the skin of mice, tumors and cancer can be induced.

The same situation is true of marihuana. You cannot, to my knowledge, produce lung cancer in animals from marihuana, but you do produce tumors by painting the tar on the skin of susceptible mice.

When one asks about cannabis-caused cancers of the respiratory tract in humans, the answer is that none have been reported in this country. We do not yet have a sufficient constituency who have smoked consistently for the many years it takes to grow a carcinoma. By the way, we know nothing of the combined effects of tobacco and marihuana smoking, which is frequent. My guess is that they are additive in carcinogenicity.

Now to the sex hormone changes: The changes in sex hormone levels are complicated and results have not invariably been confirmed. Their significance is therefore not always clear. Clinically, we see a few cases of gynecomastia, enlargement of the male breast that requires surgery, in heavy smokers—not many. There are reports of impotence in connection with heavy marihuana use, even though marihuana is used to enhance the sexual experience. Such cases of impotence, according to Kolodny, have decreased following discontinuation of marihuana.

There are mentions of decreased sperm count and abnormal sperm cells. If these observations turn out to be correct, then a decreased male fertility might be expected.

I will not go into the animal work. It certainly is indicative of the fact we can not give this drug a clean bill of health. There are many questions that have arisen in view of the animal work with sex hormones.

I would like to just summarize the sex hormone changes by saying that the clinical experience of adverse effects is sparse.

The animal work is highly suggestive that profound effects are possible, but changes in an animal should not be directly translated to the human experience. My only additional remark is that during critical phases of psychosexual development, it would be prudent to abstain or reduce the use of marihuana to a minimum. These phases include pregnancy and adolescence.

Psychological effects: To me, this aspect of the issues swirling around marihuana is of greatest importance. The short-term effects of smoking pot only rarely can be associated with problems, except driving while under the influence which I am convinced is a hazardous procedure, both for the driver and for those in his vicinity.

It is the long-term, heavy, juvenile consumer who seems to be at particular risk. There is a special term for those adolescent potheads who lose drive, ambition, and goal direction in connection with their smoking practices. It is called the "amotivational syndrome." Practically every doctor, especially general practitioners, pediatricians, and psychiatrists must have had distraught parents coming to them with complaints that their child was sleeping during the day, going out at night, not going to school, not doing anything worthwhile, undergoing a personality change, et cetera, et cetera, and blaming it on marihuana with or without other drugs.

I would like to make a couple of points. It is my impression that in some of these youngsters, marihuana has played only a secondary role in their dropout. They were dropping away from conventional growing-up patterns for one reason or other, and marihuana simply reinforced their withdrawal and passivity. They would have dropped out with or without the drug, but pot facilitated it.

Another point is that marihuana is a sedative drug. Some people use it just to go to sleep on. It is my impression that the amotivational syndrome is a special name for the sedative quality of this drug. Any young person who takes large amounts of other sedatives during the day—alcohol, volatile solvents, sleeping pills, tranquilizers, et cetera—will also develop the so-called amotivational syndrome. Marihuana produces it in certain people, and it is just like other drugs that depress brain activity.

I am not defining the problem away, merely pointing up that sedation may be an important part of the dropout picture. Another part is the pleasant, dreamy, reverie state that can produce a desire to continue using. The final point is that there are some highly-motivated young people who can smoke a lot of pot, and who can overcome the loss of drive that heavy use of the drug can induce.

Of greater consequence is the "burnout." This is the condition that may become evident after months or years of considerable marihuana usage. During the sober interval when no drugs had been consumed, these individuals are blunted, dulled, mildly confused, and appear to have a diminished attention span. Their mood is flat, thinking ability impaired, and the psychiatric diagnosis is usually "organic brain dysfunction" or some variant thereof.

Not too many such people identify themselves as "burnouts." They don't have that much insight, but their friends call them "burned out." If these people can be persuaded to discontinue marihuana, many, but not all, make progress toward recovery after a few weeks or months. Some clear up completely, look back on their state while smoking pot, and recognize that they were definitely impaired. I am not yet sure whether all would recover if they stopped their marihuana use. So this is a serious issue. I don't know what the biological substrate is. It may relate back to Dr. Heath's work that was mentioned.

It may be the pot equivalent of the chronic brain syndrome of the alcoholic—actual tissue damage due to the toxins involved.

It seems clear to me that the horror stories of the last century and the early part of this century, and the overenthusiastic assessment of marihuana during recent years, were both equally without a data base. Cannabis is turning out to be a drug that has a dose-related potential for harm, a potential for benefiting certain types of glaucoma, and some, not all, patients receiving cancer chemotherapy.

The public remains about 5 years behind the times insofar as information about marihuana is concerned. They are still not fully aware of the recent changes that have occurred; for example, the involvement of many children in daily marihuana use. It is hoped that these hearings will help to correct this information gap.

I would like to briefly state my current position:

1. Pregnant women should not use cannabis.

2. Driving under the influence of this drug can be hazardous to one's health and to the health of those in the vicinity.

3. Young people should be discouraged from its use, particularly heavy use.

4. Those individuals with lung diseases should avoid the drug. I also agree with Dr. Nahas' comment that epileptic individuals should avoid it, not because THC is a convulsant, but because anybody who has a fit, and smells of pot or alcohol, will be treated differently by the police than somebody who just has a fit.

5. People with heart disorders may be further impaired by the acceleration of the heart that cannabis produces.

6. Preschizophrenic and schizophrenic people may develop or exacerbate a psychotic break in connection with marihuana use. I have seen this. Schizophrenics should stay away from cannabis, although it has some attraction for them.

7. The infrequent adult use of marihuana—less than once a week—will probably not result in ill effects unless the smoker happens to

experience one of the uncommon, acute reactions, or gets into his car and drives.

8. Continued study of the therapeutic potential of cannabis is desirable, particularly for the management of intractable nausea and vomiting and for wide-angle glaucoma.

The population that I have not referred to above are those adults who are consistent and substantial users. I suspect that, as with the immoderate use of alcohol and tobacco, some of these people will become physically or psychologically impaired, and others will not.

What should be done about the situation? As a researcher and physician, I will avoid making legislative and enforcement policy pronouncements. I have already referred to the need for up-to-date information for users, parents, educators, and other groups. In addition, the health and human service professions also require updating. I say this not because I have faith that I am going to change anybody's behavior by giving them accurate information. Unfortunately, most people don't respond to reason. But at least they should know the possible consequences.

I feel there is a great need for accurate answers to specific questions about the adverse effects of cannabis, and that these can be achieved within a reasonable time. Some of this research is ongoing, but a program of research directed at the most important unresolved questions should be added to our current efforts.

I believe it is possible to design investigations that would have a good chance to provide decisive answers to many of the present uncertainties of the human interaction with cannabis. I do not suggest a crash program. That implies that throwing money at the problem will give us answers.

Instead, I recommend a thoughtfully designed and executed series of researches carried out in deliberate haste, and executed by the best people available. These answers are needed before major legislative amendments to our existing statutes are made.

Thank you very much for your attention.

[Dr. Cohen's prepared statement appears on p. 85.]

Mr. NEAL. Thank you, Dr. Cohen. Thank all the witnesses. Chairman Wolff has to leave our hearing this morning, so I would like to recognize him first.

Mr. WOLFF. Thank you, Mr. Chairman. Just let me comment by saying that I think that we have shed an awful lot of light here today, which is most important. However, I think we have also just followed the pattern that has existed before, of the conflict as to the effects, or ill effects, of this substance.

I am hopeful that under the leadership of Mr. Neal, that this is just the beginning of a real in-depth search for some of the answers the public needs to know, more than in any area that we are addressing.

The importance of these hearings, I think, will be felt, and the overall aspects of the abuse of this substance will be apparent to the public for whatever the findings may be.

I would like to ask just a few questions. Dr. Zinberg, you said you are not for legalization, yet you have come and refuted virtually everything Dr. Nahas has said. Why aren't you for legalization, if that be true?

Dr. ZINBERG. I am for decriminalization, but not for legalization.

Mr. WOLFF. Why aren't you for legalization?

Dr. ZINBERG. Well, this is the issue. Clearly, it seems to me, it is a rhetorical one. There are none of Dr. Cohen's recommendations with which I disagree. I agree with every one of them. Let me finish, because I can't say "yes" or "no" as to why I am not for legalization, and the issue is one of rhetoric.

Dr. Cohen says, very strongly, young people are being harmed. I agree with him. I think young people are being harmed. The issue is what you do about it; and when it is stated in a certain tone of voice, it makes it sound like you have wrapped that issue around yourself and you are against young people being harmed, while other people might be for it. That is what I am concerned about.

The reason I am not for legalization, principally, is I think in this climate, both the information problems in the climate and the political aspects of the climate, that it would be destructive.

I think you would have, as I said, another "gun control issue." I think the polarization that exists now would be inestimably stepped up if anybody ever thought of legalization.

Mr. WOLFF. Just because of the conflict, then; not because of the substance?

Dr. ZINBERG. I think we need time, at least a 10- or 15-year period of decriminalization, where we didn't send people to jail, where we can think through the scientific evidence, see what really happens over time with some of this research, develop longitudinal studies within this culture—I agree completely with Dr. Cohen there—and particularly begin to precipitate out what is caused by the social setting in which this is taking place, and what actually is the genuine health hazard of the drug. That requires time; and it ought to give us that time.

Mr. WOLFF. You also indicated you don't object to the use of intoxicants. Now, does that include the heavy drugs as well; the heroin——

Dr. ZINBERG. The use of—of course, it does, as——

Mr. WOLFF. I understand that there was a statement made, at one point, that you did not agree with the occasional chipping, or occasional use of heroin.

Dr. ZINBERG. No; I did not indicate agreement with use. You have studied the occasional use. I did not say "occasional use of heroin," or——

Mr. WOLFF. Would this be included in the intoxicants you mentioned before? You said during your exposition that you don't disagree with the use of intoxicants.

Dr. ZINBERG. At the moment, I was referring to alcohol, marihuana, and tobacco, the addition of a third intoxicant. I wasn't thinking of the barbiturates, opiates, and so on.

Mr. WOLFF In other words, they are in a different category?

Dr. ZINBERG. They are in a different category; amphetamines and so on. I said "the addition of a third intoxicant," meaning to alcohol and tobacco.

Mr. WOLFF. One of the things that troubles me, in all of the statements that have come from various elements of the psychiatric/psychological disciplines, has been the fact that although we are told to address the social problems, there is the occasional recommendation

that we use an intoxicant in order to relax the individual. In other words, we are not doctors. We can't tell whether or not a person should take a particular drug, or should not take a particular drug.

We are faced with the idea of attempting to solve the social problems in this country. And for the recommendation to be made that persons should resort to an intoxicant, to my mind, is a "copout" on the question of addressing these social problems.

That is why many times, I find it difficult to understand the recommendations that are made by people who have a very deep interest in the solution to the social problems, condoning the use of these substances to "dissolve" the problem in some fashion.

Dr. ZINBERG. OK. Now I see what you are getting at, although I did not mean to include any other drugs. I was thinking only of the three drugs.

Let me try to answer you, because I think that the position you outlined is a difficult one. And I hear you and other people on the panel call for answers to social problems. I am not so sure that we can answer social problems.

Mr. WOLFF. If we can't answer the social problems, Dr. Zinberg, then perhaps we should not be here, because that is part of our——

Dr. ZINBERG. I don't agree with that, either, because I think the question of how problems are tolerated and how they are dealt with, when they can't be answered, may be quite crucial.

See, there is a difference between a solution—"fixing" something, finding an answer, solving it—and beginning to modify and create climates where things are different. Don't forget, social problems often change on their own.

One of the most important, it seems to me, statistics that I can think of is of the first 20 social problems that were listed as most on the minds of the American public in 1965. Only 4 of them remained in 1975; and they weren't answered by any specific action of Congress, or other things: Things like the "brain drain," the teacher problem, all those things, were listed in 1965 as most on the minds of the American people. They weren't there in 1975.

Mr. WOLFF. Maybe because there are other problems that have emerged, and supplanted them.

Dr. ZINBERG. That's exactly right. But that doesn't mean Congress has answered, or should have found an answer. Congress is very much involved, it seems to me, from my view of civics, in trying to make a very complex political, psychological, what-have-you business, and finding answers may be a very small fraction of it.

So I feel the same way about individuals. The fact that many people, when they come home at the end of the day or on Saturdays, like to have a drink or two, I don't think means they are dissolving their problems. I don't necessarily mean that as running away, finding an escape. There is nothing inherently wrong with certain levels of escape.

I think the problem is these words tend to be capitalized. It is as if every time somebody has a drink, he is "escaping from his problems." Well, he is not escaping from his problems. He is not solving them; not giving up on them, dissolving them. He is taking a break, maybe so he can go back to work on them.

I think those are the differentiations, distinctions, I would like to stress.

Mr. WOLFF. Thank you. My time has expired. I ask unanimous consent that I might be permitted to put into writing questions to the other two panelists for their answers.

Mr. NEAL. Without objection, it is so ordered. Let me just say in response to a remark made earlier by Dr. Zinberg—and I tried to say in my opening remarks—the purpose of these hearings is to be objective and reasonable. I hope that is the result. I can't promise you that it will be, but that is what we are attempting.

Let me ask a question, if I may, of all three of you.

It appears that we are not going to resolve these scientific questions concerning marihuana this morning, and I know that you don't all share the same perspective concerning the health costs and benefits of marihuana. But I would like, if I can, to get from your perspective your opinion as to how marihuana could reasonably be compared to some of the other substances that are widely used in our society now, and widely prescribed by doctors.

I am thinking of such things as Valium, Librium, barbiturates, the stimulants, and so on. And maybe you could also compare it from your perspective with some of the other drugs that are widely used by young people, such as PCP, and maybe others that I don't know about.

Dr. Nahas, could you comment? And then, Dr. Zinberg and Dr. Cohen.

Dr. NAHAS. The first comparison, with alcohol; which is made most frequently is somewhat misleading. One misleading aspect of comparing marihuana with other drugs is the fact that one ignores the pharmacology of these drugs. I think that socially, a drug is most dangerous in relation to its potential to be abused.

As far as alcohol goes, it is a simple substance which is eliminated in a single dose in a period of 6 hours. It is also clear that alcohol is completely transformed by the body, either into energy or into fat. As such, it can be considered as food. One can absorb 20 percent of the caloric equivalent amount of his diet in alcohol, and not have any ill effect. This corresponds to about half a liter of wine a day. Therefore, one can use alcohol moderately daily without any physical damage.

I think this is not the case for other psychotropic drugs, which have a potential for abuse, because certainly alcohol has a very, very powerful potential for abuse.

I believe one of the great differences between the use of alcohol and marihuana is that one pays for the abuse of alcohol later in life. It is pretty well known that a lot of alcoholics can have a successful professional or business life. You have to pay the price, but it is later; while as far as marihuana abuse, which starts at an early age it will throw out of the main stream of society young people before they are able to make any social contribution. So I think that these facts should be kept in mind when one compares the two substances.

Society has to pay for alcohol abuse. On account of this, controls had to be established for alcohol consumption. Even now, we have controls forbidding the use to young people; and alcohol control is logistically simple, because it means controlling stills, controlling outlets, controlling wineries.

However, the control of cannabis is a very difficult problem, thanks to the information which is published in hundreds of thousands of copies each month; anyone can grow cannabis of very high potency just anywhere, and have a supply for weeks or months. So the problem of control of cannabis availability is a very difficult one.

Now, the other psychotropic drugs which you mentioned present a great potential for abuse. As a pharmacologist, I think I would make a simplification in stating that the abuse of all these drugs is predicated on their ability to activate the area of the brain, corresponding to the brain reward system, which has been under intensive investigation, especially at Harvard for the past 20 years, as you know, Dr. Zinberg. And all the drugs which have the potential to activate this area, and give euphoria in one way or another, have a high potential for abuse.

And I would say even that the more their ability to activate this area, which motivates behavior, the more their potential for abuse.

And I don't think it is fair to put aspirin among these drugs, because it has a very low potential for abuse. It does not activate the brain reward system.

Mr. NEAL. Thank you. What I was really trying to get at was to compare the potential for abuse, compare the costs and benefits of marihuana with alcohol, Valium, Librium, barbiturates, PCP, all these things that are used. Maybe there is something in the literature that would do this, but, Dr. Zinberg, could you just comment?

Dr. ZINBERG. I would love to shift the order, once.

Mr. NEAL. Whatever you want to talk about.

Dr. ZINBERG. I have the feeling it is almost set up as Dr. Nahas on one side, and I am on the other, and Dr. Cohen immediately takes the middle; and I mind that.

Mr. NEAL. I am sorry. I didn't mean anything by your requesting——

Dr. ZINBERG. I know. I am just saying I find that a little difficult. I think it is a difficult question to answer. I think you are asking almost as if it were a straight pharmacological question; and at least in my mind, it certainly has pharmacological aspects, but it is a psychosocial question more in measuring the question of how things are used in a particular time by particular individuals.

I think personality has an impact. I think particularly the cultural movement of how things are used, under what conditions and for what reasons—the way psychedelic drugs were used in 1973, for example, which was the last year I know of where there was reasonably heavy use of psychedelic drugs, in my opinion, than the way they were used in '65, and had a different potential for damage.

When you get to a drug like Valium, it has been an immense advantage, medically, because Valium has a low toxicity in contrast to the barbiturates. Valium, Librium, all those drugs have been introduced because the barbiturate potential for suicide, various toxicity, and so on was very bad.

So I don't know whether there have been any fatalities from Valium alone. Mixed with alcohol, there have been, but there are very few.

So you have, however, increasing use for intoxication, very heavy use, which is very bad for them. Now, how long that will continue, under what conditions that will continue and so on, I think, depends largely on policy matters, not on the strength of the drugs themselves.

PCP is another matter. That is a very difficult drug to handle. It is a very difficult drug to control or to use. I also think it is not a highly pleasurable drug, from what I can gather, in talking to users. I have the sense it is going to be something that goes like this.

[Indicating down.]

Dr. ZINBERG. I don't consider that a drug that is going to get into the armamentarium of fairly regular recreational uses. I think it will go down even faster than the psychedelics have gone down; so I think that these things are largely to be understood in terms of how these drugs are received, as opposed to their per se toxicity.

Mr. NEAL. Dr. Cohen?

Dr. COHEN. I would like to just compare marihuana with 2 drugs, and use them as a learning device.

First of all, PCP: In a city like Los Angeles, PCP is a bit of a disaster—a lot of violence, a lot of overdoses, a lot of real trouble. When we just look at that side of the picture, it is like the undertaker, who only sees dead bodies. We have to realize there is another side to the picture; namely, that 95 percent or more of the people who take PCP never get into trouble with it. They take small doses, or they are very careful.

This is perhaps the way we might also look at marihuana—that enormous numbers of people use marihuana, and only those who come to clinical vision are the ones who get into trouble with it.

Now, I would like to also compare marihuana with tobacco. I practiced medicine before World War II. At that time, I saw patients with cancer of the lung die on my wards. It never occurred to me nor did it occur to anyone else, to ask them whether they had a tobacco-smoking history, because the connection had not yet been made that a relationship between tobacco and lung cancer existed.

The concern that I have about the pulmonary effects of marihuana is not those of today, but what will happen when we have sufficient numbers of people who have used heavily over many years. Will we have a repetition of the tobacco carcinogenesis story?

Mr. NEAL. Apparently it is a difficult question. I am not getting very clear answers.

It is my understanding that it is the practice of the committee to recognize members as they arrive. If that is true, then Mr. Beard.

Mr. BEARD. Thank you, Mr. Chairman. Dr. Nahas, I was looking in your background. You are a member of the U.N.—was it the U.N.——

Dr. NAHAS. United Nations——

Mr. BEARD [continuing]. Narcotics control?

Dr. NAHAS. No, no. I am a special consultant to the United Nations Commission on Narcotics in Geneva, which administers the terms of the single treaty convention of New York, under which marihuana, cocaine, and opiates should be banned from public usage.

Mr. BEARD. In other words, the general feeling about the marihuana in the United Nations circles, have they come out with a policy saying they consider it a fairly dangerous drug medically? Or—if you could be very short, because I really need—I mean, what has been the general thrust?

Dr. NAHAS. Well, the general consensus of the United Nations and of the League of Nations before, is that for strictly social reasons, the use of opiates, cannabis, and coca leaves should be strictly limited to

medical purposes, and their general usage in the population should not only be banned, but penalized.

This is the term of the single convention of the United Nations, of which the United States is a part.

Mr. BEARD. But they have international conferences throughout, quite frequently?

Dr. NAHAS. By law, there are annual meetings of the Commission in order to find out to what extent the member nations have complied with the terms of the treaty. And they are very interested, of course, in this area of marihuana, since it is an area where there has been a great increase of consumption in the past 10 years.

Mr. BEARD. You feel the medical consensus, though, of researchers throughout the world, there have been quite a few that have come up showing medically damaging testimony?

Dr. NAHAS. Now, I believe that the social outlook, the social reasons for which marihuana was banned by these international instances, have been to some extent justified.

Mr. BEARD. Through the medical——

Dr. NAHAS. Medical research.

Mr. BEARD. All right. Dr. Zinberg, are you still a member of the President's Commission on Mental Health?

Dr. ZINBERG. I think it is defunct. It was a limited life.

Mr. BEARD. It is defunct. Is that when you did the research with the study report of the Liaison Task Panel on Psychoactive Drug Use and Misuse?

Dr. ZINBERG. I chaired it, the whole group, a large group of people; but I chaired it—coordinated it, I think, is the word.

Mr. BEARD. One of the things I was interested in is the task panel in the executive summary states that it is the recommendation, the Schaffer Commission recomendation, to decriminalize the personal possession and use of small amounts of marihuana.

When this goal is more fully implemented, and if the present trend toward responsible use of marihuana continues, then policy options should be developed to provide taxation, regulation, and control of marihuana.

That sounds like legalization to me.

Dr. ZINBERG. In time. In other words, I think we need a good decade of decriminalization.

Mr. BEARD. I see. In other words, start with decriminalization and study the options.

Dr. ZINBERG. Yes; 10 or 15 years down the line.

Mr. BEARD. NORML is somewhat pushing——

Dr. ZINBERG. No, NORML is for legalization; for the——

Mr. BEARD. Are you on the board of NORML?

Dr. ZINBERG. No.

Mr. BEARD. You have never been on the board of NORML?

Dr. ZINBERG. I have never been on the board of NORML.

Mr. BEARD. Are you on any advisory committees?

Dr. ZINBERG. I am on the professional advisory committee.

Mr. BEARD. Of NORML?

Dr. ZINBERG. Right.

Mr. BEARD. So you work with Ken Stroup and some of those people—Keith Stroup?

Dr. ZINBERG. It is a large——

Mr. BEARD. Do you advise that they are off base by coming out for legalization?

Dr. ZINBERG. No. I was against legalization; still am. They don't always take my advice.

Mr. BEARD. I can identify with that. The task panel recommends that drug education and prevention strategies be aimed at the avoidance of the destructive patterns of psychoactive drug use, and immediate cessation be imposed on the development of materials and programs aimed exclusively at prevention of all use.

Do you feel that is the approach to take in our grammar schools and high schools; that we don't come out with materials such as we have on smoking, you know, on television; public——

Dr. ZINBERG. Absolutely. I mean, in the sense that the reason for that, if you read the text, is explained rather clearly. It's that it invariably has increased use. There has been study after study that the use of certain kinds of materials—if you please, it started in the 1964 National Coordinating Council on Drug Abuse, which studied all the materials that were being used in the schools, and so on.

There have been frequent updates of these studies, which indicate that the use of these materials, rather than reducing use, has consistently resulted in upsurge of use.

Mr. BEARD. Has this happened in cigarette smoking?

Dr. ZINBERG. It is debatable, in cigarette smoking.

Mr. BEARD. I thought I saw Federal statistics——

Dr. ZINBERG. It has been very clear, about the illicit drugs. I did a study myself, in 1967, of a meeting at a high school in Newton where they did a big education business. They got the parents over, and really did a big 3- or 4-day thing. And I had interviewed a few members of the senior class before, and then followed up after that. And there was a 50-percent increase in use.

Mr. BEARD. That is totally opposite from what HEW reported to us, on their education, working with parents in the schools. They say it has been a successful program.

Dr. ZINBERG. Well, there are any number of studies—the Yanklovich study, and so on—which indicate that has been a negative impact. We went over many, many studies for that report; lots of members of the Commission. And without exception, we agreed. Again, you hear everywhere that these educational materials had a negative effect.

Mr. NEAL. Mr. Gilman?

Mr. GILMAN. Thank you, Mr. Chairman. Since our time is brief, I would like to get to a couple of important points.

I think all of the panelists agree we should not be encouraging use of marihuana by young people. Most of you, or all of you, agree there is some toxic effect from THC. You vary your opinions as to just how pertinent that may be, or how toxic that may be.

And I think all of you agree that we still lack the kind of research that we should have to make some better definitive statements, with regard to our policy on marihuana.

With those premises in mind, what would you recommend for better research, or better policy, with regard to our national policy on marihuana? I would like to address that first to Dr. Cohen.

Dr. COHEN. In my remarks, I partly covered some of this. I suggested that in addition to our present effort, that a special effort be made to do directed research.

Now, that doesn't mean basic research. That means research to answer a problem; and there are certain problems that can be isolated in the marihuana area which, I think, can be answered by extremely thoughtful and well-designed research.

I can't promise answers because of the vagaries of research, but I think this is what should be attempted, because of the sort of disparity of opinions that we are seeing here.

The bottom line is: What are the cost/benefit effects of marihuana when the drug is used by a variety of populations in a variety of ways? And this subdivides into what are the mental effects, other hazards, if any, and so forth.

Therefore, it is my belief that an organization like NIDA ought to get specific funds to answer the major burning questions about marihuana.

Mr. GILMAN. NIDA is spending $3.7 million in fiscal 1978. I don't quite understand why it has stayed at a level. In 1976 they spent $3.7 million; in 1977, $3.6 million, despite the fact that we are accelerating use by our young people, despite the fact that seizures went up from 1 million pounds last year of marihuana to 6 million pounds, this year.

NIDA seems to be quite complacent in the amount of money they are spending; and I hope to get into that further with Dr. Pollin a little later on in the testimony; but there is directed research.

Let me give you some of the research topics. You decide, and I will welcome your comments. about the long-term effects. Drugs and driving, toxicology, reproduction, neuropsychopharmacology, sociocultural research, respiratory effects, psychological studies, DNA effects of marihuana, drugs and driving, genetics, natural history. They have about 10 or 15 topics they have assigned to various investigators, and are spending about $3.7 million. What are your thoughts concerning that kind of directed research?

Dr. COHEN. I think some of those studies are going to turn out to be very valuable. I do think additional effort should be made, since this is such a major public problem, since it is growing, since the trends that Mr. Neal mentioned are happening today, that we had better accelerate the activity in the next 5 years.

Mr. GILMAN. Dr. Nahas?

Dr. NAHAS. Well, I am in agreement with what my colleague said, here. I think that the program is pretty well programed by NIDA. It has sponsored a lot of the work that I have reported here, which could not be done without its support.

I would classify in four main areas. First, in conjunction with the National Cancer Institute, studies should be undertaken to find out to what extent, in animals, marihuana would produce cancer in the same way as has been shown with cyclamate and with saccharine substances, which have a much less cellular toxicity than the cannabinoids do.

In this respect, I didn't say that marihuana was a poison, Dr. Cohen. I said it was toxic at a concentration of a millionth of a gram, in cells. And I think that there is enough evidence to back this statement.

The second series of studies should be, really, on the lung, to find to what extent the marihuana smoke will produce those changes in lung tissues, and not——

Mr. GILMAN. I am going to ask you to summarize as quickly as you can. They are ringing the bell on it, and I want to get to Dr. Zinberg.

Dr. NAHAS. The development effects on the offspring should also be stressed; and finally, also research in countries where marihuana has been used on a daily basis by native populations, and where, with modern techniques, I think answers could be found.

Mr. GILMAN. Thank you. And Dr. Zinberg, what are your comments?

Dr. ZINBERG. You will able to see a little bit just by the different answers the problem NIDA has. They have to satisfy so many constituencies. I think they have sponsored a fair amount of studies in foreign countries: South Africa, Costa Rica, Greece, Jamaica, have all been studied.

The Jamaica study, I think, is a splendid one. I would like to see, in that long list, the psychosocials mentioned once. For example, I would like to see the question of the socialization process; that is, the process by which one learns to become a marihuana user in this culture, and what impacts on that process.

You see, it is in that sort of thing, I think, we could begin to learn what we need to know in order to interfere with early use.

And second, I would like to see studies, preparatory studies, done in States that might decriminalize so we might see the impact of decriminalization on that use—in Oregon, California, and Maine, it has been studied after the fact, rather than before and after—so that we being to see whether decriminalization increases use or decreases it, that sort of thing.

Mr. GILMAN. Mr. Chairman, with your permission, just one last inquiry.

What should we be doing, what should our Nation be doing, to get this message home to our young people about the dangers of the utilization of marihuana? What would you do, if you were the director of NIDA, that NIDA isn't doing today? Can you give us a quick, brief response?

Dr. ZINBERG. I can, but it will create a struggle.

Mr. GILMAN. What is your response?

Dr. ZINBERG. My response would be to do the same thing with marihuana, that we have done, let's say, today, about sex. That is, what we have tried to teach people is not to condone early sexuality, nothing like that. But we have said that if you are going to do it, let's show you how you can do it safely. Let's try to show you how to avoid disease, avoid pregnancy, and so on.

That is, the most effective thing you could do with marihuana would be to teach people how to use it safety and effectively.

Mr. GILMAN. Dr. Nahas?

Dr. NAHAS. I think such an approach is unrealistic, and impossible to achieve in any society, even the most idealistic one. I believe that young people be straightforwardly informed about the danger of marihuana to their brain, to their reproductive function, and to their lungs.

Dr. COHEN. Even if we had all the answers to the harmfulness of marihuana today, and we spread it around the Nation, there are only

a small minority of young people who would pay attention to it. So I have no confidence in the intellectual approach to changing behavior.

What I would suggest is a bit of a revolution; a revolution in how we bring our children up; how we educate them, how we give them gratifying goals and ambitions. This is the answer to not only marihuana, but many other juvenile problems.

Mr. GILMAN. Thank you. I guess my time is up; and I thank you, Mr. Chairman.

Mr. NEAL. Mr. Railsback?

Mr. RAILSBACK. Thank you, Mr. Chairman. And I want to thank all of the witnesses.

Dr. Zinberg, I can understand why probably all of you get tired of testifying, or stating your position, and I am sure you have done it before. However, let me assure you that for those of us who are not expert, for those of us who don't know much about marihuana, and even some of us who are relatively new, or some new members of the committee, your testimony, I think, is very helpful, as well as Dr. Cohen's and Dr. Nahas'.

I would like to ask, I think, Dr. Nahas first, and then maybe Dr. Cohen; and I am going to take you out of the middle, because I know what you mean there, too.

But apparently in the case of the studies relating to interference with the reproductive function, that can be reversed with the discontinuance of marihuana use. Is that correct?

Dr. NAHAS. Yes; this is correct. I think that most changes induced by marihuana, in the lungs——

Mr. RAILSBACK. That was my next question. What about the lungs, other impairments of functions? Can they be reversed if you discontinue the use of marihuana?

Dr. NAHAS. I think the body has extraordinary and miraculous healing powers. There are many toxic agents more toxic than marihuana; such as those used in the treatment of leukemia, which produces negative side effects on the body, and these are quite reversible.

I think this is the hope of many people who have used a lot of marihuana and become impaired by it. I think it can be told to them very clearly, if they stop, this will clear up, and they will be able to live a normal, healthy, and creative life.

Mr. RAILSBACK. Is that true in respect to the lungs, where there has been chronic use for a sustained period of time? The answer may be you don't know yet, but I am just curious, when these lesions are created in the lungs, whether you have—apparently we don't have cases yet or fibrosis; but apparently we know now, and I think all of you concede, there are problems that can be caused to the lungs.

You might disagree on what causes the problem, what chemicals, and so forth. But even with the lungs where you have a chronic marihuana smoker, it is your feeling that discontinuing the use of, say, marihuana, if he is not a tobacco smoker, that he can actually reduce, reverse that lung problem?

Dr. NAHAS. Of course, with any toxic agent, the cellular damage reaches a state where it cannot be reversed, say, where fibrous tissues are produced, and there is destruction. And this may be caused with marihauna smoke in the lungs; but this requires very prolonged and heavy exposure. But there is certainly a point of no return with marihuana, as well as with any other drug.

Mr. RAILSBACK. And I want to ask all three of you, and I think this is important to me: Could you all agree with the statement of Dr. Nahas that the question of the pathologic effects cannot really be known with any degree of certainty for two or three decades? Dr. Cohen, would you agree with that?

In other words, it is still too early; the results are really not in as far as harmful physiological effects?

Dr. COHEN. We will never know the final truth about marihuana, just as we don't know the final truth about tobacco, after 50 or 60 years of research. But we will keep increasing our knowledge.

I think he was referrring to the development of what are called prospective studies in which people who haven't smoked are then followed as they go through a smoking career. And this takes decades; yes.

Mr. RAILSBACK. Dr. Zinberg, do you also agree that we really don't have any definitive or empirical evidence as to the pathologic consequences of sustained or chronic use of marihuana?

Dr. ZINBERG. Yes; I think for a degree of certainty, it is going to take time. I think cross-cultural studies, as Dr. Nahas said, have told us a great deal. The Jamaica study was important in work across culture and custom, where marihuana is in use for heavy periods of time.

What I would like to put in response to your initial question, and the reason I indicated the kind of studies I would like to see done, is the most important thing, it would seem to me, would be to find ways to interfere with chronic heavy use.

And the assumption is because, in contrast to tobacco, where you find very, very few controlled users, the huge majority of marihuana users are occasional users, the enormous majority. And the problem is those that go off. Tobacco is quite different.

Mr. RAILSBACK. I might just add that Dr. Cohen makes that very valuable point when he indicates to us that over a period of time, with his experience, he has actually changed his attitude toward marihuana, I think, at least twice.

We have what I think is an expert on our committee, David Martin, that has been going to all these conferences. David Martin indicates that at one time he wanted to legalize, he wanted to have marihuana legalized. Now, after attending many conferences and seeing some of the results of some of the studies, he is much more skeptical than what he was, and is concerned about some of the consequences.

So I think that providing a forum for experts in our country, and also the world's experts, is very important, because frankly, I get the feeling that the American people have no idea about the harmful consequences, what could be the harmful consequences, of marihuana.

Dr. ZINBERG. I think it hasn't been noted so far in this gathering, and I think it should be noted, that both the United States and the Canadian Governments have had many commissions that have studied marihuana very, very thoroughly. And I think the Schaffer Commission reports are a monument to an excellent study, again, in my opinion.

And as you know, Ex-Governor Schaffer, Dr. Farnsworth, many of the people on that commission were very hostile to marihuana use when they began; and they changed their minds, too, in the course of that multi-million-dollar study.

The LeDayne Commission was identical in Canada. So I do think that every time a serious commission has really sat down and surveyed the evidence carefully and thoroughly, not one study up like a rocket and down, that you have had a less frightening aspect, not zero, but less frightening, than you would have if you thought about one of the most recent studies.

Mr. RAILSBACK. Mr. Chairman, could I just say that some of the things that have occurred, and are occurring still, provide, I think, cause for concern.

For one thing, apparently the toxicity, if that is right, of your early marihuana cigarettes, for instance, were much less than what they may now be, when you consider we are using this different kind of marihuana, in other words, Colombian marihuana, whatever it is.

In other words, apparently the dosage or the harmful content has gone up; and that is something that may change from time to time. So I think you are probably going to need continuing studies.

Mr. NEAL. The gentleman's time has expired.

Mr. BEARD. Mr. Chairman, on that point he just made, he referred to the LeDayne Commission. I think it only fair to point out I know the LeDayne Commission.

Initially, it stated that it leaned heavily toward the finding that marihuana is a relatively benign drug; and came out in their initial hearings—is that not correct?

Dr. ZINBERG. I don't remember the exact phrasing. I think that is a little—I think they would have put it a little bit more modestly than that.

Mr. BEARD. But you referred to the LeDayne Commission report as a very good report, and very accurate.

Dr. ZINBERG. Good and accurate; and less frightening than if you took a single study.

Mr. BEARD. That is what kind of confuses me, because the LeDayne Commission's evaluation of the effects of marihuana in its final report, which appeared, stated:

> The effect of cannabis on the mind is a potent one. It is not unreasonable to assume that persistent resort to cannabis intoxication may produce changes, impairment of will, and mental capacity, the result of some biochemical effect. We believe that by simulating a test for drug experience, cannabis must be recognized as a potent factor contributing to the growth of multiuse drugs.
>
> What has come to our attention with respect to a long-term effect, since the interim report, is an effect for cautious concern, rather than optimism. In our opinion, these concerns justify a social policy designed to discourage the use of cannabis as much as possible.

So that's really a little bit heavier than——

Dr. ZINBERG. I think the Schaffer Commission says something very similar. Both of these reports say quite directly that they wish to discourage the social use of the drug, and heavy, particularly, and chronic uses, as Dr. Cohen says, it depends on how you slice it. Both Commissions ended up the same way, very definitely to discourage the heavy use of the drug, particularly in young people.

I think that both Commissions ended up almost on exactly the same note, with which I would completely agree.

Mr. BEARD. Even though the Schaffer Commission says after decriminalization, they must look at legalization? I can't imagine, in my wildest dreams, that means discouraging anybody from anything.

Legalization. Did the LeDayne Commission say legalization as an ultimate goal?

Dr. ZINBERG. They said decriminalization. I don't know whether they actually set a long-term goal of legalization. Did the Schaffer Commission ask for legalization? I don't think they did.

Mr. NEAL. Mr. Evans?

Dr. ZINBERG. The answer to that is, gentlemen, sometimes legalization can result, for example in alcohol, in lower grades of alcoholism than when it is illicit.

Mr. BEARD. I don't know where that comes from.

Mr. EVANS. Thank you, Mr. Chairman. Mr. Chairman, I would like more confirmation from Dr. Pollin, if I might, of testimony in a previous hearing that relates to the questions that I intend to ask. Dr. Pollin, you testified——

Mr. NEAL. Excuse me. Dr. Pollin is in the audience. Would you join them at the table?

Mr. EVANS. If you would. I just wanted you to confirm some statistics.

Dr. Pollin, you testified about the treatment that NIDA is giving to some people on drugs; and I don't remember the number of people that you stated. Do you happen to remember, right offhand?

Dr. POLLIN. I think you are referring to the data from our CODAP system, which in its most recent report indicates that the drugs listed as the primary drug of abuse of all patients who come into the Federal drug treatment system, marihuana is the second such primary drug of abuse.

Mr. EVANS. What was the percentage?

Dr. POLLIN. Thirteen percent.

Mr. EVANS. I remembered 17 percent, but you say it is 13?

Dr. POLLIN. Thirteen percent of patients coming into the federally supported system report marihuana as their primary drug of abuse.

Just a brief supplement that we looked at that figure to try to understand what is the nature of that population. We are just obtaining information this week. We find that the majority of those patients are under 20 and the majority of them are self-referrals, which suggests that, indeed, they are having difficulties with the drug, rather than that being a label for some other type of polydrug abuse.

Mr. EVANS. I got the impression from your testimony there was plenty of evidence to indicate that the marihuana that was being used was causing at least a psychological dependence similar to addiction.

Dr. POLLIN. There is a type of psychological dependence on marihuana that we are beginning to see for the first time. There has been the well-reported establishment for the first time of groups called by such names as "Pot Smokers Anonymous," and the like, and the increasing numbers of individuals who are asking for help in, or coming in, with what is apparently a psychological rather than psychological addiction to the drug.

Mr. EVANS. Thank you, Dr. Pollin.

Dr. Zinberg, are you familiar with these statistics and with this information?

Dr. ZINBERG. Yes.

Mr. EVANS. You serve in an advisory capacity to NIDA? Or what is the capacity you serve in?

Dr. ZINBERG. I am on their advisory council. I am a member.

Mr. EVANS. What does that consist of? Do you have any say-so over the policy, or do you just advise on the policy?

Dr. ZINBERG. I guess we just advise. We don't have any power over policy.

Mr. EVANS. How many others?

Dr. ZINBERG. Twelve.

Mr. EVANS. Is that a paid position or honorary position?

Dr. ZINBERG. Are we paid as consultants? Yes.

Mr. EVANS. I know you have done a lot of those where you weren't paid.

Dr. ZINBERG. It is hard to separate them. Yes, I think we are paid a per diem.

Mr. EVANS. You seemed to express agreement with other panel members it was not advisable for adolescents to use marihuana, also smoke or drink, which I thoroughly agree with. Do you feel that way because you feel that marihuana has potential harm for these young people?

Dr. ZINBERG. Yes.

Mr. EVANS. Do you feel that marihuana has potential harm to adults?

Dr. ZINBERG. In very heavy, chronic use—yes.

Mr. EVANS. You express some doubt in a program such as "Smoking may be harmful to your health" as being effective in helping to decrease the use of marihuana among adolescents; is that correct?

Dr. ZINBERG. Yes. I have lots of concerns about direct education as opposed to indirect or contextual education.

Mr. EVANS. The one thing—and I would like your comment on this—that I have noticed in response to the smoking ads is that young children tell their parents not to smoke. Do you think there is a potential if we followed such a policy of reaching the next generation of young people in using this type of tactic?

Dr. ZINBERG. Well, these are the sorts of things that I would like studied. You have touched on the kind of studies I would like to see because, anecdotally, and again, the whole question of the socialization process, I would love to see those kids studied because I have the clinical impression so far those are the kids who become smokers themselves, the ones who take a very moralistic, very righteous view, are very concerned about it, overly concerned, are often the ones who, when they switch, go from zero to 100 percent.

My basic position is that the moderate middle group is where you are likely to get your most effective business. For example, in some of our studies of other drug use, clearing marihuana use, where we have been studying controlled users, something I wrote in 1963 where I was investigating psychedelic drug users, I found that many of the parents of the psychedelic drug users, were, themselves, heavy users of a variety of non-illicit drugs; you know, barbiturates for sleeping—a variety of things like that.

In our controlled use study, what we found is that the controlled users' parents are moderate users of medicinal substances; while in our heavy users, many of the parents are abstinence-oriented.

It is very much like a lot of the data about alcoholism. Your alcoholics tend to come from abstinent families, or alcoholics, much less than families of moderate drinkers.

So the whole question of whether or not these children take this extremely righteous attitude with their parents, whether or not they will turn out to be smokers, is the kind of thing we are debating.

Mr. EVANS. Along that line, the research you have done in the field of marihuana, has that not been more along the line of sociological rather than chemical or pharamaceutical lines of scientific research?

Dr. ZINBERG. I have done both. I did some experiments in 1968 which were the first controlled experiments giving marihuana to human beings, now over a decade ago; and I have continued to do experimental work with the use of THC, actually, for the nausea and vomiting of cancer chemotherapy. And I am doing some work with the National Institutes of Health, with THC, again, with anorexia nervosa.

So my basic research has been psychosocial. I have done a certain amount of experimental work along these lines, but it is not pharmacological. It is experimental. But it is objective research; not perfect.

Mr. EVANS. One other question, Mr. Chairman, if I may.

Dr. Zinberg, I think that you said, when you started to testify, you got tired of testifying because people are prone to put you in a "pro" position or a "con" position as to the use of drugs.

What I would like to inquire about is that you have recognized there have been a number of studies which indicated harmful effects of marihuana. And yet in your public statements and your advocacy, you seem to emphasize only those which tend to suport a pro drug position. Is there any particular reason for that? Or is that just your belief that these studies, which indicate harmful effects of marihuana are not valid?

Dr. ZINBERG. Well, I could only suggest that you compare the first marihuana and health report, or the first two marihuana and health reports, with the last one, to read them carefully. And I think you would find that so far, my positions—and I am not specifying reading the report—but so far, my positions have consistently held up.

Mr. EVANS. Along that same line, is it not true that the early studies of marihuana are inconclusive, in that they were not studied on subjects over a long enough period of time to get the long-term effect, as, like Dr. Cohen said earlier? Have we had sufficient time to study the long-term effects, or harmful effects, or possible harmful effects, of marihuana on the individuals who use marihuana?

Dr. ZINBERG. None of us know what will be shown a decade from now, or two decades, or fives decades from now.

Mr. EVANS. The same is true of smoking, is it not?

Dr. ZINBERG. But my criticisms of the studies that were done then, and my indication of where I thought the next step of scientific knowledge would go, was that is whether they would be correctly replicated or not, which ones would and which ones wouldn't. I think my track record is very good; and it is all in print. So I don't——

Mr. EVANS. I can find it. I certainly find plenty of materials. But you don't think there is sufficient evidence to indicate that we should go slow on marihuana?

Dr. ZINBERG. Indeed, yes. I don't think it is a harmless substance. I have never said that, and I wouldn't say it now. It depends on what you mean by "going slow."

Again, you see, what I think we are talking about——

Mr. EVANS. At least, we are not for legalization.

Dr. ZINBERG. In a basic sense of what we will agree on, on the data, nobody wants 12-year-olds to smoke. But what we may not agree on is what we think is the most effective way to keep 12-year-olds from using it.

Mr. EVANS. And we are talking about a matter of policy. I understand that. Thank you, Mr. Chairman.

Mr. NEAL. Mr. Guyer?

Mr. GUYER. Thank you, Mr. Chairman. This should be very important, because my testimony is the only one that is coming by prayer. I think the Chaplain is praying in the House, right now.

I am a little bit confused about what we, as responsible Congressmen, are to tell the people who write us, in the absence of definitive conclusions.

For example, marihuana is illegal. We have established that. And cigarette smoking is legal. And yet, the Surgeon General, in terms of the cigarette smoking, says it is injurious to your health, but doesn't say the other is.

And a little while ago, I think Dr. Zinberg mentioned, in handling the subject of sex, that you can't put an end to it, but you can tell them what to avoid. But that gets a little bit like asking whether electrocution is good for your posture.

I think that someplace along the line, we have to have some answers. For example, I invite any one of you to respond. Are you familiar with the tests made by airline pilots who were given a huge, massive amount of marihuana, and their judgment? Does anyone want to comment on that?

Dr. COHEN. Yes, sir. I think you are referring to the work of Janowsky at the University of California in San Diego.

Mr. GUYER. Yes.

Dr. COHEN. The amounts given were not massive, sir. They were average amounts.

Mr. GUYER. Over a period of time, weren't they?

Dr. COHEN. No. What happened is they were tested once while sober, and once after smoking a single joint. This was done in a Link trainer, not in an airplane.

Mr. GUYER. That is a good reason for "not."

Dr. COHEN. What it did to their flight patterns were just disastrous.

Mr. GUYER. I understand that something like 8 out of 10 or 9 out of 12 had judgments that just would have been a disaster had they been in an actuated circumstance, flying a plane.

Dr. COHEN. That is correct, sir.

Mr. GUYER. I only have a couple of minutes. I guess the most souls are saved in the first 5 minutes; but at any rate, Art Linkletter, who had that experience of his daughter committing suicide, did make the statement one time that almost all people on hard drugs began on marihuana. Would you say that is basically right?

Dr. ZINBERG. No.

Dr. COHEN. Not basically.

Mr. GUYER. He was probably making a judgment based on some emotion, perhaps.

Dr. COHEN. Yes. That is something I think we ought to write off. The only connection between marihuana and heavier drugs is that marihuana may be the first illicit drug used; but even before marihuana was used, alcohol and tobacco had been used by those children.

Mr. GUYER. Or the company it keeps; also, the environment might contribute. Do you have any information on the effect on the freezing of the eye level, those who are habituate in their taking of pot, 5 to 10 sticks a day, which would be tantamount to maybe 100 packs of cigarettes or more, as far as the cartileges go? But I am talking now about freezing the eye level and determining distances, and being able to determine colors and distance. Do you know anything about that?

Dr. COHEN. You are referring to the effect of marihuana on driving?

Mr. GUYER. That's right.

Dr. COHEN. Marihuana impairs immediate memory, peripheral vision, reaction time, and certain aspects of perception, so that it is very clear to me, even with the tentative proof we have now, that marihuana and driving do not mix well.

There is another problem here, which is that a lot of kids who smoke pot also drink beer with it; and this will only have an additive effect on driving.

Mr. GUYER. The same as Valium and alcohol?

Dr. COHEN. Yes.

Mr. GUYER. Incidentally, Dr. Cohen, you were on a program, "Reading, Writing, and Reefer"——

Dr. COHEN. Yes.

Mr. GUYER. [continuing]. NBC. Do you have any results of that?

Dr. COHEN. I have been told they were phenomenal.

Mr. GUYER. I understood there were thousands of letters from young pot smokers who said they were going to quit because of that production.

Dr. COHEN. I didn't know that.

Mr. GUYER. I guess the hour is too late to get into anything else, except I would hope that the diversity, the knowledgeability, of the backgrounds of you gentlemen would have contributed a great deal to our reaching some conclusions which seem to be absent, either because it is so new to us, or we haven't had enough material for in-depth research. But I think this might be a good springboard, Mr. Chairman, to find some answers that we are trying to find out as the factors of all loss of life.

And I for one am deadly opposed to legalization of marihuana, and I am a cosponsor of Mr. Beard's bill on the diversion of the first offense in marihuana. I do not like to see 43 million kids—I am told there are that many that have tried—

Mr. BEARD. Would the gentleman yield?

Mr. GUYER. Yes. Be happy to.

Mr. BEARD. The "Reading, Writing, and Reefer," you know, in one of the reports it was stated that the task panel recommends, and that was the one that was coordinated by the President; the President's Commission on Mental Health—it states:

> The task panel recommends that drug education and prevention strategies be aimed at the avoidance of the destructive patterns of psychoactive drug use, and that an immediate cessation be imposed on the development of materials and programs aimed exclusively at prevention of all use.

Do you think, Dr. Cohen, that in your relationship with "Reading, Writing, and Reefer," that is a legitimate statement to our young people with the public service ads on smoking?

You go and ask a young seventh grader the problems of smoking, and they can tell you. Ask them about marihuana, and they cannot tell you. How would you react to that statement?

Dr. COHEN. I think that statement was made a few years ago when, indeed, we were putting out materials, and we couldn't evaluate them. And in some cases, perhaps they were doing as much harm as good.

Mr. BEARD. That was February 15, 1978?

Dr. COHEN. I think with the best minds, we can devise materials, both insofar as tobacco and marihuana and other substances are concerned, that could reach youngsters. You know these public information messages that we think are good, the youngsters may not even look at. We have to put ourselves in their place, and see through their eyes: and then maybe we will get somewhere.

Mr. BEARD. Thank you.

Mr. NEAL. On page 10 of Dr. Cohen's testimony, he lists 8 points that he said summarizes his current position on the subject of marihuana. And in an attempt to do precisely what Mr. Guyer suggested we need to do, and what I think the purpose of these hearings is, I just wonder if we could begin by asking the question: Would all three of you agree, essentially, to these eight points? If you don't know what I am talking about, I would be glad to provide you with a copy.

Dr. ZINBERG. Is this Dr. Cohen's list?

Dr. NAHAS. This is what I mentioned to Dr. Cohen as soon as I read it, before even I heard his testimony. I agree with them.

Mr. NEAL. You do agree?

Dr. NAHAS. Sure.

Mr. NEAL. And, of course, Dr. Cohen, you agree. And Dr. Zinberg, I was wondering if you would——

Dr. ZINBERG. Yes.

Mr. NEAL [continuing]. Essentially agree. Well, maybe that is a helpful beginning point.

I have another question for Dr. Nahas. You said at the beginning of your testimony, when Congressman Wolff asked you about what you meant by heavy doses, or doses that you were using for your studies, you said, I think, that you were talking about the use of between 1 10 marihuana cigarettes per day as being an average use. But is this a typical use?

Some of the other witnesses have indicated that people, as a matter of fact, don't normally use it every day, even. And if they do use, the indication is that it might not be at those levels.

Dr. NAHAS. That is the pattern of abuse such as it has been reported by the equidemiological study of NIDA.

Mr. NEAL. Excuse me one second. Do you differentiate on this subject between "use" and "abuse"? You just said this was a "pattern of abuse."

Dr. NAHAS. I would say, "yes." It is certainly abuse. But it is a pattern which has been reported in, I believe, 10 percent of the graduating classes of high schools in the United States in 1978. So it does involve a large segment of the high school population of this country. And this is why it is sort of a——

Mr. NEAL. My question is: Is this a typical level of use, or abuse? I guess that is what I am trying to get at.

Dr. NAHAS. It is very difficult to determine what is typical and what is not, especially when you are dealing with a drug which has a great potential for abuse and which is essentially one when widely available and socially acceptable, seems to be abused on a wide scale.

Mr. NEAL. Dr. Zinberg said earlier in his material, and I believe Dr. Cohen referred to it also, the overwhelming majority of people who use marihuana use it intermittently. And I assume that, you mean by "intermittent," not daily, and not at these levels of use.

Dr. ZINBERG. Yes.

Mr. NEAL. What I am trying to get at is what difference there might be between the results of your studies with people who use it intermittently, and not at these high levels, and those people who may smoke 10 marihuana cigarettes a day.

Dr. NAHAS. The conclusions of Dr. Cohen are very clear. He says there is no evidence that people who smoke less than once a week have any risk of damaging their health.

Mr. NEAL. Would you agree with that?

Dr. NAHAS. I certainly agree with this conclusion. However, it has also been reported as much as three times a week use of marihuana cigarettes by a young woman is associated with alterations in her cycle, a shortening of the luteal phase, and a cycle with production of ovum and alterations also of the pattern of their hormones. So we are really, here, in an area which is very difficult to define.

As I said previously, there is a tremendous amount of individual variation. Some people can smoke as much as once or twice a day, and maybe not show any obvious bad effect; but others would smoke three times a week and would have some. So this is why it is so difficult to answer your question about what is a typical use.

Mr. NEAL. Any other comments on that point?

Dr. ZINBERG. Well, the figure that I used, I think the most careful study of incidence was in the Schaffer Commission report, who found that fewer than 1 percent of the users used it as much as daily; and whether three times a week is different, four times a week is different from two times a week. Those are very, very difficult differentiations to make.

So I think most people have used as a cut-off point, daily use. That is heavy, chronic use. Less than that—I mean, if you found people used it every week six times a week, would that be heavy use? Probably, I don't know. It is very hard to be so fine about it. But it is certainly still true, the overwhelming majority are intermittent users.

Mr. NEAL. What was that figure again, if you don't mind? You said only 1 percent?

Dr. ZINBERG. Less than 1 percent, the Schaffer Commission found. It is a very good study, much better than the CODAP data, and the rest of it, where very heavy users——

Mr. NEAL. Less than 1 percent of the users are heavy users? Dr. Cohen?

Dr. COHEN. We have to take this in context of the time. That Schaffer Commission report was about 1972. In 1977, 10 percent of high school seniors were daily users. In 1978, I understand, in Maine and Massachusetts, 16 percent of high school seniors are heavy users. So there is a dynamic change going on which is what I was hoping to bring out to you, gentlemen.

Dr. ZINBERG. I would also like to——

Dr. NAHAS. I agree.

Dr. ZINBERG [continuing]. Point out something very much in distinction, and this is the problem with studies which the Schaffer Commission did. Any study that has been to long term marihuana use usually showed the people begin to use, become heavy users, and peak, go down. I think I would be very surprised if Dr. Cohen disagreed with that.

I think it will be very interesting to see what will happen as people continue to use. It is thus in contrast to alcohol, where people begin to use, go up, and level off at a certain pattern of use. Marihuana so far has shown a very distinctive curve.

Mr. NEAL. My time has expired, but I would ask the gentleman to yield to me for one more brief question, if I may. I am again trying to put this in some kind of perspective. We know there are health problems with overuse and abuse of alcohol.

I just wondered, Dr. Nahas, if, in your opinion, a person were to use alcohol at the same levels which you used in your studies, which I would assume would mean taking somewhere between 1 and 10 drinks a day every day for a long period of time, you would find more of a health problem with the alcohol than the marihuana or vice versa.

In other words, which, in your opinion, would you think would be more serious to the health of the individual?

Dr. NAHAS. It is impossible to perform such a comparison because we are dealing again with substances of a different nature. I already mentioned that one can absorb as much as 20 percent of his diet in alcohol and this would not have any damaging effect and one can do so during his whole lifetime, drinking a glass or two of wine for each meal. And this has been done by hundreds of millions of people, especially in the Latin countries.

This moderate kind of daily alcohol use has not been associated statistically with the use of opiates or any of the other stupefying drugs.

Now, what I say is, I believe that one cannot smoke one or two joints a day and not suffer some damaging effect, either to the lung or to the reproductive function, or to the brain. This is the best pharmocological answer I can give.

Mr. NEAL. Any other comment on that?

Dr. ZINBERG. Simply that that has not been proved. That may be his belief, and it may be so, but there is no evidence for that to date. It may be so. I personally think that twice a day is a hell of a lot of marihuana use. That is heavier than I would like to see; and I would not object to somebody who had a drink a day, from a medical point of view.

So that I am not in complete disagreement. But again, in terms of statistical relevance and use, I think it hasn't been proved. There is no evidence whatsoever this is true, and not in studies in other cultures, Jamaica and so on, where the use is heavy. It is just not proved.

Dr. NAHAS. There is proof of changes in the lung.

Dr. ZINBERG. Not in Jamaica.

Dr. NAHAS. The study in Jamaica, Dr. Zinberg mentioned the study in Jamaica, on the lung; and this study has been reviewed by pulmonary physiologists in Los Angeles; Dr. Tashkent, and by pulmo-

nary physiologists at Columbia, Dr. Yettenson, who have declared that it was not physiologically correct, and the data, as it is reported statistically, cannot be interpreted.

So the whole study in Jamaica—and this is something which I think has been established dispassionately and scientifically—cannot prove anything concerning the effect of heavy marihuana use on the lung of man.

Mr. NEAL. Dr. Cohen?

Dr. COHEN. There is another point about these studies, like the one in Jamaica, that might be enlightening. Dr. Bob Petersen, who is here, recently wrote a short article on the difference between how people like those in Jamacia smoke marihuana, and how Americans smoke it.

In Jamaica, it is hardly inhaled. It is mixed with tobacco and hardly inhaled; whereas I mentioned how marihuana is commonly smoked in this country, with a deep inhalation and retention in the lungs. And this may explain some of the differences in results between the Jamaican study and what seems to be becoming the American experience.

Mr. NEAL. Dr. Zinberg?

Dr. ZINBERG. I can't help but answer that, because after reading what Dr. Petersen wrote, I naturally did what I always do, which is go to the users. I went to our sample of heavy marihuana users, and asked them how they smoked. And it turns out that heavy marihuana users who smoke in this country do not go through the elaborate ritual of taking a puff. They tend to smoke much more casually, and do not inhale.

It is really the beginning users, the initial users, occasional users, who make use of that technique. And the heavy users don't smoke any differently than they do in Jamaica.

Mr. BEARD. Is "casual," like the doctors that you refer to in your article for "High Times," "chipping" here, within this kind of a casual type things?

Dr. ZINBERG. I don't think I referred to anybody using heroin or morphine in this case, which is the way I was talking about casually.

Mr. BEARD. Didn't you do an article for "High Times"?

Dr. ZINBERG. I have never written an article. I was interviewed. I have never written an article.

Mr. BEARD. I'm sorry. The Jamaican report, I think, is probably one of the most—if you look at some of the people involved in the Jamaican report, I hope you don't base too much of your scientific report on that. But I would seriously question the professionalism in the Jamaican report that was conducted in, what, 1972, approximately?

Dr. ZINBERG. Yes.

Mr. BEARD. Let me ask Dr. Cohen: A great deal of the research that has been done regarding marihuana and the effects, of course, which is tied in with the THC element of marihuana, it has been based, conducted, with a standard—I think NIDA has a standard of 2 percent THC in their studies. But then, the University of Mississippi, at which Dr. Turner is apparently the one who does many of our tests for us——

Dr. COHEN. Analyses.

Mr. BEARD [continuing]. Analysis for this. And he has reported much of the marihuana seizures that are now coming forth are much higher, as far as composition of THC, and to the point of 3 percent or more.

Dr. COHEN. Up to 7 percent.

Mr. BEARD. Up to 7 percent. Do you think it might not be legitimate, in some of our testing, to maybe increase the average from 2 percent up to around 4 percent? Or since the trend is toward the heavier percentage of THC, which is the real dangerous aspect of that, and if so, if we did hit the average THC of NIDA's cigarettes being tested, would this not have more of a drastic medical effect, and make these studies even look worse?

Dr. COHEN. I am very concerned that these very potent materials are flooding the market; and apparently, DEA is not able to stop large quantities of them. In addition, the material grown in northern California and Oregon has a very high THC content.

Mr. BEARD. Oregon now has decriminalization, and I hear that referred to by quite as showing the panacea for our drug problem, by decriminalization, and "the problem will certainly go away." I just had to throw that in, because when I hear the word, "Oregon," I get a little——

Dr. COHEN. To answer your first question, I would agree that if, indeed, it is common practice to smoke 5 percent material daily, then research should attempt to duplicate such studies in order to understand what is going on. There is no use in doing things that are not done in life, if we want answers appropriate to life conditions.

Mr. BEARD. You think we are somewhat past the day of the 2 percent, and we have gotten to the point, to the time, when 2 percent is somewhat of an unrealistic—for example, when the Department of Defense works in their inflation percentage for future spending, it is an inflation factor of 4 to 5 percent; not too practical, or realistic.

Do you think that we have reached that stage, where we should maybe go from the 2 percent that NIDA uses in research to at least 3 to 4 percent?

Dr. COHEN. Either that, or double the number of cigarettes that are smoked. You know, two 2 percent cigarettes equal one 4 percent cigarette. But I do think if we are getting to see heavier patterns, we had better reflect that in our research.

Mr. BEARD. The major thrust of Dr. Peter Bourne, and the President, has been the only real thing that I have seen that has been really publicized—maybe that is an unfair criticism—has been calling for the decriminalization of marihuana.

I would like to know, and maybe you have responded while I was out: Do you feel, in your personal opinion, this is the answer, or this is the first approach we should take? Or do you think there are other alternatives we should look at?

Dr. COHEN. We have decriminalization in California, and I have been watching it. From a purely public health standpoint, it may be that the decriminalization of small amounts for personal use may be desirable, because it avoids the kids getting arrest records which follow them through their lives.

And I am not aware that decriminalization has increased the numbers of users in California over and above the national average.

Mr. BEARD. If they had a poll, a breakdown, showing the increase of usage between those people of 18 to 29, you will see a dramatic increase, especially in the State of Oregon, which is where we have got one of the few areas to derive these figures from.

I would just like to ask real quickly: Are you familiar at all—and I agree with the criminal penalties; I think that is unrealistic. Particularly, I don't think that helps a bit. But rather than just, strictly speaking, decriminalization, are you familiar with the citation diversion program and all? I think the Sacramento area has that. Minnesota has it. It is an education program.

Would you feel maybe more comfortable, especially toward our young people, than just slapping them on the hand and writing a little ticket on it?

Dr. COHEN. I wonder: Do we know what the effects are?

Mr. BEARD. In Minnesota, we went up and talked to the officials up there, and they are very enthusiastic about it. In Sacramento, apparently, they are very excited about it. I just wonder if that, at least, might be better than just writing a ticket out, or a citation.

Dr. COHEN. I would like to look into it, and respond to you.

Mr. BEARD. I would like to give you a copy of my bill, if I could.

Mr. NEAL. Mr. Evans?

Mr. EVANS. Thank you, Mr. Chairman. Dr Zinberg, I would like to state that the views that you have expressed before this committee have been somewhat different than the impression that I got of your views from reading various articles. I wonder if some of the statements that you make are not taken out of context and used by those who would promote legalization of illicit, what are presently illicit, drugs.

It is my understanding, is it not, that you do not agree that marihuana is harmful, and should not be smoked by adolescents or used by adolescents?

Dr. ZINBERG. Sure.

Mr. EVANS. And that you also believe there is sufficient evidence, or substantial evidence, of harmful effects for heavy adult usage?

Dr. ZINBERG. No, I have not said that. What I have said specifically was that I can't imagine a drug as patent an intoxicant as marihuana not having some harmful effects. I have not been convinced by any research to date that the specific effects shown have been harmful.

Mr. EVANS. But you would not promote the use of it, as a medical doctor, without revisions and without restraint?

Dr. ZINBERG. Absolutely not; and I have said that in print many times.

Mr. EVANS. All right, sir. Now what I am getting to is that you are serving as an advisor to the NIDA, which is our National Institute on Drug Abuse. Is that right?

Dr. ZINBERG. Yes.

Mr. EVANS. You are also serving as a professional on the professional advisory board to the organization NORML.

Dr. ZINBERG. Yes.

Mr. EVANS. The organization NORML, as you have stated previously, does promote the legalization of marihuana; and you have advised them that they should be for decriminalization, and not legalization?

Dr. ZINBERG. Right.

Mr. EVANS. Are you aware that the organization NORML receives part of their funding from the drug paraphernalia industry? Are you aware?

Dr. ZINBERG. I don't know anything at all about their funding.

Mr. EVANS. Are you also aware that they receive funding from High Times magazine?

Dr. ZINBERG. I don't know anything at all about their funding.

Mr. EVANS. Well, OK. But the point I am getting at is this: If an organization is using your position to promote their position, and they are being partially funded, at least, by industries which stand to profit financially from the spread of drug use, would you have any objection to that?

Dr. ZINBERG. Well, I just think you are in an area that is so complicated and difficult to answer, which I haven't thought through—you are back to the South Africa area, which is being debated at Harvard endlessly, and what you can do and can't do about funding sources, and so on and so forth.

Mr. EVANS. We have a great deal of difficulty with that, Dr. Zinberg, because we are constantly on the——

Dr. ZINBERG. I don't know. I just can't answer that.

Mr. EVANS. Maybe we are paranoid about it, but the point I am trying to make is what you would want, and what I want, is not to encourage the use of these illegal and illicit drugs among young people; is that correct? Would that be fair?

Dr. ZINBERG. Well, of course——

Mr. EVANS. Adolescents.

Dr. ZINBERG. Yes. I certainly don't want—but I don't see what the point you are making is.

Mr. EVANS. I am getting to it, and I think maybe I have covered it. You have got businesses which are receiving profits from the sale of paraphernalia, which anybody can buy and use for drugs. And that industry is funding, or helping to finance, an organization which you are a professional advisor on.

And that organization is using you to promote the legalization of a substance which you feel is harmful to adolescents. Now, I can't draw a picture any better than that.

Dr. ZINBERG. Let me ask you a question. If I understand you correctly, you are suggesting that because Harvard accepts money from South African interests which promote apartheid, I should quit Harvard.

Mr. EVANS. No, sir. I am not suggesting that at all.

Dr. ZINBERG. If I am against the promotion of apartheid, I should quit Harvard; is that what you are saying?

Mr. EVANS. No, sir. I think I have answered that once. I will answer it again.

Dr. ZINBERG. It seems to me an exact analogy.

Mr. EVANS. May I finish?

Dr. ZINBERG. Sure.

Mr. EVANS. I am suggesting you are in a position to set policy in this country as an advisor to our National Institute on Drug Abuse, which does set drug policy in this country. You are also serving on an advisory board to an organization which advocates the legalization of drugs which are now illegal.

So I am saying that apparently you are being used by this organization to promote their views.

Mr. BEARD. Let me say, I think you are very kind.

Mr. EVANS. I yield.

Mr. BEARD. And I think you have been most tactful; and this is my personal opinion, and I say it in front of Dr. Pollin. NORML is a group that receives its major contribution, one of its major contributions, from High Times, which is the most vulgar, vicious magazine, creating a market for all the drug equipment, the whole ball game, that tells the kids, "Hey, get blasted," the whole ball game. You are serving on the advisory board.

I don't think the two are compatible—your being a consultant to NIDA and serving on the advisory board; and I think somebody had better make a decision, Dr. Pollin, or you, or somebody, that one of the two has got to stop. It is as simple as that.

That is my personal attitude, because I think—have you seen the magazine High Times?

Dr. ZINBERG. Sure.

Mr. BEARD. Do you find it offensive?

Dr. ZINBERG. Yes; I would say yes.

Mr. BEARD. I would hope that you would never be——

Dr. ZINBERG. I would say that I don't think we would agree on the degree of offense; but yes, I don't think it is a good magazine.

Mr. NEAL. I would like to pursue the question raised by Mr. Evans concerning our desire to encourage the use of drugs.

Now, it seems to me that over the last 30 or 40 years, that we followed a policy in this country of imposing severe penalties for the use of a whole range of drugs. And during that same period of time, abuse of all sorts of drugs has increased dramatically.

Well, I will have to say it appears to me that the policies we have been following are simply not working. And I would just like to ask the gentleman from Georgia if he thinks that the policies that we have been following are working, because I know he is going to raise the point; because it seems to me both of my colleagues on the committee are suggesting we ought to continue following these policies.

And yet, any mention of any other kind of policy is just so outrageous that we shouldn't even consider it. And I dont know what the answer is.

The purpose of these hearings is to try to build a basis of knowledge on which we could try, I hope, to come up with an answer. But it does occur to me that at the very least, we could say that the policies that we have been following aren't working. And it would seem to me perfectly legitimate to try to question those policies and seek something else that may work.

Mr. EVANS. I would have to agree with the chairman, and just point out that the panel—and I certainly have meant no offense to any member of the panel. Dr. Zinberg, I hope you don't take it that way.

But the point that I am trying to make is that it is clear, concerning the drug marihuana, that while maybe Dr. Zinberg says there has been no proof, the other two witnesses seem to think there has been sufficient proof to indicate that marihuana is a harmful drug. At least, Dr. Zinberg believes it has a potential to be.

And I think with those kinds of facts, that we should have a clear-cut policy regarding marihuana, not necessarily the jailing of the users, because I agree with the rest that I am not interested in jailing users of marihuana. But I am interested in the public knowing the potential danger.

And I think that this is what we need to direct our activities toward—making sure that the public does not know that.

Mr. NEAL. I would agree with you. I think that is an important subject.

Mr. BEARD. Let me respond, too, because I am not locked out. I don't understand the comments that were just made as to not looking for change. You better believe I am looking for change. I am looking for some leadership in this country. I am looking for somebody in the White House who would at least have an audience with our top drug people, where they go, talk to him personally.

I am tired of just the President—not just this one, but the ones in the past—who say nothing about it, who have not given it any kind of real priority. I am tired of a totally—how can you have effective law enforcement, if you have no educational programs?

And sure, I am looking for a change. I think it is offensive when you have one educational program that they say has been successful that started off with a budget of $12 million, that now has been cut down to $2 million. So please don't ever misinterpret what I am saying to saying I believe in the status quo, and am not supporting change. I am supporting change right down to the wire, without any question.

But because of what we are doing today, in the dramatic—Dr. Cohen, I think you put it so adequately. You said we are experiencing a dynamic, or dramatic, increase. Something is really happening; and you said that is the point you want to try to make. We have got to do something.

Mr. NEAL. What are we going to do? That is the question I have; and I just don't feel I have an answer. Do you have an answer at this point? I don't.

Mr. BEARD. Yes. I am saying why not an educational program? Why not? Let's attack the use of marihuana, or drugs, as heavily as we have attacked the use of cigarettes. Why don't we give it a shot? Let's do something besides sitting back here and going through studies, and having people come and say, "hey, you know," and have advisers that are representing NORML, and all that good stuff. Let's do something.

Mr. NEAL. Well, my first strong feeling was that that is precisely what we need: A good educational program to tell people honestly, straightforwardly, and as widely as possible, what we know and what we can determine.

Mr. BEARD. What is amazing is, you have just been on this committee a few months, and you have already come up with that. Hell, we have been dealing with people who have been in leadership in the drug field for the Government that have done nothing.

Mr. NEAL. Well, you know, I questioned the budget priorities the other day. We found a task force on drugs where 3 percent of its budget was devoted to education and prevention, while 52 percent was for law enforcement. And we are going to talk about that more, I understand.

The chairman said we might call those witnesses back and get into that again.

But we also heard testimony this morning that indicates some of these education programs may not work. In fact, they may be counterproductive. So I would say, even though intuitively it appears to me

this is an area that we should get into much more heavily than we are, we ought to look at the data that exists, and make sure that whatever education and prevention programs we do get into are going to do what we anticipate they will do.

Let me just ask the witnesses, if I may, to respond to my comment that it seems to me that for many years we have been following a policy of strict law enforcement, but at the same time drug use has soared. Is that accurate? If it is accurate, why? And what does that mean in terms of trying to come up with a rational policy in this area?

Dr. NAHAS. Well, if one looks at the figures specifically concerning marihuana, one sees a very important surge in the postwar period, in the 1950's, at a time when society was so prosperous that law enforcement in the South became somewhat lax, and when there was also an erosion of the social disapproval of drug use, including marihuana use.

I think one can turn around what you just said: That the dramatic increase in marihuana use observed in this country, and also abroad, has occurred in the past 10 years, at a time when measures were taken for loosening not only the penalties, which certainly was a well-taken measure, but also when an increase in the social acceptance of drugs occurred as well as acceptance of their glamorization through the media and through special publications which we have already referred to.

So I think that there are two aspects to what you just said: That maybe some very severe restrictions will make mockery of the law, and will be disregarded. But on the other hand, too much looseness in acceptance of the "other drug" in the culture might increase its usage. And this, I think, is the situation in which we are now.

I think the general consensus of this panel, and this committee, is to discourage marihuana use among the young, the priority. I think one should try to address one's self to that question: Should we discourage marihuana use?

Mr. NEAL. But how do we do that?

Dr. NAHAS. And I think we do it in a number of ways. One is through education. And I have done a lot of that education myself, in the New York area; speaking to schools, just presenting a little bit of what I presented this afternoon to this committee. And I have had, always, a very good reception. It has been very clear, and very fruitful, very gratifying to me.

So there is this problem, of course, of education. And I think there is a problem of example. One has to set an example to the young for them to follow; and this is true in this area, as well as in any other.

And there is also the problem of curtailing, as much as possible, the glamorization of drug use, because it is counterproductive, and goes against the attempt to mount a rational, humane program of education.

Mr. NEAL. How do we do that?

Dr. NAHAS. I am not a legislator, but I think that the glamorization by the media, and by certain publications, of the use of——

Mr. NEAL. That is a very difficult problem for society.

Dr. NAHAS. It is a very difficult problem. Maybe it is an insuperable one. But it really creates a bind, when you see those publications, especially in those very schools where you go and talk, in order to express very simply what we know about the problem.

So I don't have any easy answer; but it seems that this is policy which is actually backed by a large number of lay organizations, some of them present here, like PRIDE, for instance; seeing the American Council on Marihuana trying to organize parents and do a positive educational job. But I think it is a job that has to be done in a milieu and social context, where the use of harihuana is not glamorized.

Mr. NEAL. Dr. Zinberg?

Dr. ZINBERG. I would like to say that I think the problem with educational programs clearly is one of credibility. Even if Dr. Nahas is absolutely right in everything that he says, even he would say it will take decades for the actual effects of it to be apparent.

If you attempt a certain kind of heavy handed education program at the moment, when substantially, the people cannot observe the effects, and even forget the fact there is debate about them in terms of presenting the facts, it is very questionable what the facts are; so if you attempted that kind of educational program right now, it would seem to me that you would only increase use.

One of the suggestions I made publicly was that if NBC was a responsible corporation, having put on the program—incidentally, I disagree with a number of things that were presented as facts, here, about the increased potency of marihuana and so on and so forth; and I would be glad to present that, if anybody is interested.

I think that NBC, if it were really—and this is possible, according to polling organizations I have talked to—who were responsible, they would follow up the impact of "Reading, Writing, and Reefer."

They would follow it up in 1 month, 3 months, 6 months, and 2 years, and find out what really happened to people who saw the program and were impressed by it, particularly at certain ages. You see, it would be my nickel—that is the most I ever bet—that it would result in the increase in use, not the decrease. I would be willing to put a nickel on that.

So that is where we have the influence of educational aspects. I thought it was a very destructive program; and I think as time goes on, it will end up being seen as such.

I know Dr. Pollin, for example, doesn't agree with me on that. He and I have talked about it, and so on. But these are the kinds of research that are going to be done, if we are going to think in terms of that.

Mr. BEARD. Excuse me. You think that was destructive? But you have no emotions about High Times?

Dr. ZINBERG. High Times doesn't come over the tube. No; I am against High Times. You and I would disagree about degree, but I don't think it is a good magazine. But I don't think—it gets into the same thing. It doesn't come through our television sets. If they bought an hour of public television in prime time, and presented High Times, I think the public would go out of their minds. And I think they should, incidentally.

To present that biased and extraordinary version, I think, would be absolutely wrong. But I think this was wrong, too. I don't think one wrong makes a "right." I just think it will have a bad effect. I may be wrong, but I think it should be followed up. You see what I mean?

That kind of educational effort which sounds so righteous gets accepted very readily; and all I am saying is, that should be studied. I

think it will have an effect, far from a good effect. I think it will be destructive. Who knows?

Mr. NEAL. Dr. Cohen?

Dr. COHEN. I have thought a good deal, of course, about the question you asked. And it seems to me that in order to change what are now fairly ingrained attitudes about marihuana that the kids have learned—even the nonsmokers; namely, that it is not a big deal.

You have to change a whole attitudinal pattern, which is not hard, but it is also not easy. And how do you do that? You look at the school system; and you wonder whether school can be made more exciting and more attractive than it is. Apparently that is one beef they have. They are bored.

You attempt to reconstitute the family to what it should be, and have the parents accept the responsibilities that they should. You attempt to instill in them some of the hopes and aspirations that a prior generation had, when they were young. Hopes for a kind of country that is worth living in; these factors of meaningful education, parental responsibility and viable personal and societal goals.

All of the current attitudes of pessimism, of putting things down, will all have to be eradicated, before we get to the question of how people are going to change their attitudes about marihuana. As young people become involved in living and doing, being a pothead will have much less appeal.

Mr. NEAL. I think the policies that you mentioned are absolutely correct. But how can we in Government do this? Isn't that a matter essentially beyond our control?

Dr. COHEN. You do what you can. And there is a Department of Education that I guess is aware of the malaise of the elementary school system. But what are you going to do about the family? That I can't answer. What are you going to do about religion? What are you going to do about patriotism?

These are things we used to live by, and live decently by; and these have gone by the board.

Mr. NEAL. Why?

Dr. COHEN. We don't have time for the answer to that question.

Mr. NEAL. It is an important question, and I agree with you that this is essential. It appears to me, at this point, these are problems of attitude toward one's self, and life in general, that you are talking about. And clearly, it is not the role of the Federal Government to establish parent/child relationships and attitudes toward one's self, society, and so on.

I just couldn't agree with you more that probably nothing would help our country more than to get a revitalization of that kind of spirit you are talking about.

Dr. COHEN. May it be that the educational program shouldn't be for children, but for parents, to have them become parents, again, and take the responsibility for their child's upbringing?

Mr. NEAL. Good point.

Dr. ZINBERG. Certainly credibility is crucial. I do think one of the chief problems—and this is again, philosophical—is that an awful lot of people in this country simply do not believe what the Government says.

I saw a little poll that was interesting, and it turned out to be accurate. When the Skylab fell, the initial thing said it fell in the Atantic. And the Globe in Boston did a lot of quick things: Do people believe it? Because people said they weren't sure, because it was announced. People didn't believe it. It turned out they were right. It fell in Australia.

And whether the Government purposely put that out to allay fears—again, people have doubts.

Before you start an educational program I think you have to be very sure, very clear, what you said was right, made sense, and could be presented in a way that would be accepted as true. as I think smoking is gradually becoming, smoking data as opposed to the marihuana data.

Mr. NEAL. I have one more question, but I have taken more than my share of the time. Mr. Beard?

Mr. BEARD. Your point about educating the parents, I think, is a very legitimate one; and I think the idea is a great deal of the problem. Your concern about what can the Federal Government do—I think that is legitimate. How far do they go?

I think it is probably more than making the kids aware of the critical problems. The parents probably should be the thrust for the educational program.

You know, in several areas throughout the country now, like in Atlanta; Naples, Fla.; several others, parents—they have these movements, now, where parents are working with the school boards and the town councils. They have all gotten together, and they are working together. They have acknowledged it is a critical problem. They have literally acknowledged it is a critical problem.

And then, through the imagination, or through shock or concern or whatever the emotions are, they are now trying to do something about it.

So if the Government plays any role at all, I would say the first role, and probably the most effective, role they could play is to maybe show to the American people it is, or could very well be, a very critical problem, and then hope and pray that throughout the country, more groups, or more working together through parents, to get motivated and start asking where their kids are and start working with school boards. Maybe they, too, can be successful, as they have in Atlanta and Naples, Fla.

Maybe that is the Government's first role: To present to the American public just how serious this problem could be, if we don't do something about it?

Mr. NEAL. Mr. Evans?

Mr. EVANS. I have nothing further, Mr. Chairman.

Mr. NEAL. My closing question is: Where do we go from here? We want to pursue a set of hearings that would lead us to a point of being able to make some kind of reasonable political determination, recommendation, and so on. At some point, we want to look at the volume of the international traffic in illicit narcotics. We understand it is something like a $150-billion-a-year business, and having an adverse impact on our balance of trade, and a whole range of other things. But that is one question I think we should look at.

At some point, we want to be able to address the broader policy question. I would just like to ask you all what, in your opinion, ought to be our next line of inquiry? If you have any recommendations, we would welcome it. Dr. Cohen?

Dr. COHEN. Well, I don't have any recommendations, but I would plead for more data as soon as possible, so that we can be sure of what we are saying.

Mr. NEAL. Make sure that whatever we say is accurate. I think that is very important. I think the Federal Government has lost a good deal of credibility by simply being sloppy in what it said from time to time. Dr. Nahas?

Dr. NAHAS. I agree that certainly you need more researches on specific points. That would be very useful in this context. I also believe this is a question that the lawmakers will just have to decide upon. And now, I am taking off my hat as a pharmacologist to wear that one of a citizen, not only a citizen of our particular world, because this is an international problem, as you mentioned, Mr. Chairman.

And I think the problem of dealing with inaccurate information which is counterproductive to the accurate one, and which is more readily believed by the young; the problem of limiting supply of a drug which is very pleasurable; limiting flexibility, decreasing social acceptance, are problems which, as a legislator, you would have to face.

Mr. NEAL. Dr. Zinberg?

Dr. ZINBERG. Well, I thought you put it very well a while ago. It does seem to me like Dr. Nahas is saying the status quo, the current policy, basically. I think you said, and I would agree, the place I would begin, at least, is a recognition of the fact that the current policy hasn't worked. What you do from there, I don't know, but that would certainly be a beginning. It has been a disaster.

Mr. NEAL. Well, let me thank all of you for coming. I think this really has been very helpful, at least to me. Maybe others knew more about it, already; but I think this has certainly been helpful.

And we have gotten a general agreement on these eight points, beginnings, in any case; and I just want to thank you again all very much.

The Task Force will stand adjourned. We will meet again at 9:30 on Thursday.

[Whereupon, at 1 p.m., on July 17, 1979, the Select Committee on Narcotics Abuse and Control was adjourned, to reconvene at 9:30 a.m., July 19, 1979.]

PREPARED STATEMENT OF DR. GABRIEL G. NAHAS, COLUMBIA UNIVERSITY

THE REIMS SYMPOSIUM: MARIHUANA UPDATE*

Summaries of the current status of marihuana research were presented at a Symposium on Marihuana held in July, 1978 in Reims, France under the aegis of the VIIth International Congress of Pharmacology. Over 100 scientists from 14 countries attended the meeting sponsored by the National Institute on Drug Abuse, The French Ministry of Health, the French National Institute for Health and Research (INSERM) and the International Medical Council on Drug Use. Organizers of the Symposium were Gabriel G. Nahas (Columbia University), W.D.M. Paton (Department of Pharmacology, Oxford University) and Monique Braude (NIDA). Analysis, metabolism, cellular responses, effects on reproduction and brain were the topics discussed during the two day meeting.

PHARMACOKINETICS

The "pharmacokinetics" (absorption, distribution, biotransformation and elimination) of the psychoactive substance of marihuana - delta-9-THC or THC - and of its by-products (metabolites) were described by E.R. Garrett (University of Florida). Unlike water soluble alcohol, the pharmacokinetics of fat soluble THC are not dose dependent, but are characterized by a very rapid disappearance from plasma followed by a lingering for days, indicative of a variable rate of penetration into and return from multiple body compartments. When marihuana is taken daily, or several times weekly, there is a high accumulation in the body because a single dose of THC takes 30 days to be eliminated, and its half life in tissues is 7 days.

*Proceedings to be published by Pergamon Press, New York, Oxford, 1979 Marihuana: Biological Effects, G.G. Nahas, W.D.M. Paton, Eds.

After 5 days, 15% of the THC appears as metabolites in the urine and 40%to 50% is excreted in the feces. There is a 15% recirculation of these substances between the liver and the intestine which contributes to their lingering in the body. THC is the one cannabinoid not eliminated in the urine, and only 20% of its metabolites are kidney excreted, the rest being eliminated via the feces.

The pharmacokinetics of THC explain the difference in the availability of the drug in tissues when given by different routes: when smoked, 50% of THC is absorbed in the blood stream, but when ingested, only 5% to 10% is. For example, S. Agurell (University of Uppsala, Sweden) reported that in man, 5mg of THC in a smoked cigarette results in a maximal plasma concentration of 100 nanograms/ml after 5 minutes, whereas 20 mg of THC absorbed by mouth results in a maximal concentration of 10 nanograms after 1 hour. Thus smoking results in bioavailability 5 to 10 times greater than by ingestion of the drug.

This data validates earlier reports of H. Rosenkrantz (Mason Research Institute, Worcester, Mass.) who calculated an "equivalent" amount of THC in order to compare doses of THC given to animals, orally or by inhalation, to doses used in human consumption. One hundred mg ingested may approximate 10 to 20 mg smoked. Thus, in experiments in rodents, when body weight is taken into consideration, a 5 to 25mg/kg dose of THC administered by mouth is not abnormally high, as claimed by some critics, but does approximate dosages which may be reached in human consumption (1 to 3 cigarettes marihuana containing 10mg THC each).

QUANTIFICATION-IDENTIFICATION IN BODY FLUIDS

THC is very difficult to identify in body fluids because of its very low level in the plasma (nanograms/ml), the numerous metabolites which this compound produces by transformation in the organism, and its absence in urine. Three methods were described at Reims. The most accurate, mass spectrometry together with high-pressure gas or liquid chromatography, is unfortunately a slow and costly technique (Monroe Wall, Research Triangle Institute; D.J. Harvey, Oxford). The other two methods are non-specific since they identify both THC and "other cross-reacting cannabinoids" simultaneously. Vincent Marks (University of Surrey) described an immunoreactive method to detect the presence of cannabis in body fluids. In England it has been used to test drivers involved in unexplained automobile accidents. The test was positive in 14% of the subjects studied. The third screening test detects cannabinoids in urine by EMIT immunoassay (K.E. Rubenstein, SYVA)

EFFECT OF CANNABINOIDS ON CELLULAR METABOLISM

Several investigators reported that both THC and its non-psychoactive metabolites adversely affect cell division, *in vitro* as well as *in vivo*, by impairing the formation of nucleic acid and proteins. The concentration of cannabinoids required to produce these changes in the test tube was 10^{-6} to 10^{-5}M, an approximation of what may be reached in human consumption. The mechanism of this cytotoxic effect was attributed to the action of the cannabinoids on the cell membrane, in which they dissolve, thereby preventing the transport of the chemicals required for DNA, RNA and protein synthesis (G.G. Nahas, et al.

Columbia University). A further effect was reported by G. Stein (University of Florida) and R.A. Cardman (Medical College of Virginia) who found that THC and other cannabinoids also interact with the nuclear membrane and interfere with the synthesis of chromosomal proteins - histones and non histones (the proteins that regulate gene expression and enzyme synthesis). This most important finding was confirmed by the report of M.R. Issidorides (University of Athens): white blood cells and sperm cells sampled from chrnoic hashish users display abnormal amounts of chromosomal proteins and a condensation of the nucleus similar to that observed in the *in vitro* preparations exposed to THC.

MARIHUANA SMOKE AND THE LUNG

Some of the experimental studies presented at Reims described the damaging effect of marihuana smoke on the lung. These confirmed previous clinical reports which have established that marihuana smokers, studied under controlled conditions in the U.S., have decreased vital capacity and early symptoms of lung airway obstruction (with functional impairments predominantly involving the large airways.) Rosenkrantz reported that rats exposed to inhalation of marihuana smoke (under conditions equivalent to the daily consumption of a marihuana smoker) developed lesions in the lung parenchyma after 87 days and up to 360 days. These lesions took the form of scattered small focal alveolitis, granulomatic phenomena and dense infiltrations of macrophages associated with deposits of cholesterol - signs of tissue destruction. The extent of the lesions depended on the duration of the experiments and the dose inhaled. They were still present a

month after smoke inhalation had been stopped. The effects associated with marihuana were different from those produced by tobacco smoke and placebo smoke (a marihuana cigarette from which the cannabinoids had been extracted). The studies of G. Huber (Harvard Medical School) indicate that marihuana smoke (in some animal tests) is significantly more destructive than is tobacco smoke to the defense system of the lung that protects against bacteria.

EFFECTS ON THE REPRODUCTIVE SYSTEM

In the male: H. Huang (Columbia University) and G.I. Fujimoto (Albert Einstein College of Medicine) described the impairment of spermatogenesis in rats exposed to marihuana smoke or who ingested THC or cannabis extract. They noted a marked inhibition of spermatogenesis in sections of the seminiferous ducts. This oligospermia was associated with involution of the prostate and of the seminal vesicles. These changes were reversible when administration of the drug was stopped after 80 days.

J. Harclerode (Bucknell) described the enzyme mechanism by which THC inhibits the synthesis of testosterone in rats. He ascribed this to an inhibition of cytochrome P450. This inhibiting effect was eliminated by the administration of LH and FSH. A.Jacubovic (University of British Columbia, Vancouver) reported that the formation of testosterone in the Leydig cells was inhibited by the administration of various cannabinoids. The non-psychoactive cannabinoids (CBN, CBD, CBG) were more inhibiting than THC. Accordingly, he believes that this inhibition of testosterone production is due to a direct effect of the cannabinoids on the Leydig cells. A. Zimmerman (University of

Toronto) reported a significant increase in abnormal forms of sperm in hybrid mice 35 days after a single administration of delta-9-THC (5mg/kg) or CBN (10 mg/kg) (inactive cannabinoid). This author also noted, in mice treated with these cannabinoids, some chromosome anomalies in the primary spermatocytes (translocation breakages, aneuploidy). Thus cannabinoids which are not mutagenic in vitro (Ames test negative) are so in vivo.

W. Hembree (Columbia University) described the diminution in spermatogenesis occurring in young marijuana smokers after unrestricted smoking for four weeks. This oligospermia was accompanied by an increase in abnormal forms and a decrease in spermatozoa motility. The testosterone, FSH and LH levels, measured every morning before the subjects began smoking were unchanged. Monroe Wall, however, pointed out that an intravenous injection of a dose of THC was accompanied in the next few hours by a reduction in plasma testosterone, which returned to normal and then presented an overshoot. It is possible that intermittent fluctuations in testosterone and in the pituitary hormones governing its formation, can be detected only in the first hours following administration of the drug.

In summary, cannabinoids may act on the testicular function in two ways: one, through the disruption of the secretion of the gonadotropin FSH and LH, thereby causing intermittent reductions in testosterone; and two, directly on the germinative epithelium of the testis, causing inhibition of macromolecular synthesis. Both mechanisms may account for the appearance of abnormal forms of spermatozoa.

In the female: Carol Smith (Uniformed Services University, Bethesda) reported that a single intramuscular administration of THC led to a decrease in FSH and LH in rhesus monkeys. She later reported a decrease in prolactin as well. The extent and the duration of

such diminution depended upon the dose. When this primate is treated during one cycle with daily doses of THC, ovulation does not occur during the following cycle. Dr. Smith also demonstrated that, contrary to earlier beliefs, THC has no estrogen-like effect (Bauman and Kolodny have since reported that a group of young women smoking marihuana at least 3 times weekly had an increased incidence of defective menstrual cycle, 38% vs 12% of control, as well as a decrease in prolactin).

EMBRYOTOXICITY

Different cannabinoids were reported to have an embryotoxic effect, producing fetal resorptions in rats and mice that are dose related. Surviving offspring were hypotropic (Rosenkrantz). E.H. Sassenrath (University of California) reported that when THC is administered before mating to female resus monkeys, the incidence of abortion and neonatal mortality is 4 times higher than in control animals. Cannabis also has effects on the surviving offspring. Those of the THC treated mothers are smaller than the controls, and they react abnormally to sensory stimuli.

It is also established that following administration of radioactive THC to lactating rats, radioactive THC can be identified in mother's milk and in the brain of suckled infants. Other investigators have treated pregnant female rats with THC on the last day of pregnancy and six days post partum. This early treatment resulted in long term, permanent alterations in male reproductive function and behavior of the offspring.

EFFECTS ON THE BRAIN AND BEHAVIOR

Biochemical changes in the brains of newborn rodents whose mothers had been treated with THC were described by P.L. McGeer (University of British Columbia) and Y.K. Luthra (Clement Associates, Washington, D.C.). They found a decrease in nucleic acid and protein concentrations and Luthra concluded, "This effect of delta-9-THC in the neonate macromolecules could be a determinant factor in producing behavioral aberrations in the developing organism."

Several other investigators discussed marihuana's effects on the "limbic system" of the brain - a major target area of the drug - describing an alteration of these deep-seated structures that control emotion, pleasure, endocrine function and memory storage. Permanent brain wave changes are observed in the limbic structures both in rats treated for 6 months with THC or in monkeys after a 3 month's exposure to marihuana via a smoking machine: these are "irritative" tracings with high amplituded waves or spikes. After 3 months of marihuana smoking, tissues taken from the limbic area of monkeys' brains and examined by electron microscopy show ultra structural abnormalities that are located principally in the synapses. In these studies R.G. Heath (Tulane University, New Orleans) has shown that ~~the THC~~

plasma concentration reached in the drug treated animals was similar to that reached in man.

Marihuana caused impairment of brain function in rats and monkeys in experiments discussed by H. Kalant (University of Toronto) and L. Chapman (University of California). In the former study, two groups of rats fed THC for 6 months displayed significant impairment of learning a specific motor skill as well as unusally agressive behavior toward smaller rodents. Chapman reported abnormal individual and group behavior of rhesus monkeys fed THC chronically. After an initial period of withdrawal, the THC fed monkeys displayed increased irritability and aggressiveness, expecially marked in those animals exposed to stress. "This type of behavior," concluded Chapman, "lends credence to the concept that there is a direct neuropharmacological effect of THC on the brain centers controlling behavior."

The impairment of "recall memory" in a group of chronic marihuana users studied in a controlled environment was the subject of a paper by W.C. Clark (Columbia University.

L. Hollister (Veterans Administration Hospital, Palo Alto, California drew attention to the considerable tolerance to cannabis which develops and is reflected in the need to increase the doses in order to obtain the desired effect. This tolerance is observed in all animal species. In the case of man, a large-scale consumer, a daily intake of 200 - 400 mg of THC is observed when cannabis is readily accessible (Morocco, Jamaica). There is no withdrawal syndrome comparable with that produced by stopping the use of opiates. Irritability, discomfort, Hyperkinesis and nausea do occur after a sudden stoppage following a

high degree of intoxication. Though there is no marked physical dependence, there is a psychological dependence as with all euphorogenic psychotropic drugs.

THERAPEUTIC USES

In studies related to epilepsy, R. Karler (University of Utah) reported that a non-psychoactive cannabinoid, CBD, had proved to be a potent anti-convulsive agent in the rat when used in relatively high doses (100 mg/kg). This property of CBD was confirmed in human experiments reported by R. Mechoulam (Hebrew University of Jerusalem) who found that 3 out of 4 patients were relieved of their epileptic seizures when treated with 200 to 400 mg CBD daily. By contrast, Karler confirmed reports that THC in the same proportions triggers certain forms of epilepsy. Such a finding explains the so-called "street knowledge" that one should "avoid smoking marihuana if one is epileptic."

The use of marihuana and THC has been advocated for the treatment of glaucoma, and for the relief of nausea in cancer patients treated with chemotherapy. For such specific applications, THC, with its many side effects, has not proven, in controlled clinical trials, more effective than pilocarpine and beta blockers for glaucoma or the phenothiazines for nausea. In line with modern pharmacology, organic chemists from Lilly Laboratory have modified the chemical structure of THC so as to increase its therapeutic action and minimize its side effects. This method has resulted in the synthesis of a new cannabinoid, "Nabilone", which was tested according to the standards of the Food and Drug Administration. On a dose basis in preliminary

trials, nabilone was proven more effective than THC in lowering intraocular pressure and relieving nausea without the side effects of THC. Clinical trials with this drug, however, have been discontinued by the laboratory which developed it.

CONCLUSION

Marihuana, in addition to its well-known acute and reversible psychotropic properties associated with THC, has certain other properties which are just beginning to be described.

First, there is the effect of THC on the (brain) hypothalamo-pituitary axis and the intermittent inhibition which this compound can produce on the secretion of LH, FSH and prolactin. Such disturbances will have repercussions on the formation of the sexual hormones testosterone, folliculin and progesterone, and maturation of the germ cells.

Second, there are the inhibitory effects of all cannabinoids on cell anabolism and on the formation of macromolecules. At this cellular level, cannabinoids act on the plasma membrane and the nuclear membrane, interfering with the synthesis of nucleic acids and chromosomal proteins. This action will alter the expression of the genome and may explain the in vivo mutagenic effect of THC and other cannabinoids. Only longitudinal epidemiological studies of marihuana smoking populations may document the pathologic effects of long term cannabis usage. Therefore the human pathology of marihuana cannot be written before 2 or 3 decades (it took 60 years to establish the pathology of tobacco smoking). Meanwhile, the observations on animals and man reported at Reims suggest that such pathology might involve the lung, reproductive function and brain.

There are four groups who should be warned forthwith of the health risks associated with marihuana usage:

Adolescents, whose neuro-hormonal regulatory systems are in a process of development and integration - a single dose of marihuana can affect the secretion of the pituitary hormones which control reproductive function;

Epileptics: the central stimulating effects of THC may induce epileptiform seizures;

Persons with a tendency to schizophrenia and mental illness;

Women who wish to have children.

Alcohol and Marihuana

Unlike marihuana, alcohol and its by-products are within 6 hours following absorption, either eliminated from the body or rapidly transformed into a substance (acetate) which is used for energy or stored as fat. It takes 6 hours for a single dose of alcohol to be cleared or entirely metabolized by the body. The figure for THC is 30 days.

In comparison with the equivalent weight of THC, alcohol has very weak effects: the minimal dose causing measurable changes in brain function is 100mg/kg, for THC it is 0.05mg/kg, 2000 times less.

Alcohol in its weakest form, such as wine or beer, is a food. In this form it may be consumed daily in moderate amounts without any ill effects, when it does not exceed 20% of the caloric equivalent of the total food intake. Such daily consumption has not been associated with the use of opiates or cocaine. The immediate effect of alcohol on the brain is that of a tranquilizer rather than an euphoriant. (It does not activate the brain reward system as does marihuana.) Alcohol intoxication is followed by unpleasant effects: nausea, headache, vomiting, memories of obnoxious behavior which all may act as negative reinforcers. Marihuana is rarely associated with such negative secondary effects, and it is a reason why so many prefer this drug to alcohol to get intoxicated.

The long term damaging effects of alcohol are paid later in life. For many years, alcoholism does not prevent the development of a successful professional or business career. Marihuana abuse by children will prevent them from entering into the main stream of soceity. Marihuana has not become in our soceity, a substitute for alcohol. The increase in consumption of marihuana has not been associated with a fall in alcohol intake as some had hoped, and we have added

another scourge to our house.

The damaging effects of alcohol are so grave that controls have been installed through taxation and limiting the degree of alcohol to 100% proof. Laws also forbid the sale of liquor to minors. Such laws may be reasonably well enforced because one can limit the number of stills and watch over wineries and breweries. However, the control of cannabis cultivation and use is elusive since a few plants which will give several months supply may be grown easily just about anywhere according to recipies that are printed monthly in publications claiming millions of readers.

Marihuana and Tobacco Cigarettes

Smoke of marihuana cigarettes impairs lung function, lung tissue as well as airways and the immunity system of the lung (pulmonary macrophages). However, the long term effect of marihuana smoke on lung and airways has not yet been studied as was done with tobacco smoke. Tar of marihuana smoke is cancer producing when applied to the skin of experimental animals. In the Middle East and Greece hashish users smoke through a water pipe, a technique which traps a large number of water soluble toxic substances. Marihuana cigarettes which burn much more slowly and are made with much more paper, contain larger amounts of carbon monoxide than tobacco cigarettes.

On the basis of present day clinical observations in marihuana smokers and of experimental studies, my opinion is that marihuana is as damaging to the lung as tobacco smoke and that one could expect in a significant number of long term chronic users, lung pathology similar to that observed with other toxic inhalents; bronchitis, increased incidence of upper respitory infections, emphysema, lung tissue destruction and bronchial carcinoma.

Tobacco smoke does not impair psychomotor performance. It is a psycho-stimulant.

The Comparative Health Hazards of Marihuana, Aspirin, Valium and Other Commonly Used Drugs

Aspirin is a useful patent medicine, utilized for its anti-inflammatory and pain alleviating effects,(it does produce gastric bleeding in 4% of the population). Aspirin is not an euphoriant and does not have much of an abuse potential and is not listed among the drugs of abuse.

Valium is the most frequently prescribed and consumed tranquilizer in the world. It has a sedative, relaxant effect. However it is habit-forming; producing tolerance, dependence and abstinence phenomenon. Its use in pregnancy has been associated by some with birth defects. In studies that I have performed in my laboratory, I have observed that diazepam (valium), and other commonly prescribed psychoactive drugs impair to the same extent as THC, the formation of nucleic acids and proteins in cell culture.

It is my opinion that all these drugs should be kept under strict medical prescription and that physicians should prescribe them most soberly.

MARIHUANA AS A THERAPEUTIC AGENT

The potent pharmacological properties of THC, the psychoactive constituent of marihuana, have led researchers to use it in the treatment of asthma, glaucoma and of nausea (associated with cancer chemotherapy). In controlled trials the effectiveness of this drug has not proven superior to other available medications, and it retains the disadvantage of undesirable side effects. Physicians agree that more clinical double blind trials are required before THC or one of its synthetic derivatives can be prescribed as a standard medication for treatment of glaucoma or nausea.

MARIHUANA AS MEDICINE:

AN OVERVIEW

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Marihuana as medicine is a misnomer. Marihuana is a crude drug, not a plant, composed of at least 365 known chemicals. Sixty-one of these chemicals are called cannabinoids and are indigenous to the Cannabis plant. Δ^9-THC is a single pure cannabinoid as is Δ^8-THC, CBN, CBD etc.

The biological action of any of these cannabinoids is only valid for the individual cannabinoid and not for marihuana or other crude drugs from Cannabis.

Experimental therapeutic uses of cannabinoids do not support the grandiose concept prevalent with the Media and with many uninformed scientists. That concept is marihuana is an approved treatment for glacoma, nausea associated with chemotherapy etc. When medical scientists talk about the therapeutic uses of marihuana they are really talking about Δ^9-THC or other individual cannabinoids.

MARIJUANA AND EFFECTS OF GLAUCOMA

Walter M. Jay, M.D. The University of Chicago

Glaucoma comprises a group of ocular diseases in which increased intraocular pressure (IOP) may cause optic atrophy with excavation of the optic disk and characteristic loss of visual field. It is the second leading cause of legal blindness in the United States. Presently available antiglaucoma medications are not effective in all patients and often have considerable side effects. Marijuana smoking reduces IOP as does topical, oral, and intravenous administration of THC. Nabilone is a synthesized crystalline bensopyran that resembles the cannabinols. At doses of Nabilone capable of lowering IOP, there is no associated euphoria, tachycardia, or orthostatic hypertension, although these may occur at higher doses. THC and Nabilone are potentially valuable in the treatment of glaucoma. Further testing is required to discover whether these compounds are more effective and have fewer side-effects than currently employed anti-glaucoma medications.

Marihuana and Asthma

D. Tashkin, M.D. The UCLA School of Medicine

In healthy subjects both smoked marijuana (0.5 g, 1 or 2% Δ9-THC) and oral Δ9-THC (10, 15, and 20 mg) caused definite dilatation of the airways, indicated by significant increases in specific airway conductance (SG_{aw}), lasting as long as 60 minutes and 6 hours, respectively. Additional studies in normal subjects indicated that beta-adrenoceptor blockade failed to inhibit the bronchodilator response to graded doses of smoked marijuana and that marijuana did not inhibit methacholine-induced bronchospasm, thereby excluding beta-adrenergic stimulation and inhibition of cholinergic receptors as possible mechanisms of THC-induced bronchodilatation.

These observations led us to evaluate the effects of marijuana on airway dynamics in subjects with bronchospastic disease. In 11 stable asthmatic subjects smoked marijuana (0.5 g, 2% Δ9-THC) produced bronchodilatation of a magnitude (mean peak increase in SG_{aw} 48% above initial control value) comparable to that noted in healthy subjects with a duration (at least two hours) longer than that observed with isoproterenol (one hour); and in 8 stable asthmatics smoked marijuana promptly and completely reversed methacholine- and exercise-induced bronchospasm. On the other hand, oral Δ9-THC (15 mg) caused only a modest degree of bronchodilatation in asthmatic subjects (mean peak increase in SG_{aw} 18%) which was less than that noted in normal individuals (mean peak increase in SG_{aw} 32%).

Smoked marijuana itself is not useful therapeutically because it contains, in addition to Δ9-THC, hundreds of chemicals, with undefined effects on respiratory system, and unwanted effects on the central nervous and cardiovascular systems. Therefore, we evaluated the bronchial and systemic effects of different doses of pure Δ9-THC in a freon-propellant, administered as an aerosol from a metered-dose canister. In 11 normal subjects, after 5 to 20 mg of aerosolized Δ9-THC, SG_{aw} increased immediately, reached a maximum (33 to 41% increase) after one to two hours and remained significantly greater than placebo values for two to three hours. The magnitude of bronchodilatation after all doses of aerosolized Δ9-THC was comparable, but 5 mg Δ9-THC caused a significantly smaller increase in heart rate and level of intoxication than the 20 mg dose and only a slightly greater change in these parameters than placebo. Side effects of aerosolized Δ9-THC included slight cough and/or chest discomfort in three of the 11 normal subjects. Although 5 and 10 mg of aerosolized Δ9-THC caused significant bronchodilatation in 3 of 5 asthmatic subjects, it caused moderate to severe bronchoconstriction associated with cough and chest discomfort in the other two. These findings indicate that aerosolized Δ9-THC, although capable of causing significant bronchodilatation with minimal systemic side effects, has a local irritating effect on airways, which may make it unsuitable for therapeutic use.

To evaluate further the possible therapeutic role in asthma of Δ9-THC and its analogues, we studied the acute effects on SG_{aw} of different oral doses of placebo, Δ9-THC, Δ8-THC, cannabinol (CBN), cannabidiol (CBD), and nabilone (a synthetic THC-related compound). The results of these studies indicate that natural cannabinoids with minimal psychotropic effects (CBN and CBD) and the synthetic cannabinoid derivative, nabilone, do not cause significant bronchodilatation in man and a partial tolerance develops to the bronchodilator effect of Δ9-THC. Further studies are required to assess the therapeutic potential in asthma of still other synthetic cannabinoid compounds.

A Comparison of Delta-9-Tetrahydrocannabinol (THC), Prochlorperazine, and Placebo as Antiemetics for Cancer Chemotherapy. S. Frytak, C. G. Moertel, J. R. O'Fallon, Mayo Clinic Rochester, MN 55901

The purpose of this study was to assess the antiemetic effectiveness of THC in comparison to a standard agent, prochlorperazine, and placebo (lactose). One hundred seventeen cancer patients, median age 61 (range 21 - 84), receiving 5-FU and Methyl CCNU in combination chemotherapy programs were randomized in a double blind manner to THC 15 mg. p.o. t.i.d., prochlorperazine 10 mg. p.o. t.i.d., or placebo. One hundred sixteen patients were evaluable as one patient inadvertently had taken another antiemetic during the study period. 5-FU was given I.V. daily X 5 and Methyl CCNU p.o. on day 1. Thus, these patients had a strong emetic stimulus (5-FU plus Methyl CCNU) on day 1 and a weaker stimulus (5-FU alone) on days 2 - 4. They were evaluated daily for nausea, vomiting and other side effects.

The percentage of patients experiencing nausea and vomiting on day 1 is shown below.

Drug	Placebo	Prochlorperazine	THC
Total patients	37	41	38
None	19	41	42
Nausea only	16	3	5
*Vomiting	65	56	53

*P=0.05

On day 1, a significantly higher percentage of placebo patients experienced some nausea or vomiting compared with the patients in the other two study groups. The antiemetic effect of THC was almost identical with that of prochlorperazine on the first day.

The percentage of patients experiencing nausea and vomiting on days 2-4 is shown below.

Drug	Placebo	Prochlorperazine	THC
Patients	34	36	28
None	53	72	57
Nausea only	30	14	21
Vomiting	18	14	21

Although the percentage of patients experiencing no nausea or vomiting on days 2-4 was higher for the prochlorperazine group, this value was not statistically significant (p=0.22).

The percentage of patients experiencing sedation, coordination problems, or "highs" on days 1-4 is shown below.

Drug	Sedation	Incoordination	"High"
Placebo	46	19	0
Prochlorperazine	70	10	12
THC	81	70	61
"P" value	0.0055	0.0001	0.0001

Utilizing the chi-square method, the three treatment groups were shown to have significantly different distributions of sedation scores, coordination problems and highs.

Thus, while THC shows evidence of antiemetic activity, this is not superior to a standard phenothiazine antiemetic. THC, however, induces significantly more toxicity to the point of rendering such treatment undesirable for patients in this age group.

ALTERED SERUM IMMUNOGLOBULIN CONCENTRATION IN CHRONIC MARIHUANA SMOKERS

Abstract

Serum IgG, IgM, IgA, IgD were measured weekly for 2 months on 15 chronic marihuana smokers studied in a hospital ward. These measurements were compared with those from 19 control subjects studied in parallel. Throughout the 8 weeks IgG concentration was significantly lower ($p<0.05$) and IgD significantly higher ($p<0.025$) in the marihuana group than in the control. These differences were not accentuated when the test subjects smoked marihuana for 1 month.

CHRONIC MARIHUANA SMOKING AND SERUM IMMUNOGLOBULIN CONCENTRATIONS

Marihuana smoking has been reported to produce a variety of effects on the immune system of animals and man. A decreased responsiveness to mitogenic stimulation has been reported in rodents (1,2,3) and monkeys (4). Treatment of mice and rats with THC reduces the amount of antibody produced in response to a challenge with sheep red blood cells (Srbc) (2) and the numbers of plaque forming cells (PFC) following Srbc (1). Rodents exhibit an inhibition of their primary immune response to Srbc after exposure to marihuana smoke or after ingestion of THC in dosages which approximate human consumption (5). Peripheral blood T lymphocytes of chronic marihuana smokers show a decreased ability to form rosettes with Srbc (6,7,8,9). A structural change in pulmonary macrophages sampled from long-term marihuana smokers has been described (10); it has also been observed . that lymphocytes of chronic hashish users present a decrease in arginine rich histones in the chromatin (11, 12). Lymphocytes sampled from marihuana smokers present an increased incidence in hypoploid metaphases (13, 14).

In man, however, there are conflicting studies on the effect of marihuana smoking on mitogenic stimulation of T lymphocytes. A significant decrease in the response of habitual marihuana smokers to mitogenic stimlulation has been reported (15). These subjects used material of unknown composition, in an uncontrolled environment. Other investigators were unable to demonstrate alterations in thymidine uptake following mitogenic stimulation of lymphocytes sampled from other groups of marihuana users. Furthermore, the responsiveness of habitual marihuana smokers to 2,4 dinitrochlorobenzene (DNCB), which elicits a delayed hypersensitivity reaction, was found to be normal (18). Rachelefski et al (19) did not find any impairment of humoral and cell mediated immunity in daily

smokers studied in a controlled environment for 64 days.

In the present study, we performed serial determinations of IgG, IgA, IgM and IgD concentrations in the sera of 15 chronic male marihuana smokers studied in a controlled environment for 9 weeks. These measurements were compared with those obtained from a group of 19 control subjects studied in parallel and matched for age and sex. Subjects in both groups smoked tobacco cigarettes.

Fifteen male volunteer subjects 18 to 35 years of age were admitted to the Research Ward of New York State Psychiatric Institute. All of the volunteers were habitual marihuana smokers, having smoked at least 3 to 5 cigarettes per week for 5 to 16 years. They were screened from a sample of 200 subjects and selected for their negative medical histories and normal psysical examinations. Routine laboratory tests (SMA 6, SMA 12, CBC, urinalysis), chest X-rays, EEG's and EKG's were normal.

All subjects underwent a 21 day drug-free period (Period I) before smoking marihuana (Period II), and a two week abstinence period after smoking (Period III). They were kept under constant observation. Throughout the study spot urine tests for other drugs were given which were negative for all subjects. At the end of Period I, subjects were allowed to smoke marihuana cigarettes during the four weeks of Period II. All smoking was done under direct observation and subjects were checked repeatedly as to mental status and physical condition.

Subjects smoked increasing numbers of marihuana cigarettes during period II, beginning with one and increasing the number each day until they smoked as many as they wished. The average number smoked per day during Period II was 12.5, varying from 5.3 to 16.3 Each cigarette (provided by the National Institute on Drug Abuse) contained 20 mg of Δ^9THC.

During the three periods of the study, blood samples were drawn once a week in the morning between 8 and 9. At the same time, blood samples were also drawn from a group of students who did not smoke marihuana. All samples were coded, randomized, and sent in bulk for analysis to the Immunoglobulin Research Laboratory of Columbia University where they were analyzed in a blind fashion. Serum concentrations of IgG, IgM, IgA and IgD were measured by single radial immuno-diffusion (Immuno plates®, Kallestad Laboratory, Chaska, Maine) using purified immunoglobulin standards. Measurements were expressed in mg/dl. By this method, the serum Ig concentrations (mean and 95% range) of normal adult subjects are: IgG 1947 (564-1765); IgA 177 (85 - 385); IgM 144 (53 - 375); IgD 3.8 (0 - 14) (Kallestad Laboratories, Inc., Product Information Bulletin 147). In each of the three experimental periods, the mean serum concentration of each immunoglobulin was calculated for each subject.

The data were then subjected to a nested analysis of variance (20) by period and by group. This analysis tested the null hypothesis that the total mean concentration is equal for control and experimental groups, and that the changes in mean concentration, with respect to calendar time, were equivalent in the control and experimental groups.

The results of the analysis of variance are presented in Table I. Concentration of IgG (Fig. 1) was significantly lower ($F\ 1.32 = 4.94$, $p < 0.05$) throughout the three periods in the marihuana users (987 mg/dl $\pm$ 58) as compared to the controls studied in parallel (1154 mg/dl $\pm$ 58). There was a consistent increase with respect to calendar time of IgG concentrations which was comparable in both groups. In both groups there were no significant changes in Periods I, II or III. IgD concentration in

the marihuana group (4.2 $\pm$ 1.1 mg/dl) was significantly higher ($F_{1,32} = 7.48$, $p \leq 0.01$) than in the control group (1.4 $\pm$ 0.4 mg/dl) and did not change significantly with time in either experimental or control group. The concentration of IgM was not significantly different between the two groups, although in both groups there was a fall in concentration of IgM during the last two weeks of the study. The concentration of IgA was not significantly different with respect to group or calendar time.

Two other studies report Ig concentrations in marihuana smokers. In one (21), a single routine measurement of serum globulin concentrations in a group of 84 smokers showed that they were significantly lower than in a group of 156 controls studied in parallel. In the other study (19), IgG levels of marihuana smokers were reported to be normal when compared to age matched controls reported in the literature (22) ten years before. In the present study, similar changes in serum Ig concentrations were observed with respect to calendar time in both test and control subjects. This observation underlines the importance of studying test and control subjects in parallel in any long term investigation.

Throughout the present study, IgG concentrations were consistently lower and IgD consistently higher in the marihuana smokers than in the control groups studied in parallel. However, these differences were not accentuated by the use of marihuana during four weeks. There was no observable "drug effect". The reason for such apparent discrepancy is not clear. A certain degree of pharmacological tolerance to the effects of the cannabinoids on B lymphocyte function might have developed among the marihuana smokers: a marked tolerance to many of the psychological and physiological effects of cannabis has been reported (23).

One of us (A.M.) has also observed <u>in vitro</u> that delta 9 THC in

3.2×10^{-6}M increases significantly segregational errors of chromosomes in cultured cell lines derived from the lymphocytes of normal males transformed by the addition of Epstein-Bar virus. Such transformation occurs in B lymphocytes.

Altered serum immunoglobulin concentrations were not the only subclinical changes in the immunity system of the marihuana smokers noted in this investigation: T lymphocytes were isolated from the blood of five of these subjects, cultured and analyzed to detect the incidence of hypoploid metaphases. This incidence was significantly greater in all subjects during the smoking and recovery periods (14).

It should also be noted that psychoactive and non psychoactive cannabinoids contained in marihuana, or resulting from their biotransformation inhibit, in 10^{-6} to 10^{-5}M concentration, macromolecular synthesis in cultured lymphocytes and other eucaryote cells (24, 25, 26); such concentration may be reached during chronic marihuana consumption (27).

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28. We thank Mr. M. Davis and Dr. J.L. Fleiss of the Columbia University School of Public Health for performing the statistical treatment of the data.

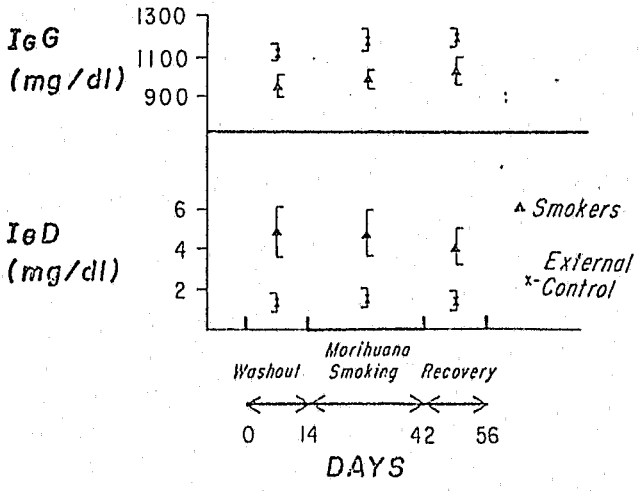
TABLE 1

Ig (mg/dl)	Period I (2 weeks) control	Period I (2 weeks) test	Period II (4 weeks) control	Period II (4 weeks) test	Period III (2 weeks) control	Period III (2 weeks) test
IgG	1091 ± 49	954 ± 57*	1169 ± 34	974 ± 50*	1202 ± 34	1031 ± 76*
IgA	183 ± 27	167 ± 18	200 ± 29	175 ± 19	213 ± 39	185 ± 30
IgM	143 ± 12	161 ± 21	140 ± 11	151 ± 14	114 ± 9	114 ± 11
IgD	1.3 ± 4	4.5 ± 1.2**	1.4 ± .4	4.4 ± 1.2**	1.4 ± .4	3.6 ± .8**

* $p \leq 0.05$
** $p \leq 0.01$

Mean ± S.E. of weekly measurements of serum immunoglobulin concentration in chronic marihuana smokers (N=15) and control subjects (N=19) studied in parallel over a period of 8 weeks. During Period I and III the test subjects abstained from smoking marihuana. During period II they smoked from 5 to 16 marihuana cigarettes per day.

Fig. 1. Serum concentration of IgG and IgD in a group of marihuana users hospitalized in a research ward and in a group of control subjects who did not smoke marihuana and were studied in parallel. In the course of their 8 week confinement, the test subjects smoked marihuana during the period indicated.



PREPARED STATEMENT OF SIDNEY COHEN, M.D., CLINICAL PROFESSOR OF PSYCHIATRY, U.C.L.A. CENTER FOR HEALTH SCIENCES, LOS ANGELES, CALIFORNIA

It is a pleasure to be here with you to try to think through the issues that cluster around the use of marijuana in the United States today and in the days to come. Because of the emotionalism about the plant, it is difficult to maintain an unbiased position. We seem unable to think of it as just another drug that should be evaluated for its potential for being helpful and its potential for harm.

Perhaps if I were to review the shifts in my attitude toward marijuana, it may provide you with some feeling for my position—and my prejudices. Before 1960 I had little personal knowledge of cannabis, and I accepted the scientific opinions of the day that "prolonged use may result in mental deterioration, a fact known for centuries in Egypt and the Orient. It was also believed to be a breeder of crime and violence".[1] During the 1960s I revised my posture toward the drug. I was seeing casualties from LSD, amphetamine and heroin use, and very few ascribable to marijuana. I wrote and spoke about it as "a trivial weed". As used in this country at that time, this opinion may not have been incorrect. It was smoked by young adults ordinarily on an infrequent basis of once or twice a week or less, and the material was either of Mexican origin with about 1 percent THC content, or the wild, local variety that had insignificant amounts of THC.

In one study during this period, marijuana connoisseurs could hardly differentiate between a cigarette with Mexican marijuana and an identically appearing placebo. During the 1970s my impressions about the harmfulness of cannabis have changed again. This latest shift has been brought about by emerging research reports including my own, and by an unhappy change in the street scene. Concerning the latter, the new patterns of usage include younger and younger children becoming involved, increased number who smoke daily and often many times a day, and a much more potent product ranging from 5 percent to 7 percent THC readily available from Colombia, Thailand and from our own country. These trends compel a re-evalution of our attitudes of the hazards involved. This heavy use of more potent material by increasingly young persons make the marijuana issue a whole new ball game.

The occasional smoking of cannabis by adults is a vastly different matter than consistent preteenage consumption. I say this for two reasons. First, the preadolescent and adolescent is involved in an intensive learning period, struggling to develop techniques of coping with life's frustrations and stresses. If this period is spent in an intoxicated state (from marijuana or any other substance) nothing is learned, and the youngster remains psychologically immature. Second, this early developmental period is one in which the habits of a lifetime are laid down. To establish a career of smoking pot during grade or junior high school, provides a lengthy period of exposure that places such individuals at greatest risk.

I intend to focus on three areas of concern while recognizing that others certainly exist. These are the pulmonary, the hormonal and the mental. From our own work and that of others, I believe that these areas are sufficiently suspect and that enough evidence of adverse effects from chronic use exists for us to press in the immediate future, for more precise answers than we now have.

PULMONARY CONSIDERATIONS

Our earlier work with cannabis and THC at U.C.L.A. indicated that dilation of the bronchi occurred after the *acute* smoking or eating of these drugs. Dr. Taskin and his associates explored this possible usefulness as anti-asthmatic medications, but the irritant effects of the crude drug on the lungs and other problems with THC makes it improbable that they will ever be used for this purpose. Since then, we have found that *chronic* smoking will eventually produce a narrowing of the medium and large sized airways. This results in a decrease in the diameter of the bronchial tubes. It causes increased airway resistance of about 25 percent as compared to a non-marijuana smoking control group.

Such a reduction in airflow should not produce symptoms except during maximal exercise. The narrowing is apparently secondary to an inflammation of the lining of the trachea and bronchi. It has been recognized clinically that sustained smoking of marijuana or hashish results in chronic bronchitis and

[1] Goodman and Gilman, Pharmacologic Basis of Therapeutics, First Edition, 1941.

pharyngitis When medical officers with the U.S. Army in Europe took biopsies of cannabis-smoking soldiers with bronchitis, metaplastic changes of the mucous membranes were found. It is not a pleasant or desirable condition, and it may contribute to a decreased resistance to infection and a decreased exercise tolerance, but it is not, in itself, a life-threatening condition. The long term complications of chronic inflamation of the airways would be. They include emphysema and fibrosis of the lungs. Have these conditions been detected in this country? Not to my knowledge, but in countries with a long history of cannabis smoking, some cases have been reported.

The ingredients in marijuana that produce inflammatory changes are the coal tars. They are present in marijuana smoke as in tobacco smoke, perhaps marijuana tars can be compared to tobacco with a high tar content. Selective breeding has reduced tars in tobacco in recent years. Two points must be made. A heavy tobacco smoker would be someone who smokes 30 or more cigarettes a day. A pothead is someone using one or more "joints" a day. This difference would seem to decrease the risk for the marijuana user. On the other hand, the technique of inhaling marijuana is quite different than smoking a cigarette of tobacco. The smoke is deeply inhaled, kept in the lungs as long as possible, and then exhaled. This method of smoking exposes the hundreds of substances in the coal tar to direct contact with the cells of the tracheobronchial tree for much longer periods during each inhalation than tobacco smoking does.

A related pulmonary problem is that of possible cancer production, also the result of chronic coal tar exposure. Hoffman suggests that due to its poorer combustibility, cannabis smoke contains about 50 percent more co-carcinogens, tumor initiators and cilia-toxic chemicals than tobacco smoke. As you may know, it is extremely difficult to produce a lung cancer in an experimental animal with tobacco smoke. Instead, when an extract of tobacco tars are painted on the skin of mice, precancerous and cancerous changes can be induced. The same situation exists with cannabis, the smoke has not yet produced lung cancers in laboratory animals, but painting the tars on the skin of mice does.

When one asks about cannabis-caused cancers of the respiratory tract in humans, the answer is that none have been reported in this country as far as I know. We do not yet have a sizable enough constituency who have smoked consistently for the many years it takes to grow a carcinoma. The data from countries where smoking of cannabis is traditional, is not too helpful because the level of medical sophistication is lower than in this country, or the drug is smoked along with tobacco making the results difficult to interpret. By the way, we know nothing of the combined effects of tobacco and marihuana smoking which is frequent. My guess is that they are additive in carcinogenicity.

SEX HORMONE CHANGES

The changes in sex hormone levels are complicated, and results have not invariably been confirmed. Their significance is not always clear. Perhaps it would be well to begin with the clinical pictures that have been reported in connection with moderate to heavy marijuana use. A number of instances of gynecomastia (enlargement of the male breast) that required corrective surgery have been published. Although many smokers claim that marijuana enhances the sexual experience, occasional instances of impotence that improve after discontinuance of marihuana can be found in the literature. Articles about reduced sperm counts and structural changes of the sperm cell have also been appearing. If these are correct observations, a decreased male fertility would be expected, but this has not been clearly established.

We have replicated Kolodny's finding regarding a lowering of plasma testtosterone in heavy, chronic users. This reduction although statistically significant, still did not reach abnormal levels and its meaning remains obscure. Other workers have not been able to confirm this finding, demonstrating the difficulty in making a positive statement about the matter.

The animal work with cannabis is suggestive. The lowering of the female sex-hormones in monkeys and their inability to ovulate while under THC administration is reported. A higher than normal incidence of death of the embryos in two species and the abolition of lactation in the mothers are also recorded. However, equivalent investigations in humans are not available since the administration of cannabis to women has been forbidden until recently. Such reports of animal studies are important as indicators of possible trouble, but they are not proof that similar changes occur in our species.

To summarize the situation involving the sex hormonal changes, clinical experience with adverse effects is sparse. The animal work is highly suggestive that profound effects are possible, but changes in an animal should not be directly translated to the human experience. My only additional remark is that during critical phases of psychosexual development, it would be prudent to abstain or reduce the use of marihuana to a minimum. These phases include pregnancy and adolescence.

PSYCHOLOGICAL EFFECTS

To me, this aspect of the issues swirling around marijuana is of greatest importance. The long-term effects of smoking upon the lungs and the endocrine glands are important to attempt to predict, but the problems of mental functioning are much more immediate.

The acute complications of smoking pot are not the important issue. True, some people will become panicky or paranoid while smoking, but hardly anyone gets hurt. The fact that certain people under the influence will drive a car or even a plane is discouraging because the deficiencies of immediate memory, reaction time, peripheral vision and the distortions of perception and thinking are sure to impair such complex operations. A recent survey has found that people who use marijuana tend to think that they can drive without hazard, and many do drive. This will simply add to the burden of alcohol-caused accidents, and we should also recall that marijuana-alcohol usage in combination is rather common.

It is the long term, heavy juvenile consumer who seems to be at particular risk. There is a special term for those adolescent potheads who lose drive, ambition and goal-direction in connection with their smoking practices. It is called the "amotivational syndrome." Practically every doctor especially general practitioners, pediatricians and psychiatrists must have had distraught parents coming to them with complaints that their child was sleeping during the day, going out at night, not going to school, not doing anything worthwhile, undergoing a personality change, etc., etc., and blaming it on marijuana with or without other drugs.

A number of points must be made. It is my impression that in some of these youngters, marijuana has played only a secondary role in their dropout. They were dropping away from conventional growing up patterns for one reason or other, and marijuana simply reinforced their withdrawal and passivity.

They would have dropped out with or without the drug, but pot facilitated it. Another point is that marihuana is a sedative drug. Some people use it just for sleeping purposes. It is my impression that the amotivational syndrome is a special name for the sedative quality of this drug. Any young person who takes other sedatives during the day: alcohol, volatile solvents, sleeping pills, tranquilizers or narcotics, also develops the so-called amotivational syndrome. While marijuana produces it in certain people so do other drugs that depress the brain's activity. I am not defining the problem away, merely pointing up that sedation may be an important part of the dropout picture. Another part is the pleasant dreamy, reverie state that it can produce and a desire to continue using. The final point is that there are some highly motivated young people who can overcome the loss of drive that heavy use of the drug can induce.

Of greater consequence is the "burnout." This is the condition that may become evident after months or years of considerable marijuana usage. During the sober interval when no drugs had been consumed, these individuals are blunted, dulled, mildly confused, and appear to have a diminished attention span. Their mood is flat, thinking ability impaired, and the psychiatric diagnosis is usually "organic brain dysfunction" or some variant thereof.

Not too many such people identify themselves as burnouts—but their friends do. If they can be persuaded to remain off cannabis, many, but not all, make progress toward recovery after a few weeks or months. Some of them clear up completely, look back on their state while smoking pot, and recognize that they were definitely impaired. I am not yet sure whether all would recover if they stopped their marijuana use.

What is this condition? Does it have any relationship to the retention of THC in the lipid phase of the neurone? Does Dr. Heath's work with implanted electrodes showing substantial abnormalities of the depth EEG relate to the state? Is this marijuana equivalent of the chronic brain syndrome of chronic alcoholism? There are no reliable answers to these questions now.

Anyone can selectively cite the scientific literature to prove that cannabis, is completely innocuous, or that it is exceedingly dangerous. What seems quite

clear now is that both the horror stories that pervaded the first part of this century and the over-enthusiastic assessment of marijuana of more recent years were equally without a data base. Cannabis is turning out to be a drug that has a dose-related potential for harm, a potential for benefiting certain types of glaucoma and some, not all, patients receiving cancer chemotherapy.

Why is it that not only the public, but also scientists have widely divergent opinions about the threat that cannabis poses to the smoker's health? One reason is the nature of the scientific process. When studying so complicated an organism as a human, two apparently identical investigations may provide opposite results. This is due to the variability of the population studied, or to minor variations in the way the research was done. Perhaps of even greater importance is the interpretation the investigator gives to his data. Here bias may creep in, or the conclusions may go well beyond the results. Finally, it should be recalled that the modern scientific study of cannabis is only a dozen years old, and large gaps in our knowledge are evident. We cannot compare the body of information we have about alcohol and tobacco with the amount of knowledge on marijuana. This is one reason why the question "which is worse, marijuana, alcohol or tobacco" is as hard to answer. Fifty years ago we knew little about the health hazards of tobacco, for example.

The public remains about 5 years behind the times insofar as information about marijuana is concerned. They are still not fully aware of the recent changes that have occurred, for example, the involvement of many children in daily marijuana use. It is hoped that these hearings will help to correct this information gap.

I would like to briefly state my current position:

1. Pregnant women should not use cannabis.
2. Driving under the influence of this drug can be hazardous to one's health and to the health of those in the vicinity.
3. Young people should be discouraged from its use, particularly heavy use.
4. Those individuals with lung diseases should avoid the drug because of its irritant effects.
5. People with heart disorders may be further impaired by the acceleration of the heart that cannabis produces.
6. Pre-schizophrenic and schizophrenic people may develop or exacerbate a psychotic break in connection with marijuana use.
7. The infrequent adult use of marijuana (less than once a week) will probably not result in ill effects unless the smoker happens to experience of the uncommon, acute reactions.
8. Continued study of the therapeutic potential of cannabis is desirable, particularly for the management of intractable nausea and vomiting for the wide-angle glaucoma.

The population that I have not referred to above are those adults who are consistent and substantial users. I suspect that, as with the immoderate use of alcohol and tobacco, some of these people will become physically or psychologically impaired, and others will not.

What should be done about the situation? As a researcher and physician, I will avoid making legislative and enforcement policy pronouncements. I have already referred to the need for up-to-date information for users, parents, educators and other public groups. In addition, the health and human service professions also require updating. It is not that I have faith that accurate information will alter the drug-using behavior of many people, but they should at least know the possible consequences.

A great need for accurate answers to specific questions about the adverse effects of cannabis within a reasonable time is evident. Some of this research is ongoing. But a program of research directed at the most important unresolved questions should be added to our current efforts. I believe it is possible to design investigations that would have a good chance to provide decisive answers to many of the present uncertainties of the human interaction with cannabis. I do not suggest a crash program. That implies that throwing money at the problem will give us answers. Instead, I recommend a thoughtfully designed and executed series of researches carried out in deliberate haste, and executed by the best people available. These answers are needed before major legislative amendments to our existing statutes are made.

I realize that I have not dealt with certain important issues surrounding cannabis in these remarks. I will be pleased to try to answer any questions you may have.

HEALTH CONSEQUENCES OF MARIHUANA ABUSE: RECENT FINDINGS

THURSDAY, JULY 19, 1979

HOUSE OF REPRESENTATIVES,
SELECT COMMITTEE ON NARCOTICS ABUSE AND CONTROL,
Washington, D.C.

The Select Committee met, pursuant to notice, at 9:40 a.m., in room 2212, Rayburn House Office Building, Hon. Stephen L. Neal (acting chairman of the Select Committee) presiding.

Present: Representatives Robin L. Beard, Benjamin A. Gilman, and Daniel K. Akaka.

Staff present: Robert Hundley, deputy chief of staff—demand; Roscoe Starek, minority counsel; Daniel Stein, David Martin, Elliott Brown, and Dr. Gerry Dubin, professional staff members.

MR. NEAL. The Select Committee will come to order.

This morning, the Task Force on Marihuana of the Select Committee on Narcotics Abuse and Control is continuing its series of hearings on marihuana.

On Tuesday of this week, the task force received testimony from three distinguished members of the scientific community to clarify and define what we know about the health consequences of marihuana use. The committee sought the broadest spectrum of opinion available in order that areas of agreement would be regarded as reliable and reasonable.

The panel of medical experts agreed that adolescents should not use marihuana; that heavy use of these is potentially harmful to adults; that one should not drive while under the influence of the drug.

Tuesday's hearing was significant, it seems to me, in that a basic consensus was reached on eight important positions regarding marihuana as follows:

1. Pregnant women should not use the drug.
2. Driving under the influence of marihuana can be hazardous.
3. Young people should be discouraged from using the drug.
4. Individuals with lung disease should avoid using marihuana because of its irritating effect.
5. People with heart disorders may be further impaired because of the increase in heart rate brought on by use of the drug.
6. Preschizophrenic and schizophrenic people may develop or exacerbate a psychotic break in connection with the effects of THC.
7. Infrequent use, less than once a week, by adults will probably not result in ill effects unless the smoker happens to experience one of the uncommon, acute reactions.

8. The therapeutic potential of marihuana, particularly for the management of nausea and for wide-angle glaucoma should be studied further.

This morning, we will compare the findings of Tuesday's panel with those of the National Institute on Drug Abuse, that agency within the Federal Government having primary responsibility for the study and dissemination of information on the health consequences of marihuana.

Having heard testimony from all sides of controversy, and having arrived at a valuable core of agreement on a difficult issue, the committee is interested in receiving answers to the following questions:

1. What is NIDA's position on the known health hazards of marihuana?

2. What is NIDA's in-depth response to those eight aforementioned areas of agreement?

3. Is the Federal Government currently providing information on these areas of concern to users of the drug, and parents of young people.

4. Given the health-related questions that have been raised, is the Federal Government, and NIDA in particular, pursuing the necessary followup research designed to provide more useful information on marihuana?

At this time, I am pleased to introduce our distinguished representatives from the National Institute on Drug Abuse: Dr. William Pollin, Director, and Dr. Robert Petersen, Associate Director, Division of Research at NIDA and the author of that agency's annual marihuana and health report.

Before we begin, I will ask my colleagues if they have any additional comments to offer at this time.

Mr. BEARD. No.

Mr. AKAKA. No.

Mr. NEAL. It is customary for this committee to swear witnesses that appear before the committee. So I will ask you to stand at this time.

[The three witnesses were sworn by Mr. Neal.]

Mr. NEAL. Let it be shown that all answered in the affirmative.

Dr. Pollin, I know you are familiar with this committee. You may place your entire statement in the record, and summarize, if you like, or proceed as you will. We welcome you.

TESTIMONY OF WILLIAM POLLIN, DIRECTOR, NATIONAL INSTITUTE ON DRUG ABUSE; ACCOMPANIED BY MARVIN SNYDER, ACTING DIRECTOR, DIVISION OF RESEARCH, AND ROBERT C. PETERSEN, ASSISTANT TO THE DIRECTOR, DIVISION OF RESEARCH

Dr. POLLIN. Fine. Thank you very much, Mr. Neal.

Mr. Chairman, members of the committee, I thank you for your invitation to appear this morning to discuss the health hazards related to marihuana use.

I would propose to summarize the statement which has been distributed this morning.

Accompanying me this morning, in addition to Dr. Petersen, is Dr. Marvin Snyder, who was Acting Director of the Division of Research.

And with us, should the committee wish to get into several areas of detail, in addition, are Dr. Stephen Szara, Chief of the Biomedical Branch; Dr. Robert Willette, Chief of the Research Technology Branch, who is in charge of our marihuana supply program: and Dr. Monique Braude, research pharmacologist.

To begin with, let me say that we at NIDA and in the Department of Health, Education, and Welfare are very concerned about the health hazards of marihuana use. These hazards are described in the Seventh Annual Marihuana Report to the Congress from the Secretary of HEW which was released on April 18, 1979. That report summarized research on the medical and social effects of marihuana use, and pointed out, in particular, the dramatic increase in marihuana smoking among teenagers and adolescents.

A need remained, however, for a comprehensive review of marihuana research efforts that would identify the most urgently needed and promising lines of inquiry upon which future decisionmaking in this area could be based. Therefore, Secretary Califano announced that the Department of HEW will undertake a comprehensive review of the existing scientific evidence on marihuana.

This review will encompass research into the biological effects of chronic marihuana use, as well as behavioral research on use-related problems, such as intervention strategies to help adolescents resist peer pressure, evaluate evidence, and assess risks.

Responsibility for seeing that this review is conducted has been assigned to the National Institutes of Health. An independent scientific group will implement this review and is expected to produce a report within 12 months.

Since 1967, the Federal Government has spent approximately $35 million on marihuana research to support over 1,000 individual research projects.

I would like to point out in passing a considerable bulk of the research results which were reported to this committee on Tuesday represented projects which had been funded by NIDA, either under the grant or contract mechanism. This research effort continues. For example, this fiscal year, fiscal year 1979, NIDA alone will support approximately 100 research studies totaling $3.8 million. NIDA-supported research includes investigations into the effects of marihuana on the heart and lungs, on psychological, social, and physical development, and pregnancy, as well as research into possible medical use.

Subsequent to my presentation, Dr. Snyder will be glad to discuss with the committee what our plans are for research in this coming year, and in the 5 years ahead.

Presently available evidence clearly indicates that marihuana is not a "safe" substance. While I will not attempt this morning to review all of the scientific findings described in the marihuana and health report, I would like to briefly indicate to the committee what the hazards of marihuana use are for adolescents in nine areas and summarize a few organ system functions which we think are at risk. These nine are:

1. Intellectual function.
2. Driving and skills performance.

3. Effects on the heart.
4. Effects on the lung.
5. On the immune system.
6. On the brain.
7. Endocrine glands.
8. Reproduction.
9. Chromosome abnormalities.

And I then discuss specific findings in detail, as the committee may wish. And I would also look forward to continuing discussion of some of the important policy points and issues which were raised at the conclusion of Tuesday morning's hearings.

Let me briefly try to summarize the health hazards, in our view, in the nine areas I mentioned.

1. ACUTE INTOXICATION

Impairs learning, memory, and intellectual performance. Virtually all of the many studies which have been done of performance while "high" show that marihuana interferes with immediate memory and intellectual performance in ways that impair thinking, reading comprehension, verbal and arithmetic problemsolving. Less familiar, more difficult tasks are interfered with more than well-learned performance, and the extent of the effect depends on the amount used and the tolerance for the effect.

Marihuana intoxication impairs driving and other skilled performance. Being "high" interferes with driving, flying, and other complex psychomotor performance at usual levels of social usage.

Research involving such diverse areas as perceptual components of the driving task, driver and flight simulator performance, test course, and actual driving behavior, all tend to show significant performance and perceptual deficits related to being high that make functioning more hazardous.

2. STUDIES INDICATING IMPAIRMENT OF DRIVING SKILLS INCLUDE

Laboratory assessment of driving-related skills, driver simulator studies, test course performance, and actual street driver performance. A study conducted for the National Highway Traffic Safety Administration of drivers involved in fatal accidents also suggests possible marihuana involvement.

More marihuana users drive today when high than was true in the past.

As use becomes increasingly common and socially acceptable and as the risk of arrest for simple possession decreases, still more people are likely to risk driving while "high."

In limited surveys, from 60 to 80 percent of marihuana users questioned indicated that they sometimes drive while high. Marihuana use in combination with alcohol is also quite common and the risk of the two drugs used in combination may well be greater than that posed by either alone.

There was brief mention Tuesday of research which has indicated that even experienced pilots undergo marked deterioration in their

performance under flight-simulated or test conditions while high. What was particularly important about that study, I think, is the following:

Not only does it indicate that flying an aircraft while marihuana-intoxicated should be considered dangerous, it is also significant that these experienced pilots, A, predicted there would be no decrement in their performance, were not aware of the decrements in their performance, and showed this very substantial decrement on the basis of having smoked only one joint.

I think that particular test is relevant not only to flying, but is also a good measure of the variety of other types of skilled performance which require good judgment.

A continuing danger common to both driving and flying is that some of the perceptual or other performance decrements resulting from marihuana use may persist for some time, possibly several hours, beyond the period of subjective intoxication. Under such circumstances, the individual may attempt to fly or drive without realizing that his or her ability to do so is still impaired although he or she no longer feels "high." Ongoing studies are attempting to further delineate these issues with driving.

3. EFFECTS ON THE HEART

Acute effects of marihuana use on heart function in healthy young male volunteers thus far appear to be benign. However, the increased heart rate produced and evidence that chest pain associated with poor circulation to the heart muscle occurs more rapidly with marihuana use than with cigarette smoking have led to a consensus that those with heart conditions, or at high risk, should not use marihuana.

4. EFFECTS ON LUNG FUNCTIONING

Since, like tobacco, marihuana is usually smoked and typically in this country deeply inhaled, adverse pulmonary effects may be expected. Based on both clinical observation and laboratory measurement, marihuana shows evidence of interfering with lung function and producing bronchial irritation in habitual users. One study has found that smoking four or more "joints" per week decreases vital capacity—an important measure of the amount of air the lungs can move following a deep breath—as much as smoking nearly a pack of cigarettes a day.

As yet, there is no direct clinical evidence that marihuana smoking causes lung cancer. However, as critical studies to evaluate this particular risk have not been done so far, there is determination to do so, in terms of the long history of the substance.

It has been reported that marihuana smoke contains more carcinogens than tobacco, that in animal testing the smoke residuals produce skin tumors, and there is laboratory evidence that human lung tissue exposed in the test tube to marihuana smoke shows more cellular changes than when exposed to similar amounts of standard tobacco smoke. Heavy smoking by healthy young male subjects causes airway obstruction. Under conditions of ready availability, there is also evi-

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dence that the number of marihuana cigarettes consumed, up to 10 joints daily, may approach that of tobacco cigarettes.

In three animal studies, after daily exposure for periods of from 3 months to 1 year, these animals showed extensive lung inflammation and other evidence of lung damage not found in animals exposed to tobacco or to inert marihuana smoke. Thus, it appears likely that daily use of marihuana may lead to lung damage similar to that resulting from heavy cigarette smoking.

Since marihuana smokers often smoke both tobacco and marihuana, the effects of the combination require additional study. Earlier studies of this effect among chronic users in Jamaica, Greece, and Cost Rica did not find definitive evidence of such lung pathology. However, the fact may not be relevant, since traditional users in those countries may not inhale as deeply or retain smoke in their lungs in the same way as do American users.

5. EFFECTS ON THE IMMUNE SYSTEM

Research findings are divided as to whether marihuana use adversely affects the body's natural defenses against infection and disease. Of the studies reviewed, the majority have shown that such an alteration occurs. Whether or not such changes, when they are found, have practical implications for users is not known at this time.

The T-lymphocyte is a white blood cell which plays a central role in the immune response. There have been two human studies, unsuggestive of studies in these lymphocytes, under conditions of heavy marihuana smokers. Other studies have failed to confirm this observation.

In animals, the results are a bit more clearcut. Three reports based on work in two laboratories have reported reductions in the immune response in mice and rats treated with high, but humanly relevant, doses of inhaled marihuana smoke. In both, there was a definite suppression of the animals' immune response.

As a whole, the results to date are far from clearcut in establishing whether or not the human immune response is impaired by marihuana, but they do raise serious questions.

6. BRAIN DAMAGE RESEARCH

A British research report, which originally appeared in 1971, attributed brain atrophy to cannabis use in a group of young male users. This research was faulted on several grounds. All patients had used other drugs, and the appropriateness of the comparison group in diagnostic technique was questionable.

In a study of chronic Greek users, with a different technique for measuring the brain, the findings were essentially negative.

And two studies subsequently conducted using computerized transaxial tomography, a nonbasic technique, with samples of young men with histories of heavy cannabis smoking, both led by experienced neuroradiologists, provided negative results.

In neither was there any evidence of cerebral atrophy.

Several additional points should, however, be stressed. Neither of these studies rules out the possibility that more subtle and lasting

changes of brain function may occur as a result of heavy and continued marihuana smoking. It is entirely possible to have impairment of brain function from toxic or other causes, but it is not apparent on gross examination of the brain in the living organism.

Tuesday, we heard of certain studies in which electrodes were implanted deep within the brains of monkeys. Persistent changes were found related to chronic use, and also persistent microscopic changes in the brain.

While these experiments demonstrate the possibility that more subtle changes in brain functioning or structure may occur as a result of marihuana smoking, the studies were conducted in few animals which have, thus far, not been replicated. And the implications of these changes for subsequent human or animal behavior are at present unknown. This is an area which clearly requires additional investigation.

As I indicated earlier, many clinicians feel that regular marihuana use may seriously interfere with psychological functioning and personality development, especially in childhood and adolescence. There is increasing clinical concern that at least some percentage of regular heavy daily users do develop a psychological dependence on marihuana to the extent that it interferes with functioning in a way analogous to heavy alcohol use.

The question of whether or not enduring psychological effects occur in chronic users remains to be resolved. While three more carefully controlled studies of heavy users in Jamaica, Greece, and Costa Rica failed to find evidence of marihuana-related psychological impairment, serious questions have been raised about some of the methodologies in those studies, and it is possible that the mode of use there differed from American use.

Overall, of the studies reviewed, both human and animal, the majority have suggested enduring impairment may occur. However, the quality of studies in this area is highly variable, and the issue is still in significant doubt.

7. EFFECTS ON THE ENDOCRINE SYSTEM

There is evidence that marihuana can affect the network of glands and hormones which are involved in such functions as growth, energy levels, and reproduction. Levels of the male hormone testosterone have been found to be reduced, though still within normal range, in some, but not all, studies.

There is animal and human preliminary evidence that relatively heavy use ranging from several times a week to daily use may reduce fertility in women. Of 11 studies dealing with these areas, 7 have reported endocrine changes, with 4 reporting no such change.

Again, however, the long term significance of these results still remains to be determined. Concern over possible effects on adolescent development and possible interference with sexual differentiation of the male fetus whose mother smokes marihuana during pregnancy has been expressed.

8. REPRODUCTIVE EFFECTS OF MARIHUANA

There are a variety of both animal and human studies suggesting that marihuana used daily and in substantial amounts similar to those

of a regular heavy tobacco smoker may adversely impair aspects of the reproductive function.

In one study of 16 male, healthy, chronic marihuana users smoking from 8 to 20 standard marihuana cigarettes per day for 4 weeks in a hospital environment, a significant decline in sperm concentration was found as was decrease in sperm motility. In this and another study, abnormalities of structure in the sperm has also been detected.

Three studies in animals of the effects of marihuana on testicular functioning, including the production of sperm, have also found adverse effects. While the clinical implications of such findings are not yet known, and the effects noted may be reversible when marihuana use is stopped, they do indicate a basis for concern.

Research on female reproductive function has detected changes that may have serious implications for human reproductive capacity as well. One recently completed study of 26 females who used "street" marihuana three times a week or more for 6 months or more found that these women had three times as many defective monthly cycles as nonusing women.

Unfortunately, since the marihuana-using women also used more alcohol, it cannot be assumed that the effects observed were necessarily the result of marihuana use.

Five recent animal studies using high but relevant doses of marihuana or THC have indicated a variety of possible problems. These include early death of embryos and their reabsorption, reproductive losses being higher among marihuana-treated rhesus females than among nontreated females; lower birth weight of male infants born to treated female monkeys, and reductions in ovary and uterine weight, estrogen production, and the production of a number of important pituitary hormones.

These and other studies using higher doses of marihuana or THC all underscore the undesirability of use, especially during pregnancy. Research directly concerning effects on human reproduction is, however, very limited. And thus far, we know of no clinical reports directly linking marihuana use and birth abnormality.

9. CHROMOSOME ABNORMALITIES

Originally, there has been three positive studies in humans that reported chromosome abnormalities in heavy marihuana users. All these studies were retrospective, had variabilities such as differences in life style, exposure to viral infections, and possible use of other drugs which were not controlled. And the results have been questioned.

Three other prospective studies yielded negative results. Animal studies have found increases in the number of cells containing an abnormal number of chromosomes, but the implications of these findings continue to be uncertain.

Overall, there continues to be no convincing evidence that marihuana use causes clinically significant chromosome damage. However, it should be emphasized that the limitations of the research to date preclude definitive conclusion.

Those represent the nine specific areas of health hazards which are indicated, we felt, to deserve individual discussion. In the remainder of my presentation, Mr. Neal, I would like to discuss briefly the question of the comparative hazards of marihuana use versus other recre-

ational drugs, and then state our position with regard to marihuana use among adolescents and our understanding of why there exists the current problem of a lack of that kind of clear-cut, definitive finding that we all wish were present.

A question that frequently arises is how hazardous is marihuana as compared to alcohol and tobacco? As appealing as such a comparison is, it is also misleading on several grounds at the present time.

Any comparison of alcohol and tobacco use and that of marihuana compares drugs with great differences in social acceptability, period of use, and degree of availability.

Also, it must be pointed out the hazards of alcohol and tobacco are reasonably well known and much better known at the present time than those of marihuana. We have known what the active component and concentration of alcohol is for hundreds of years. We have known about the presence of nicotine and have studied nicotine for over 60 years.

We only identified the psychoactive component in marihuana some 12 or 15 years ago. And the amount of research done on marihuana, though it is a much more complex substance than the two others with which it is usually compared, is quantitatively much less than the amount of research that has been conducted on those other substances with which we would like to compare marihuana. Thus a comparison at this point inevitably must be incomplete.

We do know that a full 10 percent of alcohol users have been described as having an alcohol problem, and alcohol has been implicated in half the automotive fatalities in the United States. The health costs of alcohol in terms of cirrhosis, mental illness, crime, and industrial accidents can also be documented.

A similar analysis can be done for tobacco. By contrast, marihuana has only recently become a popular substance.

In 1965, only 5 percent of college-age respondents indicated that they had ever had any kind of experience with marihuana. At the present time, some 60 or 70 percent would give a positive response to that question. So this is a recent addition to the commonly used intoxicants in this country.

It remains illegal and most use is not habitual at present. Moreover, unlike cigarettes and alcohol, for which the health hazards can be reasonably well specified, as indicated, much less is known about the implications of marihuana use.

Any consideration of the hazard a drug poses must take into account not only its present use, but also use that might be reasonably expected in the future.

At present, this involves many imponderables such as the parameters of risk for various groups in our society at different levels of use, the likely circumstances of use, effects on user functioning and motivation of heavier use patterns, degree of use restriction possible, combined use with other drugs—to name but a few.

Thus, again, I repeat, any attempt to compare the health impact of marihuana with that of alcohol and tobacco at current levels of use is certain to minimize the hazards of marihuana. Put any comparison at levels of anticipated use involves many assumptions that are at best dubious and at worst may be dangerously misleading. Such a comparison seems, therefore, useless and undesirable until such time

as the parameters of risk are better specified than they can be at present.

On the other hand, as was demonstrated Tuesday before this committee, I believe we can state that there is no controversy with respect to the hazards of use by children and young people. Studies by Dr. Gene Smith, which involve nearly 12,000 junior and senior high school students in the Boston area, indicate that the earlier marihuana use begins, the more likely is use to become heavy use and subsequently to include other illicit drugs.

In addition, although there is still much to be learned about the impact of heavier use on the physical functioning of the child or adolescent, studies indicate that use may cause alterations in endocrine functioning which are more serious than endocrine involvements in older, mature users.

Unfortunately, the hesitancy of the scientific community in not drawing unwarranted definitive conclusions from what are preliminary research findings has led many to conclude that marihuana is without serious medical hazard, even for the very young.

That point of view, I think, was much more prevalent several years ago than it is today.

In reality, the situation is more like that following the popularization of cigarette smoking at the time of World War I. It required 50 years of research for the truly serious implications of cigarette smoking to become apparent.

In view of the rapidly increasing numbers of high school students who use marihuana on a daily basis during the course of the school day, these findings are especially worrisome.

Figures derived from an ongoing study of successive yearly nationwide samples of high school seniors indicate that as of 1978, 1 in 9 smoked marihuana daily—nearly twice as many as in 1957. In two States which have done independent surveys, Maryland and Maine, still more recent figures indicate nearly 1 in 6 high school students use marihuana daily or nearly daily.

I will not go over again the additional figures which are available in the Marihuana and Health Report, and which were reviewed on Tuesday, that indicate it is a continued increase in use in various other populations.

Two days ago, we had the opportunity to hear a diversity of points of view on marihuana and its health consequences. Given the controversy surrounding the use of this drug, it is understandable that there is also a growing demand for certainty about its effects.

But, as the reentry of Skylab last week demonstrated, even in the field of physics, which certainly is more easily attained, exact prediction is sometimes difficult.

When we turn to the biological sciences, certainty is even harder to achieve. The history of medicine is replete with examples of apparent certainty later determined to have been incorrect.

Twenty-five years ago, when I was a medical student, there was no question whatsoever at that point in the top hospitals and medical schools in the country that radical mastectomy was the obvious treatment of choice for the treatment of breast carcinoma.

In subsequent years, that conclusion, about which there was no doubt 25 years ago, has been seriously questioned. And today, we are much

more uncertain as to what is the proper treatment of choice than we were at that time.

If doubt and uncertainty have surrounded a surgical procedure that can be assessed by comparing 5-year survival figures with alternate therapies, and that is a very simple type of comparison to make comparatively, how much more complicated is the assessment of a range of systemic effects which might be related to the use of marihuana.

In this presentation this morning, I have emphasized data drawn primarily from carefully controlled laboratory tests.

However, alternatives to such types of carefully controlled research are also important. Clinical observation is one such important alternative.

It was clinical observation, more than anything else, that originally linked thalidomide with birth defects—an observation later confirmed by research.

However, whatever the strengths of the sometimes brilliant intuitive jump from clinical observation to cause, such observations can be and often are wrong.

Nonetheless, in the real world in which we must all function, we make use of many sources of data. And if we must err, there are good arguments for erring on the side of caution.

What I am suggesting here is we not dismiss out of hand those many clinical reports by individual clinicians who describe significant clinical consequences of a psychological and psychiatric nature in heavy users of marihuana.

In conclusion, while much remains to be learned about the health implications of marihuana, I would like to emphasize that our present evidence clearly indicates that it is not a safe substance.

As a psychiatrist, I would also like to stress that virtually all clinicians working with children and adolescents agree that regular use of marihuana by youngsters is highly undesirable.

Although experimental evidence concerning the implications of use in this group is not easily obtained, there is little serious question that regular use of an intoxicant that blurs reality and encourages a kind of psychological escapism makes growing up more difficult.

While there is controversy over the implications of present research concerning adult use, few would argue that every effort should not be made to actively discourage use by children and adolescents.

At this point, I would be pleased to respond to any questions you may have.

If you prefer, Dr. Snyder could at this point give you a presentation of what some of the current and future plans for marihuana use by NIDA consist of.

[Dr. Pollin's prepared statement appears on p. 148.]

Mr. NEAL. Thank you, Dr. Pollin. If the others of my colleagues agree, I think it would be helpful to hear from Dr. Snyder, then from Dr. Petersen, and then engage in questions. Mr. Beard, would that be satisfactory?

Mr. BEARD. Perfectly satisfactory.

Dr. SNYDER. For the past year, recognizing the increase in use of marihuana and the response to this, we have undertaken a review of our entire program and projected plan for the coming 5 years as to

what funds are necessary to carry out the research program, and what problems would be attacked.

In doing this, we had first decided, during the coming year, we would establish a panel of about 8 to 10 scientists who were expert in the area of marihuana research, both psychological and physiological scientists, and they would meet from four to six times a year with NIDA staff to assess the current research plan and advise what directions the programs should take, and what directions they see as to be of coming importance down the pike.

We also are planning to hold either next summer or winter a comprehensive international symposium on the health effects of marihuana. This would be to assess the current state of science from broad into this narrower perspective.

There are a number of specific areas of research I would like to address. These are contained in the 5-year plan we have submitted to the Department. And basically, I think you will see that these sort of mesh with the points that were raised both on Tuesday and by Dr. Pollin this morning.

First and foremost, one of the primary studies we would like to undertake is a major longitudinal study of the effects of marihuana use.

There are a number of individuals who are currently conducting small-scale studies of marihuana use over time. We would like to and in point of fact last month had about 12 researchers in to NIDA to discuss their programs. We would like to get these researchers to work together, performing a series of psychological and biological examinations of a group of marihuana users over a projected period of time, and to follow these people to see whether any problems turn up in terms of endocrine functioning, school performance, learning, psychosocial development, disease, and so forth.

This would also include looking at any problems that might develop with pulmonary function and cardiovascular abnormalities.

One of the problems that has been developing involves the use of marihuana and alcohol. And we also will be intending to begin a number of research studies looking at the effects of these two drugs taken in combination.

During the current year, we already have a program to look at the effects of marihuana and alcohol and drug performance. This is part of our whole overall program to evaluate the effects of abused drugs on various types of psychomotor variabilities.

We also are going to target research specifically at the areas of complex performance, such as learning and memory, and how this affects the ability of children 15 years old, in high school, and their performance.

In the current year, we have a contract proposal which we will be hoping to let later, during the springtime, to study the effects of marihuana on human female endocrine function. We have received preliminary approval from the Food and Drug Administration which would allow us to administer marihuana to females on a 90-day basis. And we would be able, under controlled conditions, to evaluate the effects of marihuana on female endocrine levels.

We also are planning in the coming year a major study to assess the effects, a continuation of ongoing programs, to assess the effects of

marihuana on lung pathology and particularly, to look at the carcinogenic effects of constituents of marihuana.

In the issue of brain studies, we are planning to issue an invitation for applications to try to obtain some additional interest from major neuroscience centers to utilize some of the more recent techniques which have been developed for the study of brain structure in the infant animal. And this would be issued sometime later this year in hopes to assess more specifically what are both the effects of marihuana on the chemical structure and the physical structure of the animal brain. And hopefully we might be able to relate this to some human effects.

One major part of the upcoming program would also be to develop roadside methods, further develop roadside methods, for the detection of marihuana, since we seem to be finding results indicate that marihuana has a serious effect on driving performance. And if any legislation is to be directed at this problem, we will have to have some program for monitoring marihuana levels in drivers.

Currently, these tests involve laboratory procedures that are not directly applicable to roadside tests, but we think within 1 year or 2, it might be possible to have a similar test for marihuana somewhat akin to the alcohol test, or breath test.

We also are very much interested in the effects of—this is sort of a little bit off the track, but you will get the thrust of these studies—we have been examining the role that PCP plays in producing schizophrenic-like reactions. And we are trying to work together with some mental health centers and mental health people in assessing how many individuals in mental health hospitals are diagnosed as schizophrenics, when really they are suffering an intoxicating response to PCP.

I would envision as part of this effort, we will also be giving another look at the role of marihuana as it relates to schizophrenia.

The other part of our program, two other points we will be looking at, and that was referred to on Tuesday, is the need for policy research such as: What effects have various levels of taxation, legislative authority, regulation, family structure, on marihuana use? And how can we learn enough about policy issues to change patterns of use in a positive fashion?

And lastly, we continue to have a commitment to the development of a marihuana supply program; that is, marihuana as composed of some 300-odd different chemicals, and also as metabolized in the body to many different chemicals. A lot of our program is to synthesize these elements to determine whether any of them have some activity which is of importance to us.

And related to this activity is our continuing look at the use of marihuana for therapeutic purposes. Current research in this area indicates that marihuana may be of some value in the treatment of the nausea which is associated with chemotherapy for certain types of cancer—not all cancers.

Results with the effects of marihuana for use in glaucoma treatments are less clear at the present time. And it seems as though a number of studies are reporting negative results.

Finally, there are a few positive results, therapeutic uses. Currently, there are 31 clinical studies on marihuana use for therapeutic uses,

looking at other things, including treatment of types of spasticity associated with multiple sclerosis, anorexia nervosa, and actually for the treatment of pain in some cases.

Mr. BEARD. Mr. Chairman, just while you are on that subject, just something I was curious about. Here in the statement is using it for medical purposes. You mentioned 391——

Dr. SNYDER. 300-odd.

Mr. BEARD. Don't you think before they really start—300-something different elements in one drug; do you think doctors are going to be very quick to start issuing that out, or start writing prescriptions for it? Or will each element have to be studied to see how it could affect each of the 391 elements that have to be studied?

Dr. SNYDER. Well, in regard to the cancer studies, many of these studies are involved with THC. And we are looking for what it is that is the active ingredient.

Mr. BEARD. It was that element there?

Dr. SNYDER. Some of the others—your point is well taken. One of the problems there will be in delivering marihuana, per se, as a treatment would be that we are not quite sure what the active ingredient for any one of these particular ingredients might be. But that doesn't necessarily address the issue. It could be used, if it is going to be shown to be of no effect. Later research could isolate the active ingredient if it were deemed necessary.

Basically, I think that is my presentation.

Oh, one point I wanted to make was that currently, our research program in fiscal 1979, as Dr. Pollin indicates, $3.8 million for research on marihuana. Our projected budget for fiscal 1980 is approximately $5.2 million.

In order to fully carry out this proposed program over the next 5 years, we estimate that it would require an additional approximately $4 million for each year, if we were to adequately address this problem. Thank you.

Mr. NEAL. Thank you, Dr. Snyder. I think now would be a good time for the panel to rise for a few minutes so members might answer the rollcall vote now in progress. We will return as soon as we can to hear from Dr. Petersen.

[Whereupon, a recess was taken.]

Mr. NEAL. The Select Committee will come to order. Dr. Petersen, we would like to hear from you at this time. And we will put your entire statement in the record if you like, and you may summarize.

Dr. PETERSEN. I don't have a formal statement, because most of it was incorporated into the joint effort of Dr. Pollin's statement. I would like to stress a couple of things.

One of the things we have become aware of, with respect to the "Marihuana and Health Report," is we originally began putting it out some 7 or 8 years ago, and we assumed that each of the succeeding issues would be available to the Congress and to the general public. As a practical reality, that doesn't turn out to be the case.

Some of the areas we did have to study, such as the effects on immediate memory of the acute intoxicated state, although we have reiterated these each time; the public has not been adequately aware of these. So this year, for example, we will have a separate section dealing specifically with the effects of acute intoxication on memory, intel-

lectual performance, psychosocial performance, and so on, so there is an awareness in some depth of what are the immediate effects in the intoxicated state.

I would like to also stress that the whole area of the psychosocial implications of marihuana use is one of considerable concern for possible behavior toxicities of marihuana, insofar as it affects the way youngsters deal with the social realities of their own world; the fact that marihuana use, particularly early use, leads often to dropping out phenomena, to association with other youngsters who are in some sense either delinquent or truant or have other problems of that sort, which may not be directly the influence of the drug as such, but the influence of being a part of a drug-using subculture. So that is an important area of concern.

I think it might be more appropriate at this point to respond to the questions that you may have in a number of areas that were raised in your initial statement, Chairman Neal, about prevention and so on.

Perhaps Dr. Pollin or others of us might appropriately respond to that.

Mr. NEAL. Thank you, Dr. Petersen. I have a number of questions in a number of different areas. I will just arbitrarily start, Dr. Pollin, if I may, with your testimony.

You began and ended your testimony by stating that marihuana is not a safe drug; and of course, I think that is clearly correct. But one of the purposes of these hearings is to try to put all of these questions into some kind of perspective that we can deal with. And I guess I will start by asking you: What is a safe drug?

Dr. POLLIN. What is a safe drug?

Mr. NEAL. Yes. Is aspirin a safe drug? Is alcohol a safe drug? Is caffein a safe drug? Is Valium a safe drug?

Dr. POLLIN. I think the answer to that question, Mr. Neal, is always a relative and a quantitative question. The water which we are both drinking now, if used to excess, can be a very dangerous substance. There is a severe schizophreniform psychosis which is induced in people who, for either psychological or physical reasons, drink hugely excessive amounts of water over a prolonged period of time.

I would say that aspirin, for example, is relatively a very safe drug, based on the percentage of people who use it who encounter any difficulty with it.

And one of the yardsticks, then, is the percentage of users who encounter side effects. A second measure of drug safety, in my view, would be the nature and severity of those side effects.

Mr. NEAL. I understand what you are saying. Maybe you would say that nothing is perfectly safe, and some things probably would be more dangerous than other things.

Dr. POLLIN. Yes.

Mr. NEAL. How would you say, from your experience, is marihuana? I guess you have just said it is not as safe as aspirin. It is safer than alcohol, or less safe than alcohol; safer than Valium, Librium, those drugs, or safer than the barbiturates? How would you respond to that?

Dr. POLLIN. My response is to try very much in one sense to avoid giving you a definitive answer for the reasons that I tried to spell out in the testimony.

If we compare what we know about marihuana with alcohol or with tobacco, we necessarily must come up with a misleading response, given the tremendous difference in the amount of research that has been done, and the length of time that those other substances have been available for study, as compared to that for marihuana.

When we try to compare it with a substance like Valium, we have a different kind of problem. Valium is a single chemical entity. Marihuana, as was pointed out on Tuesday, is composed of some 360 separate chemical entities. At this point we have the beginning of a significant amount of research on one of those components, the psychoactive component, delta-9-THC. The majority of the other components have received very little study.

Mr. NEAL. Excuse me just 1 second. When a person uses marihuana, they use all the components, don't they? Don't they normally smoke marihuana, which is composed of 360 components?

Dr. POLLIN. That's right.

Mr. NEAL. So if you studied the effects on people that use marihuana, then you must study it essentially as one thing, one entity; is that right?

Dr. POLLIN. That's true.

Mr. NEAL. Is that correct?

Dr. POLLIN. Yes.

Mr. NEAL. Well, it is that thing that we are trying to understand something about.

Dr. POLLIN. Having emphasized the caveats, let me now try to give you some indication of the figures we do have available to give some suggestion of its relative problem-causing potential.

In the national drug treatment network, on which we have good data concerning what is the primary drug of abuse, the No. 1 drug that is listed and is the major problem drug for some 45 percent of people entering the national drug treatment network at this point, is heroin. The No. 2 drug that is listed is marihuana. There is no other drug that comes close to those two.

Mr. NEAL. Entering the what? I'm sorry. I missed that.

Dr. POLLIN. Entering the national network of drug treatment centers.

Mr. NEAL. Would people that are having problems with alcohol——

Dr. POLLIN. This does not include people who have problems with alcohol. This would include people who are having problems with psychoactive or addictive substances other than alcohol.

Mr. NEAL. Valium, Librium?

Dr. POLLIN. Yes.

Mr. NEAL. Those drugs?

Dr. POLLIN. Yes.

Mr. NEAL. In your own opinion, how would you relate the safety, which is just one question we are talking about now, with alcohol; the safety of marihuana with the safety of alcohol?

Dr. POLLIN. My personal opinion, and it is opinion—it is not based on hard clinical evidence—is that eventually the two may turn out overall to be comparably dangerous. At this point, we know that the Alcohol Institute estimates that there are some 150,000 to 200,000 excess deaths per year which they attribute to alcohol. We can't make any such statement whatsoever with regard to marihuana.

Mr. NEAL. Then why would it be comparably unsafe?

Dr. POLLIN. Well, we have not done that kind of longitudinal followup study over lengthy periods of time.

Let me illustrate the point I am trying to make by briefly describing the dramatic difference that has taken place in our understanding of what the danger of tobacco is.

When the first Surgeon General's report on the health hazards of smoking was issued some 15 years ago, the hazard that received preeminent emphasis was the problem of lung cancer, which is believed to cause some 70,000 to 80,000 deaths a year. This was after some 45 or 50 years of research on tobacco.

During the 15 years that intervened between the issuance of the first and second Surgeon General's health report on smoking, it became clear that a much larger number of excess premature deaths were due to the effects of tobacco, not in terms of pulmonary carcinoma, but in terms of its contributing to cardiac disease and coronary artery mortality.

And now, the current estimate is that tobacco accounts for some 300,000 to 325,000 excess premature deaths a year.

In other words, three-fourths of that excess mortality was not recognized or emphasized 15 years ago, but was emphasized in the report that was issued some months ago.

Speculating, now, based on the chemical complexity of marihuana, based on what we have heard about the route of, the level of, carcinogenesis of marihuana, based on what we know about its pharmacology, metabolism, and the extent to which it is retained in the body, I think it is quite possible that 15 or 20 years hence, we will recognize that it does have a significant mortality as well as morbidity risk.

On the other hand, I think it must also be emphasized that the other possibility exists, and we may eventually determine that it is closer to the caffein end of the psychoactive spectrum than it is to the nicotine end of the psychoactive spectrum, in terms of its mortality.

Mr. NEAL. Are there mortalities associated with caffein?

Dr. POLLIN. No. I am speaking of caffein as being a very widely-used psychoactive substance which is generally considered to be relatively very safe. And I am saying there is a spectrum of safety which is very wide, indeed——

Mr. NEAL. Between caffein and——

Dr. POLLIN. With caffein at one end and nicotine at the other end. And I am saying that at this point, I don't think it is possible to conclude where eventually it will become clear marihuana should be placed on that spectrum.

Mr. NEAL. But your opinion is it would be closer to caffein than nicotine?

Dr. POLLIN. No. My opinion is——

Mr. NEAL. I'm sorry.

Dr. POLLIN [continuing]. I think eventually, it will be closer to nicotine.

Mr. NEAL. By the way, I have heard you testify two or three times that nicotine has been demonstrated to be a carcinogen. I have read the Surgeon General's report carefully on that subject, and I cannot find anywhere in the Surgeon General's report, or anywhere else, any indi-

cation that nicotine is a carcinogen of any kind. It is just not said anywhere.

There are claims that tobacco smoking can be harmful to the health, but never once is nicotine mentioned.

Dr. POLLIN. You are correct, Mr. Neal. I am using nicotine here as "shorthand" to speak of tobacco.

Mr. NEAL. Let me say it is not a very accurate shorthand, because even tobacco is a very complex compound, also containing, I think, nine other alkaloids alone, other than nicotine, and a whole range of other components that are not studied, either. It is simply not accurate.

Dr. POLLIN. I agree.

Mr. NEAL. May I pursue this comparison? You have also said in your testimony it probably is not helpful to compare marihuana with alcohol because, well, of a range of things. But, then, it often is compared in popular discussion of these issues. You did make several points about marihuana, and I would like to ask you a little bit more about those.

For instance, you have said something about marihuana causing testicular atrophy. Isn't it also true that there are studies indicating that alcohol can have an adverse effect on the testes?

Dr. POLLIN. Yes.

Mr. NEAL. You say that it is not useful to compare marihuana with Valium and alcohol and so on, because we don't have long-term research. It is my understanding that we have only very short-term information about Valium and other anti-psychotic drugs, and yet they are widely prescribed. Is that not true?

Dr. POLLIN. That is true, Mr. Neal.

Mr. NEAL. You mentioned that marihuana is damaging, harmful, when used by adolescents; and I certainly agree. Let me tell you one of the reasons that I sought out this particular assignment in this committee. It is because I have children, one 14 and one 12. And I want to be able to tell them what makes some sense, and hopefully help them through these years, at least until they attain their maturity in some reasonable way.

But I very strongly feel I can best do that if I can tell them the truth, and try to put these things in some perspective.

I don't remember what you said in your testimony, but you certainly wouldn't say to the adolescents that it is safe to use alcohol, to the extent that the users you are talking about are using marihuana.

Dr. POLLIN. No, I wouldn't.

Mr. NEAL. In your opinion, would it be more or less damaging to them to abuse alcohol to the extent that many are abusing marihuana?

Dr. POLLIN. I think with regard to the aspect that we know best, which is the undesirable effects of frequent daily intoxication, I think both of these substances are equally undesirable in terms of heavy or regular use.

Mr. NEAL. That is another interesting point. You are saying acute intoxication impairs memory, learning, and intellectual performance.

Wouldn't acute use of alcohol or Valium or any range of other drugs impair learning, memory, and intellectual performance?

Dr. POLLIN. Yes.

Mr. NEAL. Wouldn't you say marihuana intoxication impairs driving and other skilled performance? Wouldn't alcohol intoxication. Valium intoxication, impair driving and other skilled performance?

Dr. POLLIN. If I somehow implied, or I misspoke in my testimony, to suggest that intoxicant use of other drugs is preferable to intoxicant use of marihuana, I certainly did not intend to do so.

Mr. NEAL. Then, you would treat them all the same—alcohol, Valium, Librium, marihuana, and these other drugs? The intoxication by these various drugs is essentially the same?

Dr. POLLIN. Well, there are some significant differences that have been demonstrated in psychological studies in terms of the kinds of effects they have on which specific psychological functions.

Librium and Valium have not been shown to cause the type of acute panic attack, nor to have some of the hallucinogenic-like properties, that marihuana sometimes has for certain users. But with regard to your general proposition that any type of frequent, regular drug use to the point of intoxication is highly undesirable, particularly among adolescents, I would say that that is clearly true, and that marihuana in that regard is one of a category of drugs—the intoxicant effects of all of them being highly undesirable.

Mr. NEAL. That would be true of adults, too, wouldn't it?

Dr. POLLIN. Yes.

Mr. NEAL. But specifically true of youth?

Dr. POLLIN. Yes. If I might just continue for a moment, Mr. Neal, one of the reasons for the emphasis on that point that I tried to give in my testimony is that I think that there was a period, which it seems to me is now changing, when large segments of our society were convinced that marihuana was a safe drug, and when our children, in particular, felt that there were no undesirable side effects or consequences, and that they had no reason to be concerned about its frequent, about daily, use.

Mr. BEARD. One of the reasons why you placed emphasis on it, if I may interrupt, is because this is a special task force on marihuana, and so, therefore, that is where the emphasis is to be placed.

Dr. POLLIN. The other reason.

Mr. NEAL. I want to say I don't have any quarrel with the placing of emphasis. I am just trying for my own understanding, I say to my colleagues, to try to put this into some perspective, and that is the purpose of this line of questioning.

Dr. POLLIN. The other reason why I think that point deserves particular emphasis is I think that one of the few most hopeful changes that has taken place with regard to marihuana during the past 5 or 10 years is the emergence, during the past year, of the kind of agreement which we saw here Tuesday morning with people from widely divergent points of view, in terms of the prior stance on marihuana, all agreeing on the public record that its frequent daily use, or heavy use, by adolescents is highly undesirable.

And I think that to try to get the widest spectrum of agreement by figures who represent these divergent points of view as to the dangers of such use, and then to make that information as broadly and widely known as possible to our young people, to the educators of the country, to the school system, is a doable, and important, and would be an effective. function.

Mr. NEAL. That certainly seems advisable to me, too. My own opinion, for whatever it is worth, is that it seems important that we be very careful that we are disseminating accurate information, in a perspective that will be understood and believed. It is my observation

that in the past, when the Federal Government and others in positions of authority have disseminated information that was clearly not true, the young people clearly have not believed it, knowing it to be untrue. And during this period, the use of, and abuse of, drugs has increased dramatically.

So that is my point. It does seem to me to be important that we put this in perspective and tell people the truth. That is what we are trying to get at through this series of hearings; what the truth is.

And that, in fact, leads to another question. I have probably used too much time, but I would like to ask one more question; and that has to do with these eight points that were agreed upon in Tuesday's hearings. I believe you were here, Dr. Pollin, and heard the discussion of the points. I am just wondering if the three of you would find yourselves in essential agreement with these eight points.

Dr. POLLIN. Yes, I would, Mr. Neal. I would in certain instances want to modify somewhat or change emphasis in some of the wording. For example, point No. 6, when it speaks of "preschizophrenic and schizophrenic people may develop or exacerbate a psychotic break in connection with the effects of THC," I would broaden that a bit to say that there are a variety of types of severe psychotic pathology, so that any type of relative unstable personality structure, really, a neurotic personality structure, is, I think, at risk, and a greater risk to the effects of THC. But essentially I would agree.

Mr. NEAL. Well, thank you. We had some little discussion here with the committee staff after the hearing, and I think we all agreed that these points could be refined to be a little bit more precise in a number of areas.

For instance, point No. 1, concerning pregnant women: I think we ought to put that in some kind of perspective, try to determine, maybe through future research, or analysis, or what data we already have, what the dangers are.

Someone made the point that some pregnant women, who had been using the drug, might read that and use the information as a basis for deciding to have an abortion. A newspaper report was quoted, indicating that in a similar circumstance a person had sought an abortion because they were afraid the damage was so serious they should not go through with childbirth. And staff tells me that probably is not a good course of action.

But what we are trying to find here is good, responsible agreement, so that at some point we might try to factor that into whatever policy recommendations this task force, or the committee, may come up with. So we would certainly welcome your thoughts on the refinement, or even addition to, these points as a place to begin, anyway.

Thank you. My time has expired. Mr. Beard?

Mr. BEARD. Thank you, Mr. Chairman. First of all, let me say that I am somewhat pleased with the statement made today. I think this is a step in the right direction, as to pointing out some of the real concerns, the medical concerns.

And I might say I was pleased, and felt that it was one of the better statements that I have heard come out of your Department. I do commend you on it, and I know that you must find that refreshing after a couple of our other exchanges.

But now, let me also ask, and I have to clear it up for my own understanding, and I am sure there is an explanation to it, but you heard the

exchange we had by Dr. Zinberg the other day. He is employed by NIDA as a consultant; is that correct?

Dr. POLLIN. He is a member of the National Advisory Council, which is a special body, a special group of advisors. There is that type of National Advisory Council.

Mr. BEARD. How many people are on this group?

Dr. POLLIN. Of institutes? I believe there are 12.

Mr. BEARD. I would like to see a list of those 12, if I may.

Dr. POLLIN. We would be glad to provide it.

Mr. BEARD. He was appointed by this administration?

Dr. POLLIN. Yes, he was.

Mr. BEARD. Did you understand the line of questioning or concern, at all, regarding what Mr. Evans was trying to point out about the conflict of interest or whatever, his being on the advisory board of NORML and also consulting to an Agency that tries to discourage the use of any form of drugs?

Do you think that is a legitimate concern at all? NORML, with their support from High Times, which I find to be one of the most revolting drug-pushing magazines of all types going; do you think that is a point of concern?

Dr. POLLIN. I think it is a very understandable and legitimate question. I do think that it is useful that all shades of the spectrum, points of view, be represented.

Dr. BEARD. I think you can still have a shade of perspective. I just don't think it is compatible for him to be a member of the NORML board of advisors and be a paid consultant by an agency who discourages the use of drugs. And so I am saying there are people out there that maybe feel the same way, but they are not participating with a group that receives their largest contribution from High Times, and literally are pushing and encouraging the use of drugs.

I think the two are totally incompatible. And there are plenty of people who can believe in decriminalization, private use, and plenty of use. But I would hope you would look at that and maybe consider some action along that line, because I just don't think our taxpayers' dollars should go to one who is on both.

I would like to also ask, in your statement, you did put some qualifications on it: This Jamaican report. Dr. Zinberg mentioned it. I think it was done in 1972. And Dr. Snyder, I don't know; are you familiar with it?

Dr. SNYDER. I think Dr. Peterson is more experienced than I am.

Mr. BEARD. The Jamaican report was contracted out by NIDA; is that correct?

Dr. PETERSON. Actually, I think it was under the predecessor program in the National Institute of Mental Health, where, at that time, drug abuse research was located.

Mr. BEARD. Do you know how much we paid for that?

Dr. PETERSON. I can't tell you exactly. Probably on the order of as much as $200,000. The cost of the Jamaican study was $158.105.

Mr. BEARD. I have heard some furious reservations regarding the study; yet I hear it used as kind of a very substantial study. And whenever I get on my little "horse" and start riding around and reactionary screaming and hollering, they will always refer to the Jamaica report, saying that it failed to find evidence of psychological impairment.

Dr. PETERSON. Actually, that report, I think, is largely misused in a variety of ways. And I think people do many things. They choose what they wish to choose, whether it is for the "Marihuana and Health Report" or the Jamaican study, to suit their purposes.

We have been at pains to point out the limitations of that initial study. For example, we pointed out we studied 30 users, matched with 30 nonusers, carefully matched, to be sure.

But we have also pointed out those kinds of numbers would not detect rarer, less common effects of marihuana, as would be true of a study of alcohol or cigarette smoking using similarly sized samples.

We have also pointed out that the study was by no means intended to be adequate from the standpoint of chromosome integrity, which has been cited. There were a number of deficiencies which we were at pains to point out.

I think the difference is partly people took what is essentially a first preliminary study, and overinterpreted the findings in a way that is inappropriate.

We have gone on record as indicating that the level of use may not have been as high, in terms of the ability of the material that actually got into the body, as we thought it was. Differences in drug inhalation patterns can be important.

We have also pointed out, for example, some of the psychological testing. This was a lower-class, relatively low education group of primarily agricultural laborers, fishermen, people of that sort; and that making comparison in that group, the level of overall performance of both groups, may have been too low to detect an effect.

So what I am saying is, it seems to me people who are, in some sense, marihuana, if you will, "advocates" have overinterpreted that study, even though we have been at pains in each of the subsequent marihuana and health reports, to qualify very carefully what the limitations are.

And that is true of several other studies that were done. They are all studies that—any one does have certain limitations. The Jamaican study was carefully done within those limitations.

For example, I have heard it said it showed no pulmonary effects. That was said, I guess, on Tuesday. In point of fact, we did find pulmonary effects that were more related to smoking per se, smoking as such, as opposed to marihuana smoking.

The Jamaican study was not a definitive study, because no study of 30 users compared to 30 nonusers, can under any circumstances be intelligently interpreted as a definitive indication of all the chronic effects of cannabis.

Mr. BEARD. I think you pointed out some of my concerns very nicely, and I think you summed it up by saying it has been misused, which has been my main concern, because leading clinicians and psychiatrists in Jamaica have challenged the report when misused to say it was a report that was headed by 2 anthropologists. They questioned the thrust of it as to the real meaning, the sampling, the different mores.

Dr. PETERSEN. That is somewhat misleading, in the sense we had the cooperation of the University of the West Indies, and a highly regarded group of medical staff. The two anthropologists involved simply were the managers of the project. They simply had some role in carrying it out. But the medical examinations were done by highly

qualified medical staff of the medical school of the University of the West Indies. So that is not quite accurate.

I think the limitations of certain sorts are real in terms of what we did measure and what we did not. We did not, for example, measure blood levels of cannabinoids, because the techniques for doing so were unavailable at that time, which is an important consideration for future research and so on.

But the quality of the medical examinations, insofar as they could be done, were quite adequate. I don't think it is fair to say those are not exactly——

Mr. BEARD. Are you aware of a paper entitled, "Role of Cannabis in Psychiatric Disturbances in Jamaica," written by Dr. Frank Knight, chief of the department of psychiatry at the University of the West Indies, and published in 1976 in the annals of the New York Academy of Science?

Dr. Knight spoke of the very high rate of cannabis-using males admitted to mental hospitals in Jamaica and expressed a definite marihuana psychosis.

Dr. PETERSEN. There is one obvious limitation of any study of that sort. The numbers of people admitted to hospitals in the United States with alcohol psychosis is also quite high. That may or may not indicate what is the typical consequence of alcohol use.

In the Jamaican study, we attempted to study representative users. I am not necessarily saying some users of cannabis, as is true of users of alcohol and other drugs, may not become psychotic. The real question is: Does the typical user, under those circumstances, show that kind of pathology?

And again, the evidence at least from the Jamaican study and two other countries that were done in two other overseas locations were not confirmative. That does not mean that some users may not show psychoses or may not be overrepresented in the psychotic population, even as alcohol users certainly are overrepresented in a psychotic population.

Mr. BEARD. Dr. Pollin, did you agree with Dr. Zinberg's statement or finding regarding the educational need, cessation of educational material or programs for the use of marihuana; that it just probably would be ineffective, and we are past that stage?

I am somewhat paraphrasing what he said, but he just pretty well said that that would really not do much good. As a matter of fact, it would probably do more harm than good.

Dr. POLLIN. Rather than try to recall and respond to Dr. Zinberg's comments, let me tell you what my present feeling is to what makes sense at this point and something of what we are attempting to do along those lines.

I feel that it is proper, feasible, and very important that we develop those kinds of materials that will not be subject to the deficiencies that Mr. Neal pointed out may have, indeed, diminished the value of some of the materials that were used 8 and 10 years ago.

But I do feel that the pendulum has swung too far in the direction of overconcern. I do think that parents, schools, PTA's, do need a succinct, cautious, but strong statement of what we know at the present time, and do need encouragement in attempting to take a more active role in discouraging drug use by adolescents.

We have been actively seeking those kinds of materials which we think would represent that proper blend of caution and fact. We have identified certain programs which seem to achieve that mix, and that effectiveness. And where we find them, we are attempting to achieve widespread distribution of that material.

Mr. NEAL. Mr. Gilman?

Mr. GILMAN. Thank you, Mr. Chairman.

Dr. Pollin, I note that there is a task force that advises with regard to research in marihuana. What is that task force called?

Dr. POLLIN. I am not sure, Mr. Gilman. If you are referring to the——

Mr. GILMAN. Who advises your Department with regard to research for marihuana? Do you have an advisory council or task force council? In your report, your 1977 report, it says, "Report from a Task Force of Non-Government Experts in Marihuana Research." Is this something that is institutionalized?

Dr. POLLIN. We have had a number of ad hoc task forces.

Mr. GILMAN. Is there such a task force now?

Dr. POLLIN. The task force that most recently reviewed our marihuana research is no longer active.

Mr. GILMAN. Who decides policy, then, where you are going on marihuana research?

Dr. POLLIN. It is decided by the professional staff at the National Institute on Drug Abuse. There is currently being formed a departmental initiative which will involve the National Institutes of Health to review the whole body of how——

Mr. GILMAN. That hasn't been formed yet, has it?

Dr. POLLIN. It is in the process of formation now, Mr. Gilman.

Mr. GILMAN. At the moment, do you have any advisory group that advises the directions for marihuana research?

Dr. POLLIN. Well, we have——

Mr. GILMAN. That is not departmental.

Dr. POLLIN. We have a number of groups with whom we consult. And in addition, there is a committee——

Mr. GILMAN. Dr. Pollin, forgive me for interrupting. Our time is very limited, and I would like to get to the point. Who helps to make policy on where you are going on research on marihuana in your Department? Who determines that policy? Who advises on that policy? Who are the policymakers?

Dr. POLLIN. The scientific staff at NIDA in consultation with our advisory council, and in consultation with a variety of ad hoc groups.

And specifically at this point, for example, Mr. Gilman, there is a committee at the National Academy of Sciences, a committee on the addictive behaviors, which has reviewed marihuana policy and various policy options, and which is also advising.

Mr. GILMAN. Dr. Pollin, I am going to ask you if you will provide this committee with a list of any of the ad hoc groups and those advisers within your group who make those decisions. And Mr. Chairman, with your permission, I would like to make that a part of the record at this point in the record.

Mr. NEAL. Without objection.

[The information referred to follows:]

TASK FORCES WHICH ADVISE NIDA ON MARIHUANA PROGRAM

1. Task Force on Studies on Effects of Marihuana (composed of non-Government scientists).
2. Work Group on Marihuana Research (composed of non-Government Scientists).
3. National Advisory Council on Drug Abuse (composed of non-Government personnel).
4. Drug Abuse Research Review Committee (composed of non-Government scientists).
5. Interagency Committee on New Therapies for Pain and Discomfort (composed of Government scientists and practitioners).

PERSONS WHO HAVE ADVISED US ON MARIHUANA

I. TASK FORCE ON STUDIES OF EFFECTS OF MARIHUANA

Gene Smith, Ph. D., Harvard Medical School.
William H. McGlothlin, Ph. D., U.C.L.A.
Reese T. Jones, M.D., U. Calif.-San Francisco.
Denise B. Kandel, Ph. D., Columbia U.
Peter M. Bentler, Ph. D., U.C.L.A.
Lloyd D. Johnston, Ph. D., U. Michigan.
Jerome Jaffe, Ph. D., N.Y. State Psychiatric Institute.
Jack Mendelson, M.D., Harvard Medical School.
Ira Cisin, Ph. D., George Washington U.
William Cochran, Ph. D., Harvard U.
Marvin Dunnette, Ph. D., Personnel Decisions Research Institute.
Norman Garmezy, Ph. D., U. Minnesota.
Eric Kandel, Ph. D., Columbia U. School of Medicine.
Glen Mellinger, Ph. D., Institute for Research in Social Behavior.

II. WORK GROUP ON MARIHUANA RESEARCH

Gene Smith, Ph. D., Harvard Medical School.
Denise Kandel, Ph. D., Columbia U.
Lloyd Johnston, Ph. D., U. Michigan
Howard Kaplan, Ph. D., Baylor Medical School.
Herbert Hendin, M.D., Center for Policy Research.
Reese Jones, M.D., U. Calif.-San Francisco.
Marvin Dunnette, Ph. D., Personnel Decisions Research Institute.
Sidney Cohen, M.D., U.C.L.A.
Peter Bentler, Ph. D., U.C.L.A.

III. NATIONAL ADVISORY COUNCIL ON DRUG ABUSE

Chairperson

William Pollin, M.D., Director, National Institute on Drug Abuse.

Acting Executive Secretary

Pamela Jo Thurber, Special Assistant to the Deputy Director, NIDA.

Membership

Richard J. Bonnie, LL.D. (1980)[1], professor of law, University of Virginia Law School.

William M. Harvey, Ph. D. (1980), Director, Narcotics Service Council of St. Louis.

Herbert D. Kleber, M.D. (1979), professor of clinical psychiatry, Yale University, and Director, Substance Abuse Treatment Unit, Connecticut Mental Health Center.

Morris A. Lipton, M.D. (1982), Kenan Professor of Psychiatry, and Director, Biological Sciences Research Center of the Child Development Research Institute, University of North Carolina.

M. Ellen Moffett, M.A. (1982), Executive Director, Gaudenzia, Inc.

[1] Date of expiration of term.

Lee N. Robins, Ph. D. (1981), professor of sociology in psychiatry, Washington University School of Medicine.

John F. Russell, M.D. (1980), Associate Chief, Alcohol and Drug Dependence Division, Mental Health and Behavioral Science Service, Department of Medicine and Surgery, Veterans Administration.

Mercedes A. Scopetta, Ph. D. (1982), assistant professor, Division of Addiction Sciences, Department of Psychiatry, University of Miami.

Hon. Carlos E. Velarde (1979), Superior Court Judge, California.

Norman F. Zinberg, M.D. (1981), professor of psychiatry, Department of Psychiatry, The Cambridge Hospital.

Ex-officio members

James C. Crutcher, M.D., Chief Medical Director, Department of Medicine and Surgery, Veterans Administration.

(Vacant), Assistant Secretary of Defense for Health Affairs, Department of Defense.

National Advisory Council on Alcohol Abuse and Alcoholism liaison member

Rev. Philip Hansen.

National Advisory Mental Health Council liaison member

Cecil L. Wittson, M.D.

Ex-officio alternate members

Stewart Baker, M.D., Chief, Alcohol and Drug Dependence Division, Mental Health and Behavioral Science Service, Department of Medicine and Surgery, Veterans Administration.

Brig. Gen. John H. Johns, Special Assistant for Drug Abuse to the Assistant Secretary of Defense, Department of Defense.

IV. DRUG ABUSE RESEARCH REVIEW COMMITTEE

Chairperson

Smith, Gene M. (1979), psychologist, the Price-Lindemann Mental Health Center.

Executive Secretary

Morrison, J. Michael, pharmacologist, Biomedical Branch, Division of Research, National Institute on Drug Abuse, Alcohol, Drug Abuse and Mental Health Administration.

Members

Ball, John C. (1979), professor of psychiatry, Department of Psychiatry, Temple University Medical Center.

Finkle, Brian S. (1979), Director, Center for Human Toxicology, University of Utah.

Hollister, Leo E. (1979), medical investigator, Veterans Administration Hospital.

Mellinger, Glen D. (1979), Associate Director, Institute for Research in Social Behavior.

Shuster, Louis (1979), professor of biochemistry and pharmacology, Tufts University School of Medicine.

Erody, Theodore M. (1980), professor and chairman, Department of Pharmacology, Michigan State University.

Frosch, William (1980), vice chairman, Department of Psychiatry, Cornell University Medical College.

Ling, Walter (1980), Chief, Drug Dependence Treatment Center, Veterans Administration Hospital.

Cobri, Daniel (1979), professor and director of toxicology laboratory, College of Medicine, Ohio State University.

Groves, Philip M. (1979), professor of biological psychology, Department of Psychology, University of Colorado.

Jones, Reese T. (1979), professor of psychiatry, Langley Porter Neuropsychiatric Institute, University of California.

O'Brien, Charles P. (1979), associate professor of psychiatry, Department of Psychiatry, University of Pennsylvania.

Sparber, Sheldon E. (1979), associate professor of pharmacology, Department of Pharmacology, University of Minnesota.
Byck, Robert (1980), associate professor, Department of Pharmacology, Yale University School of Medicine.
Glick, Stanley D. (1980), professor of pharmacology, Department of Pharmacology, Mount Sinai School of Medicine.
Maddux, James F. (1980), professor of psychiatry, The University of Texas Health Science Center at San Antonio.
Nelson, Wendel L. (1980), Professor, School of Pharmacy BG-20, University of Washington.
Stitzer, Maxine L. (1980), medical research associate, Baltimore City Hospital.
Comitas, Lambros (1981), professor of anthropology, Teachers College, Columbia University.
Mayer, David J. (1981), associate professor of physiology, Medical College of Virginia.
Simon, Eric J. (1980), professor of experimental medicine, Department of Medicine, New York University Medical Center.
Wilkinson, Grant R. (1980), associate professor of pharmacology, Department of Pharmacology, School of Medicine, Vanderbilt University.
Lewis, David C. (1981), associate professor of medicine, Brown University.
Wise, Roy A. (1981), Co-Director, Center for Research on Drug Dependence, Department of Psychology, Concordia University.

V. INTERAGENCY COMMITTEE ON NEW THERAPIES FOR PAIN AND DISCOMFORT

I. *NIH:* Dr. Robert Butler, Director, NIA; Dr. Vincent DeVita; Dr. Ronald Dubner; Dr. Diane Fink; Dr. Douglas Gaasterland; Dr. Murray Goldstein; Dr. Richard Greulich; Dr. Seymour Perry, Chairman; Dr. Arthur Upton; Ms. Janet Lunceford; Dr. Jane Henney; Mr. Lawrence Burke; Dr. Donald Paster; and Dr. Emily Black.
II. *NIDA:* Dr. Larry Ng; Dr. Marvin Snyder; and Dr. Robert Willette.
III. *FDA:* Dr. Ronald Kartzinel; Dr. Stuart Nightingale; Dr. John Scigliano; and Dr. Edward Tocus.
IV. *NIMH:* Dr. William Bunney.
V. *DEA:* Mr. Kenneth Durrin, and Ms. Judith Lawrence.
VI. *OASH:* Dr. Faye Abdellah.
VII. *Health Resources Administration:* Dr. Ken Moritsugu.
VIII. *White House:* Mr. Robert Angarola.
IX. *VA:* Dr. Marguerite Hayes.
X. *Department of Defense:* Capt. Peter A. Flynn.
XI. *OS:* Mr. Joel Mangel.
XII. *HCFA:* Mrs. Bernice Harper.

Mr. GILMAN. Dr. Pollin, hearing your panelists and listening to your people and the panelists the other day, you are all in agreement much more research needs to be done in this area; isn't that correct?

Dr. POLLIN. Yes, Mr. Gilman.

Mr. GILMAN. There are certain dangers we have found in marihuana use among young people, adolescents, and possibly among the adults; isn't that correct?

Dr. POLLIN. Yes, Mr. Gilman.

Mr. GILMAN. We have found there is a growing usage in this country of marihuana; a critically growing usage; is that right? Are we all in agreement?

Dr. POLLIN. That is correct.

Mr. GILMAN. Tell me why we maintain such a plateau of funding: For 1976, $3.7 million. We go down to $3.6 million in 1977, $3.7 million in 1978. If there is such a critical problem, such an important problem, why aren't we asking for more funds and doing more research to get to what we are talking about?

You are now talking about a 5-year plan for a comprehensive study. What has taken so long to do the research that is needed and provide us with the answers that we are seeking? We continually say there isn't enough data out there to pinpoint the problems.

You missed a report in 1979 that was prepared in 1977; and I don't know why the timelag. Maybe you can explain why you sat on a report for 2 years.

We are now dealing with information that is 2 years old in a growing problem. Last year the seizures were 1 million pounds of marihuana. This year, it is 6 million pounds. And that is only the tip of the iceberg to indicate what is going on in our Nation. And we are without adequate information, adequate research.

Can you tell us why we are without that adequate information and research that is so needed at this time?

Dr. POLLIN. Yes. I think that your definition of "adequate," Mr. Gilman, is something that we have under discussion.

Mr. GILMAN. All the panelists agreed yesterday that we just don't have the information we need. We need much more research and much more critical data. And I think you indicated in your report——

Dr. POLLIN. Yes. We certainly need more research. As Dr. Snyder summarized, we have requested additional funds.

Mr. GILMAN. You didn't make the request for additional funds. You are maintaining the same plateau of research. And that is what I am criticizing. Your funds are at $3.6 to $3.7 million for 1976, 1977, 1978, and into the 1979 period.

If there is such an important need, why aren't you asking for more funds for research?

Dr. POLLIN. Mr. Gilman, actually, there was a decrease in the amount of funds spent for marihuana research if one goes back 1 or 2 years before the years that you quoted. The reason for the change in funding in marihuana is multiple.

First, for 3 years, we had a flat research budget during a period of time when we were mandated to undertake a whole set of new research initiatives, properly mandated to do so.

It was during that period of time, for example, that there was an explosion of use and concern about PCP. And within a flat budget, we had to find funds to undertake a set of initiatives, research initiatives, in new areas.

Mr. GILMAN. Apparently, you have set a lower priority for marihuana research; is that what you are telling us?

Dr. POLLIN. No. I am saying——

Mr. GILMAN. How much did you request for marihuana research in the current budget? In 1978 it was $3.7 million.

Dr. POLLIN. We requested $3.9 for the current year, and roughly $5.5 for the coming year.

Mr. GILMAN. $5.5 million for 1980?

Dr. POLLIN. That's right.

Mr. GILMAN. I think again you were telling us how important it is to educate our young people with regard to the dangers of continual smoking of marihuana; isn't that correct?

I have before me a May 31, 1979, letter by Mr. Califano addressed to, "Dear School Administrators." Are you familiar with that letter?

Dr. POLLIN. Is that the one that refers to discouraging use of——

Mr. GILMAN. It says, "The Department of Health, Education, and Welfare has designated 1979 as the year of prevention." And it goes on to tell that you have already contributed one part of this effort in reducing cigarette smoking, and you talk about cigarette smoking through half of the letter, and then say:

"I am seeking your help in fighting alcohol and alcohol abuse," but not one word in here about drug abuse. And this is a May 31, 1979, letter to go out to all of the school administrators.

If drug abuse is so important, why haven't you included that in your message to school administrators? You are making it seem like alcohol and tobacco are the only problems they are confronted with.

Dr. POLLIN. I think, Mr. Gilman, there is no intent to diminish the importance of drug abuse. The Secretary has attempted to stage sequentially the topics that he has focused on. A year ago, he focused on the health consequences of smoking. This year, his focus has been on the health consequences of alcoholism.

Mr. GILMAN. When are we going to focus on drug abuse?

Dr. POLLIN. He certainly has indicated his concern and great interest in——

Mr. GILMAN. But this is what we are talking about at this hearing. There isn't enough dissemination of the dangers of marihuana smoking, of drug abuse, of all of the other problems with regard to narcotics. And your Department isn't disseminating that information.

Dr. POLLIN. I would agree that more information optimally could and should be distributed. And as I tried to indicate, we are very actively seeking to find those materials which imperfectly have been shown to be effective, so that that kind of large distribution campaign could be mounted.

Mr. GILMAN. When do you think we will mount that type of a campaign?

Dr. POLLIN. We are presently working on two major projects—one involving a book for parents and teachers; one in collaboration with DEA and the White House office involving a film for parents. We expect both of these to be available this fall.

Mr. GILMAN. I assume, Dr. Pollin, you do place important emphasis on drug abuse, and the dangers of drug abuse, among young people, do you not?

Dr. POLLIN. Very high emphasis.

Mr. GILMAN. And I assume your Department places that kind of a stress.

Dr. POLLIN. I think so.

Mr. GILMAN. Then I would hope you would address yourself to Mr. Califano, as long as he is around, in arguing——

Mr. NEAL. He is not.

Mr. BEARD. He is to be replaced by Ms. Harris.

Mr. GILMAN. I would hope the new Secretary would be urged to get out a prompt letter.

The last paragraph of this letter says:

> Cigarette smoking and alcohol abuse are two of the leading causes of injury, illness and death in our society—and of skyrocketing health costs. If we can reduce both among our young people, we will greatly increase their prospects for long, healthy, and productive lives.

I agree with that. But where is any warning of the dangers of drug abuse in here? You are making a major proposal to all of the school administrators throughout our Nation, and not one word on drug abuse.

I think the Department is highly remiss when they put out material like that and don't talk about drug abuse and the need to do something about it.

Dr. POLLIN. Mr. Gilman, the Department has accepted the notion that we should focus on the addictive disorders as a group of disorders. It is our hope that following a meeting of all departmental programs which have any involvement with drug programs, which is scheduled for later this summer, that the Department will be in a position to issue a more accurate statement along those same lines.

Mr. GILMAN. Can you tell us why there has been such a delay in disseminating a 1977 report that came out in 1979 like it was the current report? It was 2 years old. Why did you sit on it that long?

Dr. POLLIN. First, it is a report that deals with research that was completed through the 1977. So it was indeed delayed, but not delayed for 2 years. We all regret the complexities of the clearance process.

Mr. GILMAN. It was delivered to the Congress in April of 1979, was it not?

Dr. POLLIN. Yes, it was.

Mr. GILMAN. It is entitled, "Seventh Annual Report to the U.S. Congress from the Secretary of Health, Education, and Welfare, 1977," and delivered 2 years later to the Congress; is that correct? If I am wrong, Dr. Petersen——

Dr. PETERSEN. I think that is somewhat misleading. Let me make my point.

In the first place, we have always labeled these reports conservatively in the sense the year current is the year through 1977, in other words, through the end of 1977, beginning of 1978. That is one point.

Second, since we have available to us from the researchers who we contact directly preliminary reports, so that just about everything contained in here is surprisingly up to date, there have been very few developments since. There have not been a large number.

In other words, the kinds of research that are reported are very much in the vanguard.

Mr. GILMAN. Your statistics only go up through 1977.

Dr. PETERSEN. That is because there hasn't been a 1978 survey; and it is only every 2 years, so we don't have a 1979 survey until the beginning of 1980.

In other words, the national survey is done every 2 years, which means that it will not be until late 1979 that a national household survey of use will have been done. That is one of the reasons. In our testimony, we submitted it with some additional epidemiological information.

Mr. GILMAN. What I am asking is: Why does it take so long to submit this kind of data and material to the Congress once it is completed? We completed it in 1977.

Dr. PETERSEN. That's not correct. We completed it in 1978, covering the year before, and it was then submitted and took some time for clearance, that is true.

I cannot offer an explanation of why the clearance takes as long as it does.

Mr. GILMAN. I would hope your Department, the Institute, would place a greater emphasis on the priority for disseminating information on drug abuse, or doing a more comprehensive research program on marihuana. We have been talking now for some 5 to 6 years of the need for a comprehensive national study. And now, I hear talk that maybe there is a 5-year plan "out there," and maybe you are getting a task force together to do that sort of thing.

I can't understand why we delay on such an important, critical problem.

Dr. POLLIN. Mr. Gilman, I have to disagree with you when you reach the judgment we have delayed. The great program of research which has yielded the conclusions that were presented to this committee Tuesday and today, some 90 percent of that research has been funded by the Federal Government. Over 70 percent of it has been funded by NIDA. This is an area of research which didn't exist, essentially, 10 years ago.

Mr. GILMAN. But at the rate we are going, it will take us another 10 or 15 years to complete the kind of work that should be completed within a year or two.

Dr. POLLIN. But answers to the kinds of questions which we would like to get, Mr. Gilman, we would all hope that they would be available in a year or two.

Mr. GILMAN. If we don't spend the funds to do it, we will never get the answers.

Dr. POLLIN. That is certainly true, but we can't get the definitive kinds of answers we would hope to get within a year or two. We have to accept the fact that many of the most important questions won't be answered, no matter what funds are made available, for 5 or 10 years.

Mr. GILMAN. I would hope you would try to accelerate the pace. I think the snail's pace we have been going is certainly a disservice to the young people in our Nation. Thank you, Mr. Chairman.

Mr. NEAL. Thank you. Dr. Pollin, I would like to pursue the line of questioning about the research.

As I understand it, you have a total research budget of $3.8 million.

Dr. POLLIN. For marihuana.

Mr. NEAL. For marihuana?

Dr. POLLIN. That's right.

Mr. NEAL. And how is that research money divided? In other words, as I understand it, you think in terms of two basic kinds of research—biomedical research and psychosocial research. How do you divide your budget between those two areas of research?

Dr. POLLIN. The bulk of the money spent for research, as well as in other areas, is money that is spent on research grants. And though we have general programmatic goals, these investigator-initiated research grants go through the same type of peer review system that is used at NIH, and which grants will be approved or disapproved, the relative priority score, is determined by that peer review system.

So that it isn't a case of deciding a year ahead of time that a precise percentage of those funds will go to psychiatric research, the biomedical research, and the like. The breakdown is between those two gross areas, or for more specific individual programmatic areas.

It is highly influenced by the quantity and quality of the research proposals which are submitted from the research community throughout the country. We attempt to influence and to some extent, to shape those submissions, by publicizing those areas which we feel to be of high research priority. We do this by a variety of announcements which are distributed to the scientific field in general.

We have targeted grant announcements when we feel that there are some areas that are sadly lacking. And a certain significant part of the research is done by contract. When we find that we do not obtain acceptable proposals in areas that we feel to be essential, we will then let a competitive research contract.

Mr. NEAL. There is no priority set in advance? You just sort of wait until private researchers come in and say what they think you ought to look at?

Dr. POLLIN. No. Each year, we do set up a program of priority areas and priority projects, somewhat along the lines that Dr. Snyder indicated.

Mr. NEAL. Excuse me. Do you divide your priorities between biomedical and psychosocial research?

Dr. POLLIN. No. We don't prioritize in those ways. We would indicate in each of those areas what we think are the most important studies.

Mr. NEAL. Excuse me. Let my try to tell you what I am getting at. I don't understand why people use and abuse a whole range of drugs, marihuana most particularly, since that is the subject of these hearings. Do you?

Dr. POLLIN. I don't think we have the basic answers to those questions. We have some important leads and clues.

Mr. NEAL. It is my understanding that the area of phychosocial research is into this type of question; is that correct? My understanding of what you mean by "psychosocial research"; is that correct?

Dr. POLLIN. Yes. Much of the research, but not all of the research, that attempts to get at the question of the etiology of the behavior is done in psychosocial research. However, it should be pointed out that there are important biological studies which are also looking at the same question.

Mr. NEAL. Well, who makes the ultimate decision, again, now, on how the research money is spent? Do you know?

Dr. POLLIN. No. There is a sum of dollars that is appropriated by Congress——

Mr. NEAL. $3.9 million.

Dr. POLLIN. For research. Now, the appropriation is a global appropriation for the total research efforts of the Institute, which span a very wide area of research into multiple types of drugs and drug-related problems.

Mr. NEAL. I thought you said you had $3.8 million, or $3.9 million, for research for marihuana.

Dr. SNYDER. I wonder if I could comment on that just a moment? Basically, that means this year we are projecting we will spend $3.8 million on marihuana research. Next year, it isn't that we have a

budget allocation specifically for $5.5 million, but our projections are based on what we intend to do in the research program for the coming year. We expect to spend $5.5 million in fiscal 1980.

Mr. NEAL. How do you think you will spend that? How will that money be divided?

Dr. SNYDER. Basically, I have some documents here on the current year in terms of, as Dr. Pollin mentioned, two basic types of mechanisms. One is grants; one is contracts. This year, under the contract mechanism, we are funding $930,000 worth of research. The remainder is being funded through grants—in marihuana; I'm sorry.

For instance, in February 1978, in an attempt to get more researchers interested in the area of longitudinal studies of marihuana, we issued an announcement to get people into this research area. Unfortunately, I think we only received one application that specifically went through the peer review process that we could support. So it is not just a question of providing funds.

There is a limited number of researchers out there, and researchers have to be trained, and they have to be interested in the problem and interested in being willing to perform some of these research projects.

It is somewhat difficult to get a researcher interested in longitudinal studies, because it requires a long-term commitment on their part, and at the same time, the Government, because of the funding mechanism, does not provide for long-term support of those studies.

Mr. NEAL. My basic question is this: It seems to me this panel has agreed with the panel on Tuesday, on a sort of basic understanding of the problem. There has been a good deal of research in the biomedical area indicating some health problems with marihuana.

Now, it could be argued that not enough people know about those findings. But if we compare the experience with other substances of wide use in our society—tobacco, alcohol, Valium, a whole range of other things—it has been made clear over and over again to the vast majority of the American public that is the opinion of the Government that there are harmful effects associated with these substances.

Yet, important as this biomedical research is, the rate of use has not significantly declined in any of these area. Again, I am in no way indicating research findings are not important. I think they are very important. Wouldn't it also be very important for us to try to determine why people use and abuse marihuana and a whole range of other substances? Because frankly, I can't see, and you can correct me if I am wrong, how we are going to rationally approach the problem of discouraging use and abuse if we don't understand, to start with, why there is the use and abuse.

Because clearly, just telling people, pointing to health problems, is not enough. And we know that, because it hasn't been enough with other substances, and it hasn't been even in the case with marihuana.

True or not—I think mostly untrue—over many, many years we have been telling people there are all sorts of health consequences and social consequences connected with the use of marihuana. I said they probably were untrue. No one believed them anyway. We told people that, and the use increased dramatically.

My point is: In your opinion, shouldn't we be placing a higher priority than we are on this other area?

Dr. POLLIN. Mr. Neal, we have placed a high priority on that area. We have.

Mr. NEAL. Excuse me just a second. I have just looked over your principal investigators funded in the field in fiscal year 1977. And out of 15 areas that were funded, only 3 were in this area, or I guess remotely could be considered to be in the area of psychosocial research.

Dr. POLLIN. Are you talking about studies, investigators, specifically in the area of marihuana, or in the area of drug use in general?

Mr. NEAL. I think in marihuana. I am looking at appendix B. Oh, you don't have it.

Dr. POLLIN. If we might submit for the record, Mr. Neal, we have supported an extensive series of studies that deal with the general problem and the specific question, actually, that you have addressed. What do we know, and how can we learn more about what are the determinants, psychosocial determinants, of why certain young people turn to drugs, why certain young people experiment and then leave the use of drugs, whereas other people become convulsively involved with them. We have had some very significant successes in that area.

Mr. NEAL. Well, could you just help enlighten me? What have you found?

Dr. POLLIN. One of the important findings was the very clear demonstration that in this area of drug use, that peer influence plays a much larger role than parental influence in determining whether young people will start with drugs, whether they go through the sequence of use of heavier drugs, and use drugs more frequently, or whether they stop at a certain point in time. That is the work of Dr. Denise Kandel.

[The information referred to follows:]

Kandel, Denise. Adolescent marijuana use: Role of parents and peers. Science, 181:1067–1081, 1973.

Drug: Cannabis.
Sample size: 9,318.
Sample type: Parent-child, peers.
Age: 8,206 adolescents, 1,112 adults.
Sex: Both male and female.
Ethnicity: Not specified.
Geographical area: New York.
Methodology: Exploratory/descriptive.
Data collection instrument: Questionnaires.
Date(s) conducted: Fall 1971.
No. of references: 11.

SUMMARY

In order to examine the relative influence of parents and peers on marijuana use among adolescents, independent data were obtained from adolescents, their parents and their best school friends in a sample of secondary school students in New York State. The data indicate that drug use by peers exerts a greater influence than drug use by parents. Friends are more similar in their use of marijuana than in any other activity or attitude. Parental use of psychotropic drugs has only a small influence, mostly related to maternal use. Peer and parental influences are synergistic; the highest rates of marijuana use are observed among adolescents whose parents and friends are drug users.

Adolescent drug use has been interpreted by some as a response to parental consumption of psychoactive drugs. The assumption is that the child is imitative of adult behavior. These conclusions have been based on studies which used the child's perceptions of parents' drug use, but not actual self-reports by the child's parents. This study was based on both perceived and actual self-report use of psychoactive drugs by parents.

METHODOLOGY

Independent survey data was gathered by means of a self-administered questionnaire on the use of illegal drugs by secondary school students, their best friends, and on the use of legal psychoactive drugs by their parents. The sampling was in two stages: the first, a stratified sample of high schools in New York State, and the second, a sample of students clustered by homerooms and then stratified to represent grades within that high school. Eighteen schools participated in the study: 13 were chosen for the stratified homeroom sample and 5 in which the entire student-body was questioned. In the latter sample (entire student-body), best friends' data was matched, providing a dyad sample; and then, in 1112 of the dyad cases, data from parents provided material for triad study of the interaction of peer-student-parent influence.

The total adolescent sample (N=8206) provides the material for this report except where the dyad and triad material is represented—in which case only the 5 school sample is represented. Usable questionnaires were returned by 5574 parents or 61 percent of the initial group contacted. Using record identification codes, the following sample matches were made: 49 percent of all students were matched to their parents' questionnaires (parent/child dyads); 38 percent of the students in the 5 school sample were matched to their best friend's questionnaire (best friend dyads); and 23 percent of the students in the 5 school sample were matched to both parents and best friends (triads).

Adolescents answered questions about their use of illegal drugs, (and their attitude towards the legalization of marijuana), and their perceptions of their parents' use of psychoactive drugs. Questions were asked on their attitudes and activities, such as their grade average, days absent from school, attending religious services, listening to records, watching television, their political orientation and getting together with friends.

Since marijuana was the most frequently used drug by the adolescent sample, this study focuses on its use as a single behavioral entity even though, as the author states, 90 percent of the extensive marijuana users also used other drugs. This simplification did not alter the basic results of the study.

Parents completed questionnaires about their use of psychoactive drugs such as tranquilizers, barbiturates, sedatives, stimulants, diet pills and pep pills. The author did not elaborate on the content of the remainder of the parent questionnaire. The adolescents were administered questionnaires in a school setting. The parents of these adolescents were mailed questionnaires three weeks later.

FINDINGS

The most important correlate of adolescent marijuana use was involvement with drug-using peers. When the best friend has never used marijuana, only 15 percent of the subjects use marijuana. Yet when the best friend has used it (60 times or more) 79 percent of the subjects use it.

The author points up the need for an analysis of the adolescents who are not in the majority statistical groups—adolescents who apparently did not respond to peer pressures.

The extent of involvement with peers seems to focus on the use of illegal drugs as a common bond. No other activity or attitude (excluding demographic characteristics) is as congruent between friends as that of common illegal drug use. The association between adolescents' drug use and the adolescents' perceptions of their parents' use of psychoactive drugs was confirmed. While the proportion of adolescent users is directly related to their perceived frequency of parental use of these drugs, actual parental report on their use of these drugs lowered the association by a factor of 2 (as measured by tau-beta association for ordinal data). Actual maternal use of any psychoactive drug and child's marijuana use is .083 in contrast to .161 based on child's perceptions of maternal use.

In situations involving conflicting role models (parents use drugs, friends do not use drugs, for example) adolescents are much more responsive to peers than to parents. Only 17 percent of adolescents use marijuana when their parents use drugs and their best friends do not. Parental behavior becomes important only in a situation where the peers already use drugs. Children of non-drug-using parents are somewhat less likely to use drugs, and on the other hand, somewhat more likely to use them if their parents use drugs. However, the child's use of drugs is related to the parent behavior only when such use already exists in the peer group or relationship. In these cases parental influence was found to synergize

with and potentiate peer influences. When both parents and peers used drugs, the highest degree of marijuana use (67 percent) occurred. Parental behavior increases the influence of a peer-using drug situation and modulates it when the child's peer group has already had experience with drugs.

CONCLUSIONS

The author suggests that the findings fit a "cultural deviance" model of behavior, particularly the theory of differential association developed by Sutherland and Crissey which points to the learning of delinquent roles as due to the availability of delinquent role model in the peer group. The family can encourage delinquency by either displaying delinquent behavior to be imitated, or by creating a hostile climate from which the child seeks to escape. But, the delinquent acts will not be forthcoming if the peer culture lacks such behavior.

In summary, peer behavior is the crucial determining factor in adolescent drug use, and parental behavior becomes important once such behavior exists in the peer group. The author points out, however, that the key question "Which comes first, the drug use or drug-using friends?" is not answered by the fact that adolescents who use drugs associate with like others. She asks "Do adolescents seek out drug users after they themselves have become involved with drugs, or do they start using drugs because they come to associate with other drug using friends?" She recommends longitudinal studies to search for answers.

Mr. NEAL. Excuse me. If I may interrupt to try to understand something, how does that process get started? Obviously, some young people must think it is desirable to use the drugs, or there would not be the peer pressure to begin with. Do we understand that?

Dr. POLLIN. We understand something about it, Mr. Neal. One thing that we understand, I believe, and it has been not adequately attended to, is that this period of the past decade which saw an explosive increase in the use of drugs was a period of very unusual demographics in this country. It was the decade when there was a similarly explosive and unparalleled rise in the ratio of adolescents to adults in the country.

And various social historians and demographers have pointed out whenever something similar has occurred of the past, although it has never been of this magnitude, that the adult society just does not have adequate institutions to take care of a sudden, explosive increase in the number of kids going into adolescence.

This was a multidetermined thing, in my view, in the sixties.

At the same time that we had this unparalleled increase in the ratio of adolescents to adults in this country, we also went through a period of rather unprecedented social unrest. There was the whole conflict about the Vietnamese war. There were the urban riots.

Mr. NEAL. Excuse me just a second. I am sorry to interrupt, but we have gotten a little out—I understand those conditions existed. Are you indicating if we had not had rapid increase in population——

Dr. POLLIN. In that particular segment of the population.

Mr. NEAL [continuing.] We probably wouldn't have a drug problem?

Dr. POLLIN. I think it would be much less than it is today.

Mr. NEAL. So I guess our recommendation would be not—well——

Dr. POLLIN. That particular problem has taken care of itself.

Mr. NEAL. I get your point. This is just an opinion, an uninformed one, I will admit, but it does seem to me that we need some more research or a better understanding of this area. As important as biomedical research is, and it should be ongoing, I don't think it is going to ultimately have the major impact some people think it is, because it hasn't in comparable areas.

Dr. POLLIN. Might I just say, Mr. Neal, I agree with you. We have been aware of the need for additional psychosocial research. We have been under considerable pressures to try to stimulate that research. It is not a simple matter for a variety of reasons. One of those that Dr. Snyder mentioned was to get this kind of research started.

Mr. NEAL. I just want to get to one other area here, and I will yield to Mr. Gilman.

We are trying to build a report here that might make some sense later, and I am not even sure that it will. You indicated earlier that marihuana causes chromosome breaks, or one of you did, in your testimony.

Dr. POLLIN. I think the testimony tries to summarize that field by saying there were some initial studies that so reported; that those have not been confirmed by subsequent human studies. There are one or two animal studies that do seem to suggest that, but at this point, we do not have any weight of evidence.

Mr. NEAL. Are there other drugs that you know of that cause chromosome breaks?

Dr. POLLIN. Many drugs do cause chromosome breaks.

Mr. NEAL. Are there any that are common?

Dr. POLLIN. If used heavily enough, aspirin can cause some chromosome breaks.

Mr. NEAL. Alcohol?

Dr. POLLIN. Caffein can.

Mr. NEAL. Valium?

Dr. POLLIN. It is not certain about Valium.

Mr. NEAL. You said in your testimony, when we are talking about marihuana not being a safe drug and so on, something to the effect that you can't rule out the possibility that brain damage could be caused by marihuana. Could you rule out the possibility that brain damage could be caused by Valium, alcohol, caffein, and so on?

Dr. POLLIN. We know alcohol does cause brain damage. That has been well documented.

Mr. NEAL. Can you rule out these other drugs?

Dr. POLLIN. No.

Mr. NEAL. Again, we are trying to establish some kind of perspective. I am told there was a study of drug abuse in Puerto Rico, and that the Veterans' Administration hospital said that 60 percent of the people entering that hospital with heroin problems said that they began their drug experience with Valium.

Am I asking the question correctly? No. They said that 60 percent of their patients entered the hospital with heroin as their primary problem, and 40 percent entered the hospital with Valium as their primary problem. Are you familiar with that study?

Dr. POLLIN. I am not familiar with that study.

Mr. NEAL. OK. I am just curious about their Valium. I encountered something interesting not long ago, and again trying to put this in perspective, I was told by a person who had had an alcohol problem that he was told in the alcohol treatment facility that the brain cannot differentiate between alcohol and Valium and Librium and drugs of this nature.

In other words, that chemically, alcohol and these drugs are either the same or so close to the same the brain cannot differentiate. Is that correct in your understanding?

Dr. POLLIN. No. I think this is quite incorrect. We know that alcohol has its effects by a very generalized process acting upon the totality of a cell membrane, whereas the other drugs you mentioned which are all representative of a class of drugs called benzodiazapines, have very specific, sharply localized, molecular receptors, and that those drugs work only as a result of a kind of local and "key fit" with those localized receptors.

So that the biological mechanisms which are involved in the effects of alcohol are very different from those that are involved in the use of Valium, Librium, and the like.

Mr. NEAL. The biological drugs. Would that mean also that the psychological effects would be quite different?

Dr. POLLIN. There are numerous difference in the psychological effects, between those drugs, yes.

Mr. NEAL. I have taken more than my share of time. Mr. Gilman?

Mr. GILMAN. Thank you, Mr. Chairman. Dr. Pollin, I wasn't too clear on the procedure you utilized for establishing the priorities for your research. Who sits on that panel that establishes the priority?

Dr. POLLIN. There is no single panel that establishes research priorities, Mr. Gilman.

Mr. GILMAN. Who made the selection of these investigators for fiscal year 1979?

Dr. POLLIN. The bulk of these are grantees, and they would have submitted research grant proposals which would be reviewed by our peer review system. That is a 2-tier system which first requires review by an initial review group. They are specialized groups in the biological sciences and the psychosocial sciences and other areas.

Those groups, all composed of distinguished investigators, judge a proposal for its scientific merit, approve, or disapprove. And then, if approved, they give it a relative priority score.

Mr. GILMAN. Do you send out invitations for research? Do you set forth the area that you want——

Dr. POLLIN. Yes, we do, Mr. Gilman.

Mr. GILMAN [continuing]. To support? That's what I want to know. Who makes those decisions?

Dr. POLLIN. Those decisions are made by the Institute staff, together with occasional consultation with a variety of——

Mr. GILMAN. Ad hoc groups?

Dr. POLLIN [continuing]. Ad hoc groups.

Mr. GILMAN. Who in the Institute staff makes those decisions?

Dr. POLLIN. It would include the director of the Institute, the director of the Division of Research, predominantly, and other members of the executive staff of the Institute.

Mr. GILMAN. Now, you refer to the finding by Dr. Elliott Sassenrath that THC results in a very high rate—I think about 44 percent—of reproductive losses in rhesus monkeys. Was that the only research that was conducted with regard to the effects of THC on the reproductive functions in primates?

Dr. POLLIN. No. There have been a number of studies in primates, and much larger number of studies looking at these same questions.

Mr. GILMAN. And are those studies continuing?

Dr. POLLIN. Yes, they are.

Mr. GILMAN. And this wasn't the only study?

Dr. POLLIN. No. In my testimony, I believe I referred to some total of seven studies which looked at the same or very closely related issues, and I would be glad to provide——

Mr. GILMAN. And you are still pursuing that issue?

Dr. POLLIN. Yes, we are.

Mr. GILMAN. Is that correct? You referred to Dr. Heath's research on the effects of marihuana on the brains of monkeys. Is there any other research going on comparable to Dr. Heath's research with reference to the effects of marihuana on the brains of monkeys?

Dr. POLLIN. There are no studies which precisely duplicate the research protocol that Dr. Heath employed. There are, though, a variety of studies which are looking at both biological and psychological effects of marihuana on animal behavior.

[The information referred to follows:]

REPRODUCTIVE STUDIES WITH MARIHUANA ON PRIMATES

The Institute currently supports three studies on the reproductive effects of marihuana on primates:

(1) Prenatal Effects of Marihuana on Adult Behavior: Ernest L. Abel, Ph. D., Research Foundation for Mental Hygiene, Research Institute on Alcoholism, Buffalo, N.Y. Project period: July 1, 1979 to December 31, 1981.

(2) Drug Use and Male Pubertal Development: Robert C. Kolodny, M.D., Reproductive Biology Research Foundation, Endocrine Research Section, St. Louis, Mo.

(3) Marihuana and Reproduction in the Female Primate: Carol G. Smith, Ph. D., Uniformed Services University, Department of Pharmacology, Bethesda, Md. Project period: February 1, 1978 to February 28, 1982.

The following were recent grants in the area:

(1) Long-Term THC Exposure in Adults and Offspring: Loring F. Chapman, Ph. D., University of California, Department of Behavioral Biology, School of Medicine, Davis, Calif. Project period: June 1, 1975 to June 30, 1979.

(2) Marihuana and Reproduction in the Female: Carol Grace Smith, Ph. D., University of Texas, Health Science Center, San Antonio, Tex. Project period: October 1, 1975 to November 30, 1977.

(3) Effects of Cannabis Inhalation on Reproduction and Gonads: Harris Rosenkrantz, Ph. D., Mason Research Institute, Director of Biochemistry, Worcester, Mass. Project period: June 30, 1976 to June 29, 1979.

Mr. GILMAN. I would assume you place a great deal of importance on the potential harm and dangers to the brain tissue with regard to prolonged marihuana use, do you not?

Dr. POLLIN. Yes, we do.

Mr. GILMAN. Why have you discontinued the study of the primates with regard to brain damage, both in the case of Dr. Heath's studies and Dr. Sassenrath's studies?

Dr. POLLIN. It is my recollection that those grants, when they came up for renewal, were not approved by the peer review system.

Mr. GILMAN. Has there been some other study that has been substituted that relates to the brain damage in primates for Health or Sassenrath?

Dr. SNYDER. I think I would like to comment on that. This is an area of research which I indicated in my earlier testimony we are trying to stimulate now.

Mr. GILMAN. If you are trying to stimulate—I recognize the importance of it—why are we cutting off this kind of research?

Dr. SNYDER. The problem, the reason this was cut off, is basically the peer system of competent scientists review this research as not being worthwhile for further support. The analysis of brain tissue for primate cellular changes is in a state of technology right now where we can't be too sure of what we are finding.

Mr. GILMAN. But isn't the subject of brain damage, the effects of marihuana on brain tissue, an important aspect?

Dr. SNYDER. It is a very important aspect. I think we all agree on that. The issue is how best to attack it.

Mr. GILMAN. Wouldn't the study of the primate be important to make a determination?

Dr. POLLIN. Only if the results of that study can be shown to provide reliable data. What we don't want to do is have a study from which the results are open to question, and we are put in a position of supporting something for 3 years, and at the end of 3 years, we still don't know if it does or does not produce brain damage.

What we are talking about is looking at and identifying cellular changes. We are not talking about an area of the brain disappearing, or some gross malfunction or distortion in size. What we are talking about is an effect that would have to be magnified 100,000 times to perceive it. These are not only qualitative changes, but quantitative changes.

Mr. GILMAN. If you weren't satisfied with Dr. Heath and Dr. Sassenrath, did you pursue it in another area? Did you request other primate studies?

Dr. SNYDER. We have supported others. Basically——

Mr. GILMAN. Is there any ongoing research now with regard to brain damage in primates from prolonged use of marihuana?

Dr. SNYDER. To the best of my knowledge, right now, supported by NIDA, I don't think there are. But I would have to confirm that.

[The information referred to follows:]

Brain Damage in Primates: No projects active as of July 1979.

Mr. NEAL. Would the gentleman yield?

Mr. GILMAN. I would be glad to yield to the Chairman.

Mr. NEAL. Are there other comparable studies in other areas?

Dr. SNYDER. What I am trying to emphasize, again I would like to point out, is this area of analysis of brain damage as a result of excessive use of drugs is an area that we are not quite technologically ready to handle.

Mr. NEAL. For any drugs?

Dr. SNYDER. For almost any drug, unless it is something like alcohol, which will produce gross distortion in brain tissue. What we are talking about is minute cellular and subcellular changes that are not easily picked up. And when they are picked up, it is difficult to convince a group of peer scientists that those changes are real and not some artifact of technique.

Dr. POLLIN. If I could supplement that response, Mr. Gilman, there are a great many areas where we would very much like to see quality research underway.

Mr. GILMAN. Then you discontinued Heath because it wasn't quality research; is that what you are telling us?

Dr. POLLIN. The peer review system disapproved that grant application.

Mr. GILMAN. Have you made an invitation for other research of that nature?

Dr. POLLIN. Yes, we have.

Mr. GILMAN. Apparently you don't have anything under way to take its place.

Dr. POLLIN. There are multiple areas, Mr. Gilman. Although we make numerous efforts to elicit grant applications, either the grant applications are not submitted or——

Mr. GILMAN. Was an invitation, Dr. Pollin, sent out to substitute Heath's research for somebody else's research in the same area, on primates?

Dr. SNYDER. No.

Mr. GILMAN. That's what I can't understand.

Dr. SNYDER. I must repeat, once again, though, it was the opinion of the group of peer review scientists, the opinion of NIDA staff. that the study to which you are referring right now is not capable of being performed. So that it didn't seem worthwhile to pursue it.

Dr. Heath's work is composed of several different aspects. One is the cellular changes that result after marihuana ingestion. The other is the EEG changes.

Mr. GILMAN. If you can't make the study on primates to determine the extensiveness of brain cellular damage, what other study is possible to make that determination? What are you doing to pursue it?

Dr. PETERSEN. There have been a variety of studies to try to determine what effects on psychological function, in terms of IQ measurements and various other problem-solving——

Mr. GILMAN. We are not talking about function. We are talking about damage to the brain, brain cellular damage.

Dr. PETERSEN. In the case of Dr. Heath's study, even he himself has indicated what this means behaviorally is not by any means clear.

Mr. GILMAN. Because it was in the initial stages when it was cut off. You had only gone 2 or 3 years in the study, and you cut off the study.

What I am interested in is, if this is such an important issue, why have we suddenly stopped, and not pursued it in another area?

Dr. PETERSEN. We haven't. In point of fact, there are any number of applications being made in functioning of individuals using marihuana.

Mr. GILMAN. You are talking again about functioning, but not damage to the brain cells.

Dr. PETERSEN. That is one way of measuring damage to the brain, is the ability of the individual to psychologically function. That is, ultimately, is the individual able to function socially, intellectually, with problem-solving materials, and so on? Many, many studies have been supported by us, such as the studies of driving, flying——

[The information referred to follows:]

THE IMPACT OF DRUG USE ON PSYCHOMOTOR PERFORMANCE, ESPECIALLY DRIVING

Numerous investigators in several countries have been conducting studies on the effects of drugs on performance and the incidence of drug involvement in traffic accidents and fatalities. The National Institute on Drug Abuse (NIDA) published two documents which review much of the pertinent literature: NIDA

Research Issues 20, *Drug Users and Driving Behaviors*, is an annotated bibliography; NIDA Research Monograph No. 11, *Drugs and Driving*, contains critiques of the literature prepared by specialists convened by NIDA in August 1976 in an effort to lay the foundation for planning future research.

The Department of Transportation's National Highway Traffic Safety Administration (NHTSA), independently initiated studies on the possible involvement of drugs in traffic accidents. A study was conducted in Boston of 267 drivers in fatal accidents. By interviewing friends, relatives, etc., it was estimated that 16 percent of these drivers had most likely used marijuana prior to the accidents. NHTSA also conducted two studies that attempted to determine the presence of drugs in blood samples collected from fatally injured drivers. Both studies indicated the presence of numerous drugs, but the sample size was too small to draw definite conclusions. In the latter of these two studies, the blood samples, submitted for determination or cannabinoid levels as well, are still in the final stages of analysis. It appears, however, that sufficient evidence will be available to show a relationship between drug, incidence, traffic accidents, and fatalities.

Over a period of many years, a large number of studies have supported the conclusion that some drugs can impair drivers while operating a motor vehicle. Whether such drug use actually leads to traffic fatalities or accidents is not as certain. The evidence strongly suggests, however, that there is more than casual relationship between drug use and accidents. Thus, the principal agencies involved—NHTSA, the National Institute on Alcohol Abuse and Alcoholism (NIAAA), and NIDA—are working together to define the nature of the problem more fully.

In the late 1960's, while a part of the National Institute of Mental Health (NIMH), NIDA began to gain better understanding of the behavioral processes involved in drug use and the effects of those drugs on performance. Initiatives undertaken to develop sensitive, accurate analytical methods for the detection of drugs have led to several analytical methods now in use, including the first commercial methods for the detection and quantification of marijuana constituents in human body samples.

The collaboration between NIDA and NHTSA began in 1973 when NIDA staff began to serve as consultants for ongoing NHTSA studies. This close but informal cooperation culminated in 1976 in a formal agreement to discuss future plans and to mutually monitor progress in this area. We feel that this has been a very productive collaboration.

This background information indicated to our two agencies the areas needing additional work and the drugs most likely to be involved in traffic accidents. The following is a discussion of the ongoing projects and a summary of their progress to date.

A. Over the past 10 years, NIDA has been reviewing, improving, and developing new assays for the detection of drugs. Of utmost importance is the need for reliable, convenient methods for detecting marijuana use. *Immunoassays for Drugs Subject to Abuse* and NIDA Research Monograph No. 7, *Cannabinois Assays in Humans* summarize early efforts by investigators in radioimmunoassays (RIAs) and marijuana analytical methods.

NIDA has developed kits for detecting and quantifying tetrahydrocannabinol (THC) in plasma and hemolized blood, and an Enzyme Multiplied Immunoassay Technique (EMIT) assay for the detection of THC and its metabolites in urine. This complementary battery of assays is currently undergoing field tests to evaluate their adaptability for routine use, reliability, and the need for further developmental work. EMIT provides rapid urine screening that can be used to select subjects on site from who blood samples should be collected. Later, in the laboratory, RIAs may be used for quantifying or confirming the presence of cannabinoids. Other analytical methods (primarily gas-liquid or high-performance liquid chromatography with or without mass-spectroscopic detection) have also been developed as reference methods or to validate the results obtained from the inherently less specific immunoassays.

The incidence of marijuana use in casualty cases being studied as part of the field trial. Kits are being distributed to medical examiners and forensic laboratories to analyze samples from a variety of cases, mostly resulting from traffic accidents. Through this study, other possible areas of marijuana impairment may be identified.

Last year NIDA attempted to solicit contract proposals for unique and portable methods of roadside detection, but concluded that such methodology was

not yet feasible. Some new and promising developments in the use of solid state techniques have encouraged NIDA to solicit similar contract proposals during fiscal year 1980.

B. A study jointly funded by NIDA and NHTSA is attempting to correlate the levels of drugs in saliva and blood. Earlier studies found that too few drugs (other than alcohol) can be detected on the breath to permit its use as a reliable means of detection. Saliva, long used for the detection of drug use in horse racing, is the next most accessible body fluid for roadside tests. The present contract calls for the administration of known amounts of drugs to subjects from whom blood and saliva samples are collected. These two samples are then correlated to determine if the saliva level can be used as a predictor for the blood level. This correlation is important because much data is available on the correlation of blood levels with certain human pharmacological responses. Only secobarbital and amphetamine have been studied thus far. Secobarbital shows very good agreement between saliva and blood vessels, amphetamine does not. Other drugs to be studied are diazepam, diphenhydramine, chlorpromazine, and possibly codeine.

C. There is still much controversy over the degree of driving impairment at various alcohol levels. Experts agree that the somewhat arbitrary 100 milligram percent (0.1%) level of blood alcohol concentration is a sufficiently high cutoff to minimize false positive determinations, although many individuals (if not most) are significantly impaired at lower levels.

NIDA and NHTSA have initiated an extensive 5-year study to correlate the impairment of complex human performance with blood levels of several drugs. A battery of human performance tasks, representative of various facets of driving ability, are selected for study. The drug is administered in at least three different doses to at least four subjects from whom many blood samples are drawn. The results of the measures are then subjected to analysis to estimate the various characteristics of the blood levels in that subject population. A group of eight subjects are then randomly administered the three different doses plus a placebo and put through the battery of tests. Three blood levels are taken during the 12-hour period of performance, with the final test taken at 24 hours. Similarly, a group of 15 subjects are being selected and trained in a new, sophisticated driving simulator. Their performance on the simulator is again tested with the same drugs at three dose levels. Blood samples are collected before and after the test period.

Performance impairment and blood level analyses based on this study have been completed for the following drugs: diazepam, secobarbital, diphenhydramine, and the first group of subjects receiving marijuana. Studies with chlordiazepoxide, methaqualone, flurazepam, and second group of marijuana subjects are in final stages of completion.

The third part of this study involves the detailed biomathematical analysis of the correlation between blood levels and performance measures. This has nearly been completed for diazepam and indicates a distinct threshold blood level above which specific levels of impairment occur. The same kind of correlations will be carried out for all drugs in the simulator tests as well.

D. The previous study and most past studies are considered laboratory studies in that they measure specific effects of drugs on series of complex performance tasks or in simulated driving conditions. It is generally agreed that such studies only help to identify those drugs that may be involved in traffic accidents. Epidemiological studies are required to determine whether in fact specific drugs are over-involved in traffic accidents or other types of improper automobile operation. A rather unusual epidemiology study was conducted by the California Department of Justice (with support funds from the Department of Transportation) of blood samples collected for alcohol determinations from drivers arrested and charged with driving while intoxicated. All blood samples found to have less than 0.1 percent alcohol were then submitted for quantitative assays for TCH levels. In addition, several randomly selected blood samples from drivers whose alcohol levels were above 0.1 percent were submitted for comparison.

Although only 1,792 blood samples were tested (266,000 drivers were arrested for this offense during the study period), it does give some indication of the incidence of marijuana use among these drivers. Overall, 16 percent of the samples were found to contain more than 5 nanograms per milliliter (the present sensitive level of the assay). In the 185 drivers who had no alcohol present, the incidence of marijuana use was as high as 24 percent.

E. Another major epidemiological study, supported by NHTSA (with NIDA in an advisory capacity), is being conducted by the Highway Safety Research Institute of the University of Michigan. The planning stages of this third national survey of fatally and non-fatally injured drivers for incidence of drugs have just been completed, with sample collection and an analysis to begin soon. Its design incorporates lessons learned from the earlier, above-mentioned studies and has a more representative sample of accident occurrences. With better recognition of target drugs and new, improved analytical methods, a comprehensive drug screen will be carried out, including tests for the presence of marijuana use.

Epidemiological estimates of drug involvement require the evaluation of samples not only from injured drivers, but also from drivers at similar sites and times who were not involved in accidents. In the first two surveys, vigorous attempts were made to obtain a large number of matched or controlled drivers at certain sites where the fatal accidents had occurred. Drivers in these areas were stopped and asked to voluntarily participate in the study, with over 90 percent participation, which is felt to be unusually high. After the Department of Transportation decided not to conduct a controlled driver survey at this time, NHTSA asked NIDA to consider a research grant for this purpose. NIDA plans to notify all potentially interested research groups of our desire to fund a study of control sites. We hope it can be initiated by the time a sufficient number of fatality samples are collected. Under present regulations governing informed consent and protection of research subjects, it is extremely difficult to ensure the participation of a representative number of volunteers. In this event, the fatally and non-fatally injured driver survey will serve only as one side of the relative risk equation. Other types of studies may be required to estimate the actual over-involvement of drugs.

In develop ng the survey of fatally injured drivers, NHTSA is conducting a series of workshops for small groups of specialists to discuss and to plan continuing studies. These workshops are very useful in guiding the agencies involved.

Under Public Law 95-599, the Department of Transportation is required to prepare a report on the impact of marijuana and drugs on traffic safety and has outlined its future research plans in a recently proposed 5-year plan. NIDA has been consulted on these plans and expects to actively participate in these studies.

Mr. GILMAN. Do you think that is satisfactory, Dr. Petersen, studies just of the function aspects?

Dr. PETERSEN. There are many ways of looking at it, one of which is to look at it from the standpoint of the neurophysiology and so on. But the problem is the technologies in those areas yield out results very hard to interpret. And I think that is the point Dr. Snyder and Dr. Pollin have both made.

Dr. POLLIN. I would very much welcome, we would be very glad to receive, a grant proposal which met the criticisms and overcame the criticisms of some of those earlier studies.

Mr. GILMAN. Has that invitation gone out?

Dr. POLLIN. There has not been a specific, formal invitation in that precise area, no.

Mr. GILMAN. I would hope that your policy group would do a good, hard look at where you have gone and where you have been. Could you submit a list to us of studies on this subject that have been in progress?

For the record, Mr. Chairman, with your permission, I would like to include such a list in our record.

Mr. NEAL. Without objection it is so ordered.

Dr. POLLIN. I would be glad to. And also, with your permission, I would like to submit copies of the various targeted grant announcements and research requests that we have submitted to give you an

indication of the kinds of the wide variety of studies we have sought to elicit.

Mr. NEAL. We would welcome that, Dr. Pollin.

[The information referred to follows:]

(National Institute on Drug Abuse—Division of Research)

RESEARCH GRANTS PROGRAM

ANNOUNCEMENT OF AREAS OF SPECIAL INTEREST

(February 1978)

Introduction

The purpose of this announcement is to stimulate investigator interest in certain research areas of particular importance to the national drug abuse research program which is authorized under Section 301 of the Public Health Service Act (42 U.S.C. 241). Since the formation of the National Institute on Drug Abuse in 1973, our understanding of this major public health problem has been greatly increased. Much of the credit for this is due to scientists supported by the Institute's research grant program. However, there still remain several research areas of high programmatic concern that have been insufficiently addressed, and the Institute wishes to call these to the attention of researchers. These areas include crime and drugs, cigarette smoking behavior, longitudinal studies of marihuana use, drug abuse prevention, inhalant abuse, and phencyclidine and phencyclidine-like drug abuse. Background and guidance for research proposals in each of these areas are provided in this announcement.

Application, review, and funding procedures

The Institute wishes to encourage investigators to submit research grant proposals in the areas discussed in this announcement. Applications for research grants may be made by any public or non-profit institution such as a university, college, hospital or laboratory; units of State or local government; and, authorized units of the Federal Government.

Applications submitted in response to this announcement will compete for funds available for all other drug abuse research grant applications considered by the National Institute on Drug Abuse. Also, they will be subject to the research grant program guidelines of the Institute's Division of Research. The guidelines, other information about the drug abuse research grants program, and further information about areas of interest described in this announcement may be obtained by contacting the Executive Secretary, Drug Abuse Research Review Committee, Division of Research, National Institute on Drug Abuse, 5600 Fishers Lane, Rockville, Maryland 20857.

Applications should be prepared on Form NIH–398 and sent to the Division of Research Grants, Westwood Building, Bethesda, Maryland 20016. Receipt dates for new applications are July 1, November 1, and March 1. Applications submitted in response to this announcement will be reviewed according to peer review procedures applicable to all research grant programs sponsored by the Alcohol, Drug Abuse, and Mental Health Administration, and review will be based on considerations of overall quality and scientific merit. Along with these considerations, the Institute's interest in the areas described in this announcement will be a factor in making funding decisions on applications recommended for approval by the National Advisory Council on Drug Abuse.

Applications are invited in the following areas of interest:

CRIME AND DRUGS

Significance

In recent years, the media have devoted considerable attention to the relationship of drug use and criminal behavior. Although the assumption is made that they are causally related, definitive studies demonstrating this phenomenon have not been performed.

Numerous studies which establish the existence of an association between drug use and criminal behavior have been conducted. Showing that drug use and criminal behavior are correlated statistically is not sufficient grounds for asserting the two phenomena are causally related. Definitive answers concerning the relationship of drug use and criminal behavior and its "causal" status require

that the criteria of association, temporal order and tests for spuriousness be met. Findings from such comprehensive studies are needed before this important research and policy issue can be dealt with effectively.

Purpose of studies

The primary purpose of studies addressed to this issue would be (a) to untangle the time-order of occurrence of use of various drugs and involvement in various criminal activities and (b) to identify variables that could be used to test the drug use-crime relationship for spuriousness. While prospective longitudinal studies are the most appropriate method to apply to this research issue, carefully designed cross-sectional, retrospective, life history studies using different populations would be acceptable. Thus, the studies envisioned here would deal with comparisons involving the onset of drug use with the onset of criminal activity. A second meaning of "casuality" in the drug use-criminal relationship focuses on a much shorter time frame and addresses the question: Among chronic heavy users of drugs (opiates, in particular heroin), what is the interplay of drug consumption and criminal activity patterns? Studies designed to answer this question require detailed data on all drug consumption/criminal activities occurring within a one to six-month period of a user's life. Also of relevance would be data on income sources including drug sales and expenditures both for the maintenance of drug use and for the usual items like rent, food, etc.

CIGARETTE SMOKING BEHAVIOR

Significance

Cigarette smoking is the nation's most widespread, costly, and dangerous habit. It involves ⅓ of the national population and leads to 300,000 excess deaths per year.

Although a majority of smokers accept the scientific evidence that tobacco smoking is dangerous to their health, they are unable to control their habitual use of this substance. Until we learn more about the underlying bases of nicotine dependence, we can expect little progress against the adverse health consequences that accompany cigarette smoking.

Purpose of studies

The primary purposes of these studies would be to further our understanding of the etiology and basic mechanisms of nicotine dependence and withdrawal and to increase our effectiveness in the treatment of this public health problem.

Specifically, further research is necessary on the biomedical, psychological and social factors which predispose many, but not all, individuals to experiment with cigarette smoking. Such studies might include investigations on (a) possible genetic factors influencing an individual's response to nicotine, (b) the role of hypothesized nicotine receptors in predisposing a person to nicotine dependence, (c) personality variables causally related to cigarette smoking, (d) the role that social or ethnic class and peer groups play in the initiation of smoking behavior, and (e) behavioral and conditioning factors which influence the acquisition, maintenance, and extinction of tobacco smoking.

Little is known about the basic physiological and psychological effects of nicotine dependence and withdrawal. Further research is necessary concerning (a) the sites of action of nicotine in the central nervous system, (b) the mechanism by which nicotine exerts its reinforcing effects, (c) the structures and mechanism involved in the abstinence syndrome resulting from cessation of cigarette smoking, (d) the existence of an endogenous nicotine-like substance in the brain, and (e) the possible existence or creation of a nicotine antagonist.

Finally, there is some indication that it may be more difficult to stop smoking than to stop the self-administration of opiates. Research on new techniques to help individuals to reduce or eliminate tobacco-smoking behavior must be developed. These could include approaches which emphasize (a) the application of behavior modification techniques, (b) the development of education programs to change public attitudes toward smoking, or (c) the development of pharmacological therapies which replace cigarette smoking with other, less harmful, substances.

LONGITUDINAL STUDIES OF MARIHUANA USE DURING LATE CHILDHOOD AND EARLY AND MIDDLE ADOLESCENCE

Significance

There has been increasing concern on theoretical and clinical grounds that marihuana use may have more serious deleterious effects on an individual when

used during late childhood and early adolescence than it does on the young adult, who has been the subject of most marihuana research. Such adverse consequences might be the result of a special vulnerability arising from such factors as endocrinological changes, rapid growth and immature ego development which are characteristic of this age group.

Purpose of studies

The primary purpose of these studies would be to focus on possible special hazards of marihuana use for those from age eleven to age fifteen (approximately). Such studies should concentrate on the biological, social, and behavioral consequences of use in this age group. Possible areas of interest might involve research on genetic, endocrinological, immunological, and developmental effects in the biomedical area and research on interpersonal relations, school performance, and psychodynamics in the social and behavioral sciences.

Other types of research that we wish to encourage involve biomedical, clinical, and psychological studies focusing on (a) longitudinal studies on specific populations, (b) childhood and adolescence in traditionally using populations, (c) multiple drug use in young user populations in which cannabis is the predominant drug, and (d) users with developmental anomalies in which cannabis use might be expected to exacerbate already existing problems. Prominent emphasis should also be placed on female users since this group of users has been relatively neglected in research to date despite the fact that in younger age groups female use is approaching parity with male use.

RESEARCH ON PREVENTION OF DRUG ABUSE

Significance

In view of the difficulties in treating drug abuse and of the rising costs of the various treatment strategies, it is becoming imperative that we re-emphasize the concept of prevention with regard to this public health problem.

Recent longitudinal and other survey efforts have uncovered a sequential pattern in the development of drug abuse behavior. The age of user and the substance of abuse are important variables in this sequence which hypothesizes that illicit drug experience follows trials with licit, but age-inappropriate substances such as tobacco, beer/wine and spirits. According to this thesis, the first use of illicit drugs is almost always marihuana. The next group of drugs used by those individuals who continue to increase their drug use behavior has not been clearly specified. These are often referred to as "pills" (amphetamines, barbiturates and tranquilizers, not medically taken); last in the series for the very few who move through all drug groups are cocaine and heroin. While it is true that experimentation with the first group of drugs does not inevitably lead to use of more dangerous substances, it is also true that cigarettes, beer/wine and spirits come first; they function as gateways to illicit drugs.

Evidence from numerous studies also indicates that early drug use is correlated with more serious drug involvement. Persons who start drug use earliest are most at risk of using dangerous drugs to a degree leading to damaging consequences. At present, we are particularly concerned with persons immediately at risk of experimentation with gateway drugs—namely those 10–13 years of age—for it is with this group that we feel progress can be made in interfering with the variables leading to drug abuse.

Purpose of the studies

The primary purpose of these studies is to stimulate investigations of the following research questions related to the prevention of drug abuse and smoking. These topics are given only as examples and investigators are encouraged to consider related problems.

What are the conditions of acquisition of gateway drug abuse? Less research has been done in recent years on the acquisition of smoking behavior than on its extinction. The relative emphasis in research on use of other drugs is perhaps even more weighted to extinction of an already acquired behavior. In the case of primary prevention with pre-teen and teenage children, there are many gaps in basic knowledge. These include: the community and peer supports for early drug experimentation and smoking; the adaptive role played by drugs in this age group; the positive images of drug-using; the impact of parental smoking and drug-taking. The use of small-scale laboratory studies to test hypotheses and develop theories about these and other underlying processes of acquisition would appear most appropriate at this time. Applicants may seek support for con-

ferences with invited participants to generate state-of-the-art documents which could be of assistance in providing a background on the formative studies.

What mass media programs and messages are appropriate to prevention of smoking/drug-taking within the target groups? The overall goals are (a) to understand the factors for nonsmokers/drug-takers (ages 10–13) which may be used to delay onset of experimentation with gateway drugs, particularly tobacco; (b) to understand the factors which can help reduce the number of smokers in ages 15–18. Because of the potential of the mass media for high cost effectiveness (i.e., the delivery of service to many persons at one time) formative studies in the program design and message development are needed for those two populations. Some of the research questions requiring investigations are: What procedures can enhance the likelihood of subject exposure to media-bone messages? What number of exposures are required by message and by target groups to raise awareness of the messages above threshold? What kinds of messages are appropriate to each goal and age group? What is the impact of context of exposure (at home alone; with friends; with large groups) on reception of the message? What are the interaction effects between self concept and message impact? How much of the health implications of smoking and drug abuse is believed and understood by children of these ages? What other components (i.e., physiology courses, curricula, films, games) can be developed to enhance the effect of the media effort? What are the ways (i.e., underlying processes) in which media campaigns impact upon target groups or communities? Is a media campaign alone (i.e., without other components) likely to impact on smoking/drug-taking behaviors? It would appear that small-scale laboratory studies followed by small-scale, limited field studies (i.e., in natural groups such as schools, churches, businesses) would be needed to investigate these and related questions about mass media message development. Such research should contain appropriate matched control groups and the design should allow for detailed assessment of the long-term effects of the media program. Techniques to evaluate effectiveness should be a major consideration in all applications.

INHALANT ABUSE

Significance

The demonstrated toxic effects of inhalant abuse require that further attention be directed at this problem. Inhalant abuse can result in permanent brain damage and concomitant neurological deficits from relatively brief exposures. The problem is particularly acute among minorities, particularly Mexican-Americans and Indians, and in young age groups.

Purpose of the studies

The purpose of these studies is to stimulate research in the following areas so that the extent of the inhalant abuse problem can be understood and an effective treatment and prevention strategy developed. Among abused drugs, the inhalants are essentially unique in the severity and chronic nature of the resulting impairments. Further research is needed on (a) the cognitive, behavioral and other neurological impairments caused by various inhalants (and combinations), especially in human subjects; an important subarea involves the hazards associated with acute heavy as opposed to chronic low exposure; (b) the causes of death in inhalant abusers, i.e., whether because of physiological or behavioral toxicity; (c) the neuropathological changes associated with inhalant abuse.

Etiology of inhalant abuse

Mexican-Americans and Indians as well as many white youths are involved in inhalant abuse. Blacks seem to be relatively uninvolved with inhalants. Studies are required to investigate the socio-cultural, psychological, and biological bases of inhalant abuse in these groups. Particular attention should be directed at an understanding of differential use patterns. Factors to be considered might include peer pressure, availability, specific effects, membrane permeability, and antigen profiles.

Basic research

The mechanism by which inhalants exert their addictive and reinforcing processes is unknown. Techniques have to be developed which enable us to study these effects in the laboratory. Further studies are required which will identify the site of action of various inhalants as well as the physiological changes occurring with the development of tolerance and during withdrawal. Possible pharmacotherapies can be developed to combat specific withdrawal syndromes and further experimentation in this area is encouraged.

PHENCYCLIDINE AND PHENCYCLIDINE-LIKE DRUG ABUSE

Significance

The use of phencyclidine (PCP), known on the street as angel dust and by a score of other names, may be the most rapidly growing pattern of drug abuse in recent years. Because the drug frequently masquerades as other substances, any survey statistics represent a minimal estimate of the extent of the problem. However, between the 1976 and 1977 National Institute on Drug Abuse National Surveys, the number of those between 12 and 17 who were aware they had used PCP doubled. Among the 18- to 25-year-old group during that same year, use had also increased by nearly fifty percent. This occurred despite the poor street reputation of the drug, the evidence that it can be life endangering, and the fact that it can cause a serious schizophrenic-like toxic reaction.

The rapid growth of this serious pattern of drug abuse is alarming. Since little is presently known about the psychological and biological implications of PCP, it is important that the parameters of risk for both acute and chronic use be understood. Such knowledge may also serve as an effective deterrent to use if it is employed in well-designed prevention programs.

Purpose of the studies

The purpose of these studies is to stimulate research concerning the basic sociological, psychological, and biomedical aspects of phencyclidine and phencyclidine-like drug abuse as well as to develop effective treatment and prevention methodologies.

More specifically, additional studies are needed on the incidence and prevalence of PCP abuse. The increased use of PCP in spite of its bad street reputation offers a unique opportunity to test the hypothesis that the extent to which a drug or substance is abused is primarily determined by relative availability. Research should also be concerned with the patterns of PCP use which should include information concerning what drugs, if any, are usually taken together with PCP.

In the behavioral area, studies should address the issue of the personality characteristics of PCP abusers and their motivation for use. An area of particular importance involves the frequency and significance of adverse behavioral toxicity episodes including criminal activities and aggression. Investigations should also address the significance of the schizophrenic-like toxicity that has been reported following PCP abuse and methods should be developed to provide a differential diagnosis of this PCP induced toxic psychosis as opposed to schizophrenia and other psychotic disorders.

Little is presently known concerning the acute and chronic effects of PCP abuse on psychological and physiological function and performance and on the development of tolerance and dependence. An animal model for PCP abuse should be developed and basic biomedical studies initiated. The interaction effects of PCP with other drugs such as alcohol, marihuana and barbiturates are of especial interest as are the possible genetic and reproductive effects. Since there appears to be a marked variability in response to PCP, drug-response studies are needed with particular emphasis on individual differences.

The development of methods for the rapid assessment of PCP and PCP-like compounds in body fluids is necessary from the experimental, treatment and forensic points of view. Methods for detoxification and treatment of abusers should be developed and rigorous research on prevention strategies based on both behavioral and biomedical concepts is encouraged.

Mr GILMAN. Just one other question, Dr. Pollin. Could you tell us what the status of NIDA's 1979 drug prevention campaign is?

Dr. POLLIN. The TV spots were audience-tested within the past few weeks. NIDA does not at this point have any direct involvement in the analysis of the results of that audience testing. We are awaiting a report from the Department, and hope that we can reach agreement within the Department, as to whether or not to go with that campaign.

If the test is positive, it will be keyed to the beginning of the new school year.

Mr. GILMAN. Those are the same TV spots that this committee had a look at earlier this year?

Dr. POLLIN. That's right.

Mr. GILMAN. Is that the only thing you are doing, the TV spots?

Dr. POLLIN. No. There are a wide variety of other preventive initiatives. But in terms of a single nationwide campaign, those particular spots were part of a multimedia approach which included TV spots, radio announcements, print media, competition scheduled for schools and college campuses, all of them designed to focus on——

Mr. GILMAN. That is the entire 1979 program, is it not?

Dr. POLLIN. That is the 1979 prevention campaign.

Mr. GILMAN. How much do you earmark for that campaign?

Dr. POLLIN. Approximately $250,000.

Mr. GILMAN. $250,000? And here it is July, and you anticipate utilizing that program starting when?

Dr. POLLIN. If the audience reaction testing is positive, we would hope to key it to the beginning of the fall school year.

Mr. GILMAN. September or October. Thank you, Mr. Chairman.

Mr. NEAL. We will suspend to answer this roll call vote, and be back in about 10 minutes.

[Whereupon a recess was taken.]

Mr. NEAL. The Select Committee will come to order. Dr. Pollin, I thought I heard you say a few minutes ago, in response to a question by Mr. Gilman, that you were concentrating your efforts on a whole range of addictive drugs. And are you including marihuana? Is marihuana an addictive drug?

Dr. POLLIN. There has been controversy about that point, Mr. Neal. I think that the most recent data does suggest that there is a low degree of tolerance and physical dependency which develops to marihuana, and we do have clinical reports of individuals who report difficulty in controlling or discontinuing the use of marihuana.

So that at this point, I think we would consider it a drug which shows some level, but a low level, of physical and a high level of psychological dependency, but much less so than is shown by a drug, for example, like heroin or nicotine.

Mr. NEAL. Just again to try to establish some perspective on this question, how would you compare addictive qualities with alcohol, caffein, and Valium?

Dr. POLLIN. I don't think that we have adequate data to make that comparison, Mr. Neal.

Mr. NEAL. Well, I have mentioned Valium several times. I have heard that Valium can be a highly addictive drug, and can be very damaging in a number of regards. Is my information essentially correct, my understanding?

Dr. POLLIN. Yes. I think that is true. But I would like to get back, if I could, Mr. Neal, to a point which I tried to make earlier, that when one tries to estimate the relative danger or safety of a drug, one has to do it using, as one of the yardsticks, its frequency of use.

One can say the same thing, in a sense, about penicillin. For certain people, penicillin is a very dangerous drug, and can cause very serious and life-threatening consequences.

Overall and relatively speaking, penicillin is a very safe drug, because the percentage of people who use it who run into complications is very low.

One of the reasons that we are seeing so many reports of difficulties with Valium is because it is, perhaps, one of the most highly and fre-

quently prescribed drugs currently used in American medicine. And if we look at the rate of complications in comparison to the level of use, comparatively, I think one would have to say that it is a relatively safe drug. But it does have definite abuse liability properties. And there is a subgroup of users who definitely run into serious difficulty with it.

Mr. NEAL. Did you indicate earlier that that is essentially the same case with marihuana, or didn't you? Maybe that was the testimony given on Tuesday. And you were here, I believe. I believe one of the witnesses said on Tuesday that the typical user of marihuana uses it intermittently, and that the problems occur with a relatively small group of the marihuana-using population. Do I remember that correctly?

Dr. POLLIN. Well, I recall the first part of that. I don't think that we have adequate evidence as to the second part. That is, there are certain drugs, certain substances—tobacco is one of them—where the great majority of people who use it indicate on surveys that they wish that they could either stop its use, or they wish that they could use a lot less than they use.

And conversely, there are other substances where the great majority of users show an ability to use as infrequently as they wish, and don't feel troubled by the extent of their use.

I think that would probably be true of 90 percent of the people who use alcohol.

At this point, where on that spectrum marihuana fits, I don't think we say with certainty. But at this point, it seems to be closer to the alcohol than to the tobacco end. That is, it does appear that the majority of users are intermittent rather than daily users.

Mr. NEAL. Well, I understand the difficulty with a question like this, because it is illegal, and certainly it is reasonably hard to get adequate information. On this point, I just wonder if it wouldn't be helpful, since over and over again the point has been raised that we don't have the longitudinal studies we need in a whole range of areas, to try to seek out some anecdotal type of information from people who have used it over long periods of time.

Has there been any attempt made to your knowledge to do that?

Dr. POLLIN. Yes.

Mr. NEAL. Are there published results of that?

Dr. POLLIN. Well, we are very actively involved now in planning just such studies. We seriously considered—one of ad hoc task forces I mentioned to Mr. Gilman spent months reviewing the pros and cons of a very large-scale, long-term longitudinal prospective study. It was decided such a study at this time would be exorbitantly expensive.

And alternatively, we have identified a number of separate populations where we have data that goes back 4, 5, 8 years, where there were people identified as using marihuana heavily at that time. And we are attempting to plan studies which will be follow-up studies on those kinds of populations to get at just the kinds of questions that you are asking.

Mr. NEAL. Well, I was also thinking it might be useful to try to find some people who had used them over very long periods of time, not 4 or 5 years, but people who have used it for 20 or 30 years or so. That would seem to me to be helpful.

Dr. POLLIN. This is what we have tried to do in some of the overseas studies. Those have generated major problems of their own. In this country, people who would have used for 20 or 30 years would, for the most part, represent a highly, very atypical, very small segment of the population.

Until 10 or 15 years ago, it was really very specialized and very rare subgroups of people in this country who used marihuana. And the generalizability of such data would be open to very serious question.

Mr. NEAL. Well, I understand that marihuana was somewhat popular back in the thirties, and I just wonder if there are people still around from those times who used marihuana, and perhaps still use marihuana? Marihuana was made illegal in this country in the late 1930's, wasn't it?

Dr. PETERSEN. 1937.

Mr. NEAL. I just wonder if it would be possible to locate some people who had been users of marihuana during that period, and continued their use for the 40 ensuing years. I don't know how reliable it would be, but wouldn't it be interesting to try to see what had happened with some of these people, if we could locate them?

Dr. POLLIN. We have been doing something similar on an anecdotal basis with heroin users. We haven't attempted as yet to do that with marihuana users. But we have tried, and as you say, are planning to go back and identify people who have been using heavily and chronically for the past 8 or 10 years, as far back as we can go.

Mr. NEAL. How about people that you indicated earlier, and it was indicated in Tuesday's testimony, that the majority of people don't use it chronically and heavily; that they use it intermittently and lightly? Wouldn't it be good to try to seek out a population that uses it in that regard, to see what we could learn from those people?

Dr. POLLIN. Yes, indeed. And that is the kind of study which we——

Mr. NEAL. I thought I just heard you say you were going to seek out those people who used it chronically and heavily for the last 5 years.

Dr. POLLIN. That is our area of greatest interest.

Mr. NEAL. If the majority of people don't use it that way, why is that your area of greatest interest?

Dr. POLLIN. For the same reason that, the way the relationship between smoking and lung cancer was first demonstrated was by trying to collect a sample of people who had smoked very heavily for very long periods of time.

When you are not sure whether or not pathology exists and whether it is related to a given set of circumstances, it is a frequent research approach to look for the extreme case, and then work one's way back. That is, therefore, our area of greatest interest.

But the kind of study that we are exploring is to go back and use groups like the Kaiser-Permanente medical group in California, which have very complete medical records extending over 10 or 15 years, to see if we can retrospectively identify, in that population with very complete medical records, those people who used heavily, those people who used intermittently, those people who didn't use, and see whether there has been some difference in their health history over that period of time, to get at a variety of questions such as if

there is an effect on the immune response, does it reflect itself in some different level of generalized physical illness.

Mr. NEAL. I am just wondering if you plan to place some emphasis on this kind of study soon.

Dr. POLLIN. We have spent a considerable amount of time during the past year and a half carefully reviewing alternative research strategies.

I started to point out to Mr. Gilman there was a point some 3 or 4 years ago when marihuana research peaked in terms of dollars spent. That was at a time when there was a greater emphasis on biomedical research, because we were still trying to learn what was the composition of the material, and so forth.

As that type of research has gradually diminished, having found many of those answers, we are trying now to replace that kind of research with the type of psychosocial research looking at questions of etiology, determinants of different patterns of use, and consequences of use, very much along the lines of the questions you have asked.

It is very difficult to communicate in any brief period of time, such as we have here, the great complexities from a scientific and research point of view, in trying to structure studies of that kind.

To mention just one among many, it is almost impossible to find people who have used marihuana chronically and heavily who have not used numerous other drugs as well, and to try to devise a research design so that you are sure that if findings emerge, what the relationship of those findings will be to marihuana on the one hand, and other drugs they have used, or to the general lifestyle. That is just one among a multitude of problems.

Mr. NEAL. I can certainly see the difficulty. It still occurs to me, however, that if you could find people who have had long-term experience, either previously heavy or intermittent, that they might be helpful to us in understanding why they have engaged in this particular form of behavior; what led them to this in the first place.

I guess physical examinations could indicate what kind of health consequences these sorts of behavior have had, and so on. It seems to me that we could possibly do that, and qualify any kind of findings by saying clearly, "We can't prove this person really did use the drug in the quantities he or she said," and so on.

But it just might point in some directions that could be useful, it seems to me.

Dr. POLLIN. I agree with you entirely, Mr. Neal. This is an area of high priority.

Actually, when we break down the allocation of our research resources, the bulk of our resources go to heroin and heroin related problems. The next single largest category is marihuana; and we are eager, indeed, to get this kind of research started.

Mr. NEAL. Excuse me. I am not sure I understand whether you said you are planning to seek out people who have used it over long periods of time to try to determine what they say about that use. Is that something that is in the planning stages now?

Dr. POLLIN. For the record, I would like to submit the grant announcements which describe our interest in just that type of longitudinal study and request proposals. And we do have some of those studies currently underway.

And we would also like to submit descriptions of those studies for the record.

[The information referred to follows:]

YOUTH AND DRUGS

I. DATA SOURCES

Probably the most significant and reliable data source available on the patterns, precursors, and consequences of adolescent drug use is that compiled by Denise Kandel in her book, "Longitudinal Research on Drug Use." She summarizes the results of eight methodologically superior longitudinal studies (see references), six of which focused on adolescents (the remaining two were Lee Robin's study of Vietnam veterans and Don Cahalan's study of adult male alcohol abusers). Kandel presents selected findings from these studies in the form of 19 propositions organized around 3 aspects of drug use: (1) patterns of involvements, (2) antecedents, and (3) consequences. Summaries of Kandel's summaries follow below.

Patterns of involvement in illicit drugs

1. The period for risk of initiation into illicit drug use is over by the mid-20s.

The studies suggesting this finding were completed in the early 70s. Therefore, Kandel asks "What will be the patterns of use of later cohorts as they enter the mid and late 20s? Will they experience much higher rates of use than the cross-sectional cohorts studied to date or will they decrease their use relative to their own level of use at an earlier age? Robins data . . . suggest that both use among users and the rates of initiation into drugs among nonusers peak at ages 22–23 and decline sharply thereafter."

2. A high proportion of youths who have tried marihuana will eventually go on to experiment with other illicit drugs.

These studies find that ". . . the probability of becoming a multiple user increases in direct proportion to the recency and extent of initial marihuana use . . . (However) it is important to stress that these findings do not establish that youths who experiment with these drugs will necessarily become habitual users."

3. Later age of onset is associated with lesser involvement and greater probability of stopping.

4. There are clear-cut developmental steps and sequences in drug behavior, so that use of one of the legal drugs almost always precedes use of illegal drugs.

Kandel's own studies suggest the following 4 stages in the sequence of involvement with drugs: beer or wine; cigarettes or hard liquor; marihuana; and other illicit drugs.

5. Addiction to heroin is not necessarily a permanent state.

Studies of non-treatment populations, particularly Robin's work, suggest that ". . . narcotics addiction is not necessarily a permanent process and that heroin can be given up more easily than had been previously thought possible." Norman Zinberg's preliminary data concerning controlled heroin users suggests a similar conclusion.

6. Occasional use of heroin does not necessarily lead to addiction.

Robin's findings suggest that this may be so, but Kandel notes that the social environment in which Robin's subjects began their heroin use (i.e., Vietnam) was quite alien (and) ". . . it remains to be seen whether the same processes take place in situations in which users remain in the same geographical and social environment." Again, Zinberg's preliminary findings tend to support this conclusion.

Antecedents of drug use

7. Different factors are involved in the transitions into different stages of drug use.

Most relevant for the involvement of youth with drugs are Kandel's findings that ". . . Adolescent beliefs and values favorable to the use of marihuana and association with marihuana-using peers were the strongest predictors of initiation into marihuana. Poor relations with parents, feelings of depression, and exposure to drug-using peers were most important for initiation into illicit drugs other than marihuana."

8. Personality factors, indicative of maladjustment, precede the use of marihuana and of other illicit drugs.

The personality variables seemingly "predictive of subsequent involvement in marihuana are related to the following themes:" rebelliousness, lack of self-initiated tenderness, high value on independence, low sense of psychological well-being, low self-esteem, and lower academic aspirations and motivation.

9. Poorer school performance is a common antecedent of subsequent initiation into illicit drugs.

This finding was especially prevalent among high school rather than college students.

10. Delinquent and deviant activities precede involvement in illicit drugs.

It was suggested that the specific kind of delinquent activity can be predictive of different kinds of drug involvement. For example, minor delinquent acts (e.g., cheating on a test, minor stealing, driving too fast) may predict both hard liquor and marihuana initiation. Drug dealing and participation in major delinquent activities may predict marihuana use and, particularly, initiation into other illicit drugs.

11. A constellation of attitudes and values favorable to deviance precedes involvement in illicit drugs.

These studies suggested that "attitudes and values that are favorable to deviance and reflect lessened conformity to social institutions" may also predict subsequent drug involvement.

12. There is a process of anticipatory socialization in which youths who will initiate the use of drugs develop attitudes favorable to the use of legal and illegal drugs prior to initiation.

"Initiation to each of three forms of drug use—hard liquor, marihuana, and other illicit drugs—was preceded by beliefs that use of the specific drug in each case, especially casual use, was not harmful." Attitudes were especially important to predicting subsequent initiation to marihuana.

13. Drug behavior and drug related attitudes of peers are among the most potent predictors of drug involvement.

Strongest peer-related predictors were extent of perceived drug use in the peer group, self-reported drug-use by peers, and perceived peer tolerance for drug use. However, ". . . peer influences were not as important to the prediction of initiation to hard liquor and to other illicit drugs as they were for marihuana." Finally, ". . . greater closeness to and reliance on peers as opposed to parents were also predictive of subsequent marihuana use."

14. Parental behaviors, parental attitudes, and parental closeness to their children have differential importance at differential stages of involvement in drugs.

"Parental models, in the form of use of hard liquor, predict adolescent initiation both to hard liquor and to other illicit drugs, although they do not predict marihuana use. Parental use of psychoactive drugs predicts initiation to other illicit drugs. Parents' specific rules against the use of drugs are ineffective, but parents' tolerance of marihuana use by their children or their belief in the harmlessness of various drugs favor subsequent drug use by their children. Lack of closeness between parents and children predicts subsequent initiation to marihuana and, especially, to other illicit drugs. Analyses of changes in frequency of marihuana use over time indicate that although parents appear to be able to shield their children from initial involvement in heavy drug use, they do not have the ability to help their children give up a habit of heavy use once it is formed. In a high school sample, parental influences were, however, of greatest importance in the third stage of drug involvement: the use of other illicit drugs."

15. Sociodemographic variables hold little predictive power for initiation into marihuana.

16. Age of onset of drug use declines as degree of proneness to deviance increases.

17. A social setting favorable to drug use reinforces and increases individual predisposition to use.

Again, Robin's study suggests the powerful influence of the social setting. She concluded that "a setting with greater opportunities to express deviant behavior increases the impact of prior predispositions to deviance." Zinberg, also, is considering these factors, which he terms "setting variables." Kandel notes that no contextual effects directly relevant to adolescent drug use have yet been studied.

Consequences of drug use

18. Nonaddictive illicit drug use has not been shown to lead to increased criminality.

Johnston's study concludes that "the hypothesis that the association between nonaddictive drug use and other forms of delinquency exists because such drug use somehow causes other kinds of delinquency has suffered a substantial, if not mortal, blow." Rather, they assert, ". . . the association results from characteristics of the social environment in which drug users live and from the personality characteristics of the users."

19. Drug use has not been shown to lead to the amotivational syndrome.

The findings thus far suggest although there is an association at one time point between indicators of the amotivational syndrome and drug use, such states precede the use of drugs.

II. POSSIBLE THEMES

Review of the findings compiled by Kandel summarized above and of other relevant psychosocial research suggests several themes which could be touched upon in such a wide-ranging topic as "Youth and Drugs." Several of these suggested themes are outlined below:

(*a*) *Findings from longitudinal studies, while not upbeat, do not present as dismal a picture of youthful drug use as has been traditionally envisioned.*—While avoiding a Pollyanna or ostrich-like stance, the findings concerning a cessation of use and lack of association between criminality and drug use as well as the amotivational syndrome and drug use could be presented.

(*b*) *The influence of peers is probably the strongest factor in the initiation and continuation of drug use.*—A point for emphasis here might be that the perception of peer attitudes and levels of use are as important as actual attitudes and levels of use (i.e., All that maybe necessary for a youth to initiate or continue his drug use is that he thinks that his friends either approve of drug use or use drugs themselves).

(*c*) *While the effect of peer influence may be more pervasive in adolescence, the role of the family in the prevention or minimization of drug use may be more powerful at certain critical times.*—This could be related to crisis theory, i.e. that a crisis represents a turning point and that guidance and comfort may have a particularly strong influence at this time. Emphasizing this point may also stave off disaffected family-oriented members of the audience who threatened to storm the stage earlier when peer influence was accorded pre-eminence.

(*d*) *Environmental, or social setting, influences may be asserting a powerful, if not tangible, effect on adolescent drug use.*—The accumulation of nearly 15 years of widespread college student use of marihuana and the attitudes this has spawned among over half a generation, the nearly daily media discussions of decriminalization, the deemphasis of police action against marihuana use, changing community values, as well as other influences has certainly had an effect, albeit difficult to measure, on drug use (not only marihuana). However, one *preliminary* study (Stuart, 1975) suggests that decriminalization does not result in increased use of marihuana.

(*e*) *Prevention should be pursued but this cannot be done in a blind "stamp it all out" sense.*—The term "enlightened prevention" comes to mind (as does, unfortunately, Moynihan's "benign neglect" term also come to mind) in that, at the risk of sounding defeatist, while we cannot hope to *eliminate* "demand" (in Congressman Wolff's words) we can make (and have made) great strides in predicting who may be at risk and in providing a potential user with as much information as possible to use in making a decision (if he or she chooses to use or put trust in that information).

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Mr. NEAL. Please; and feel free to advise us on this committee in any way at this time or any other time. I would like to get back for a moment to the question of Valium, even though I know that isn't the primary subject of our hearings. But how many prescriptions were written for Valium last year? Do you know?

Dr. POLLIN. I am sorry. I don't have that figure available.

Mr. NEAL. I was told 57 million.

Dr. POLLIN. That would be consistent with what I believe to be the case, but I am just not certain.

Mr. NEAL. 57 million prescriptions each for what? Multiple numbers of Valium pills? Is that the idea? How many Valium pills? 9 million pills a day of Valium were prescribed, I am told; 9 million pills a day. Would that ring true, do you think?

Dr. POLLIN. I am just not certain. I don't know. The average prescription, I would suspect, would call for between 25 and 50 pills. So that if you multiply the 57 million times 25, we should come up with approximately the same figure.

But it is a very widely prescribed drug, and the figures would seem to me to be approximately in the proper order of magnitude.

Mr. NEAL. Well, I won't stay on it very long, and maybe I am wrong. That is why I am asking the question. But I have been told there are clear-cut physical withdrawal symptoms that result from the cessation of use of Valium, and that there are not these kinds of withdrawal symptoms that occur from a cessation of the use of marihuana.

And we are cautioning people, properly, I think, about the health problems associated with marihuana. But are we cautioning adequately, do you think, on the question of Valium use? Or would that caution be appropriate?

Dr. POLLIN. I think the caution is appropriate. There has been a very noticeable increase in the amount of attention and concern paid to this whole area of either illicit use or misuse of prescription drugs, with much of the focus being on Valium during the past year.

And judged by the marked increase in the number of articles which appear in the daily press, as we see them in our NIDA clipping service, I think that there has been an appropriate and a very marked increase in public awareness of the fact that this drug, though relatively safe, like all other drugs, has to be treated with a certain amount of caution.

I am sure you have noticed that whereas 2 or 3 years ago, one never heard mention of Valium on the talk shows, that it is one of the common subjects of talk shows these days.

I might say, Mr. Neal, that I am not certain in my own mind what basically are the pros and what are the cons of making the kinds of

comparisons, explicit and implicit, that we are making at this stage in the hearing with regard to Valium as compared to marihuana.

Valium, like any psychoactive drug, is a drug which can and sometimes does cause serious problems. It is a drug, though, which is usually used under medical supervision. It is a drug which tends to be used by a different segment of the population.

And I would welcome some clarification as to how this particular comparison helps to clarify or to deal more successfully with the problems presented by marihuana.

Mr. NEAL. In my own mind, I am trying to understand, and I am not sure, I can offer any help at all. But from my understanding, I am told on the one hand that Valium can be physiologically addictive, and that there can be severe withdrawal symptoms experienced from the cessation of its use. And there have been deaths reported from withdrawal. And yet, none of these are true of marihuana. Yet we are legally prescribing millions of pills of Valium, and marihuana is an illegal substance.

I am just trying to understand how all this fits together; and it is not entirely clear to me at this point.

You just made the statement that Valium is relatively safe, and marihuana is relatively unsafe. You know, I am sure politically that makes a lot of sense. But is that scientifically verifiable? Does that make sense?

Dr. POLLIN. Well, again, I would point to the issue of the levels of use, the conditions of use, the demonstrable therapeutic indications for Valium, which are of a kind that doesn't exist for marihuana.

But as to the fact that one of them is legally available and the other isn't, that paradox, it seems to me, becomes even more difficult to comprehend when one looks at the different way we treat tobacco as compared to the whole range of illicit drugs.

Mr. NEAL. Or alcohol.

Dr. POLLIN. Or alcohol.

Mr. NEAL. There are certainly some ironies here that are beyond my immediate comprehension. And I assume that is what you are saying, too.

Dr. POLLIN. That's right.

Mr. NEAL. It is hard to make sense of the way we treat these various substances, isn't it?

Dr. POLLIN. If one looks at the totality of psychoactive substances used in any society, or this society, and with, starting from scratch, it would be hard to think of what kind of rationality would lead to our present system.

But given the fact that we have our present system, we do have to ask ourselves: Are there any drugs which the society wishes to make illegal, or do we wish to make all drugs illegal?

To my knowedge, practically no one has suggested that we make all drugs legally available, or very few people suggest that. If we accept the fact that there has to be a certain category of drugs which are illegal, then the question becomes, where do we draw that boundary line? And that is a very difficult question.

On the other hand, we saw that in the panel Tuesday morning which reflected a wide diversity in points of view. There was no one on that

panel who suggested they thought it was a good idea, at this point, to legalize marihuana.

Mr. NEAL. Well, I certainly am not suggesting that, either.

Dr. POLLIN. I realize that.

Mr. NEAL. What I am trying to do is understand the logic in all of this. And the only way I know to gain that understanding is to try to put it in some sort of perspective.

I think if we were starting now with the known health hazards of alcohol, and if it were an illegal substance, we probably wouldn't think of making it legal, based on the same logic that we are following here.

I am just personally finding it difficult to understand. That is the purpose of these hearings. We are hoping to gain a better understanding.

Well, I have got the second bell on a vote. I would like to ask you, if I can, as we did earlier in the hearings, maybe to give a little bit of further thought to these eight points and to the possible refinements of them, in hope that we might at least start with some agreement, somewhere, and see where we go from there.

Of course, I have no idea where that might be. There was one other question that I had here, and that was that I understand that out of your $3.8 million research project, that $1.6 million of that goes to Columbia University. That is almost half to one school, or one research facility.

Is that because that facility specializes in that area? Or is there some other reason?

Dr. POLLIN. I would like to have an opportunity to review those figures. The $3.8 million is the amount of our research funds that went this past fiscal year for marihuana research.

Mr. NEAL. That is what I am talking about.

Dr. POLLIN. The bulk, the great bulk, of those moneys which go to Columbia University do not go to marihuana research. I believe that the bulk of those funds go to the Center for Psychosocial Research, which takes up the whole spectrum of drug problems, drug use, behaviors. And it is inappropriate to compare the $1.6 million or $1.8 million, whatever figures you quoted, to the $3.8 million, since——

Mr. NEAL. I was just handed a figure; and I am sorry, I have no background on it whatsoever.

I just want to thank you all for appearing this morning, and for helping us try to understand this subject.

MARIHUANA STUDIES AT COLUMBIA UNIVERSITY, FISCAL YEAR 1978

Research project	Project head	Title of project	Amount
1 R13 DA/DA-02077	Nahas	Symposium on marihuana: Detection, effects on brain and reproduction.	$7,985
5 R01 DA/DA-00894	Hembree	Marihuana effect on DNA in zygotes	137,851
5 R01 DA/DA-01476	Morishima	Errors of chromosome segregation induced by drugs	53,704
5 R01 DA/DA-01838	Comitas	Diachronic and synchronic variations in cannabis use	14,355
2 P01 DA-01097-06	Comitas	Cross national study of consequences of cannabis use	0
Total			213,895

Dr. POLLIN. I would like to thank you, Mr. Neal, for bringing a new atmosphere of rationality and real constructive interest to a field which in the past has often been very heavily colored by heat, rather than light.

Mr. NEAL. Well, thank you. In terms of your appearance, we look forward to your appearance again.

The Select Committee now stands adjourned, subject to the call of the Chair.

[Whereupon, at 1:08 p.m., on July 19, 1979, the Select Committee adjourned, subject to the call of the Chair.]

PREPARED STATEMENT OF WILLIAM POLLIN, M.D., DIRECTOR, NATIONAL INSTITUTE ON DRUG ABUSE, DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Mr. Chairman and members of the Committee, I thank you for your invitation to appear this morning to discuss the health hazards related to marijuana use. Accompanying me this morning from the Institute's Division of Research staff are Marvin Snyder, Ph. D., Acting Director; Robert C. Petersen, Ph. D., editor of the annual report to Congress on marijuana and health and Assistant to the Director; Stephen C. Szara, M.D., Chief of the Biomedical Branch; Robert Willette, Ph. D., Chief of the Research Technology Branch; and Monique C. Braude, Ph. D., Research Pharmacologist.

We are very concerned about the health hazards of marijuana use. These hazards are described in the Seventh Annual Marijuana Report to the Congress from the Secretary of Health, Education, and Welfare, which was released on April 18, 1979. This report summarized recent research on the medical and social effects of marijuana use and pointed out the dramatic increase in marijuana smoking among teenagers and adolescents.

A need remained, however, for a comprehensive review of marijuana research efforts that would identify the most urgently needed and promising lines of inquiry upon which future decisionmaking in this area could be based. Therefore, Secretary Califano announced that the Department of HEW will undertake a comprehensive review of the existing scientific evidence on marijuana. This review will encompass research into the physiological effects of chronic marijuana use, as well as behavioral research on use related problems, such as intervention strategies to help adolescents resist peer pressure, evaluate evidence, and assess risks.

Responsibility for seeing that this review is conducted has been assigned to the National Institutes of Health (NIH). An independent scientific group will implement this review and is expected to produce a report within twelve months.

Since 1967, the Federal Government has spent approximately $35 million on marijuana research to support over 1,000 research projects. This research effort continues. For example, this fiscal year, fiscal year 1979, NIDA alone will support approximately 100 research studies totalling $3.8 million. NIDA-supported research includes investigations into the effects of marijuana on the heart and lungs, on psychological, social, and physical development, and pregnancy, as well as research into possible medical use, including the treatment of glaucoma.

Mr. Chairman, presently available evidence clearly indicates that marijuana is not a "safe" substance. While I will not attempt this morning to review all of the scientific findings described in the "Marijuana and Health Report," I would like to briefly indicate to the Committee what the hazards of marijuana use are for adolescents and to various organs and systems of the human body. My colleagues and I can discuss specific findings.

ACUTE INTOXICATION IMPAIRS LEARNING, MEMORY AND INTELLECTUAL PERFORMANCE

Virtually all of the many studies which have been done of performance while "high" converge toward the conclusion that marijuana interferes with immediate memory and intellectual performance in ways that impair thinking, reading comprehension, verbal and arithmetic problem solving. Less familiar, more difficult tasks are interfered with more than well-learned performance, and the effect depends on the amount used and the tolerance for the effect.

MARIJUANA INTOXICATION IMPAIRS DRIVING AND OTHER SKILLED PERFORMANCE

Evidence strongly suggests that being "high" interferes with driving, flying and other complex psychomotor performance at usual levels of social usage. With the exception of one early, rather inadequate study, research involving such diverse areas as perceptual components of the driving task, driver and flight simu-

lator performance, test course and actual driving behavior, all tend to show significant performance and perceptual deficits related to being high that make functioning more hazardous.

While there have been no major recent studies, there is now some evidence that marijuana use at typical social levels may impair driving ability and related skills. Studies indicating impairment of driving skills include: laboratory assessment of driving-related skills,[1] driver simulator studies,[2] test course performance,[3] and actual street driver performance.[4] A study conducted for the National Highway Traffic Safety Administration of drivers involved in fatal accidents also suggests possible marijuana involvement.[5]

Despite their commonly expressed belief that their driving skills are impaired by cannabis intoxication, there is reason for believing that more marijuana users drive today while "high" than was true in the past.[6] As use becomes increasingly common and socially acceptable and as the risk of arrest for simple possession decreases, still more people are likely to risk driving while "high." In limited surveys, from 60 percent to 80 percent of marijuana users questioned indicated that they sometimes drive while high.[7, 8, 9] Marijuana use in combination with alcohol is also quite common and the risk of the two drugs used in combination may well be greater than that posed by either alone.

A study reported in 1976 of drivers involved in fatal accidents in the greater Boston area was conducted by the Boston University Accident Team. They found that marijuana smokers were overrepresented in fatal highway accidents as compared to a control group of nonsmokers of similar age and sex.

There are several converging lines of evidence that simulated driving performance for some subjects can be impaired when under the influence of marijuana, including users' subjective assessments of their driving skills while "high," measures of driving-related performance, and finally, a limited study of actual highway fatalities.

The degrees of impairment for the average driver under various dosages of marijuana cannot yet, however, be adequately specified and we are working with the National Highway Traffic Safety Administration to develop reliable standards for what constitutes driving under the influence of cannabis so as to encourage more responsible use. At present, it is clearly desirable to discourage driving while marijuana-intoxicated.

A research monograph summarizing what was known through 1975 about the effects of drugs, including marijuana, on driving and related psychomotor performance has been published by the National Institute on Drug Abuse.[10]

While there have been no recent studies, research thus far indicates that even experienced pilots undergo marked deterioration in performance under flight simulator test conditions while "high." Thus, flying an aircraft while marijuana-intoxicated should be considered dangerous.[11, 12]

A continuing danger common to both driving and flying is that some of the perceptual or other performance decrements resulting from marijuana use may

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[1] Moskowitz, H., McGlothlin, W. and Hulbert, S. The effects of marijuana dosage on driver performance. Contract No. DOT–HS–150–2–236, University of California, Los Angeles, California. 1973.

[2] Moskowitz, H. Marihuana and driving. "Accident Analysis and Prevention", 8(1) :21–26, 1976.

[3] Klonoff, H. Effects of marijuana on driving in a restricted area and on city streets: Driving performance and physiological changes. In: Miller, L.L., editor. "Marijuana: Effects on Human Behavior." New York: Academic Press. 1974. pp. 359–397.

[4] Klonoff, H. Marijuana and driving in real-life situations. Science, 186 :317–324, 1974.

[5] Sterling-Smith, R.S. A special study of drivers most responsible in fatal accidents. Summary for Management Report, Contract No. DOT HS 310–3–595. April, 1976.

[6] Thompson, P. "Stoned" driving is unpleasant, say marihuana smokers. The Journal (Addiction Research Foundation), 4(1) :13, 1975.

[7] Klonoff, H. Marihuana and driving in real-life situations. Science, 186 :317–324, 1974.

[8] Klonoff, H. Effects of marihuana on driving in a restricted area and on city streets: Driving performance and physiological changes. In: Miller, L.L., editor. "Marihuana: Effects on Human Behavior. New York: Academic Press. 1974. pp. 121–155.

[9] Smart, R.G. Marihuana and driving risk among college students. Journal of Safety Research, 5(4) :155–158, 1974.

[10] Willette, R.E., editor. "Drugs and Driving." National Institute on Drug Abuse Research Monograph 11. DHEW Pub. No. (ADM) 77–432. National Institute on Drug Abuse. 1977.

[11] Janowsky, D.S., Meacham, M.P., Blaine, J.D., Schorr, M., and Bozzetti, L.P. Simulated flying performance after marihuana intoxication. Aviation, Space and Environmental Medicine, 47(2) :124–128, 1976.

[12] Janowski, D.S., Meacham, M.P., Blaine, J.D., Schorr, M., and Bozzetti, L.P. Marihuana effects on simulated flying ability. American Journal of Psychiatry, 133(4) :383–388, 1976.

persist for some time, possibly several hours, beyond the period of subjective intoxication. Under such circumstances, the individual may attempt to fly or drive without realizing that his or her ability to do so is still impaired although he or she no longer feels "high." Ongoing studies are attempting to further delineate these issues with driving.

EFFECTS ON THE HEART

Acute effects of marijuana use on heart function in healthy young male volunteers have been viewed as benign. However, the increased heart rate produced and evidenced that chest pain associated with poor circulation to the heart muscle occurs more rapidly with marijuana use than with cigarette smoking, have led to a consensus that those with heart conditions, or at high risk, should not use marijuana.[13]

EFFECTS ON LUNG FUNCTIONING

Since, like tobacco, marijuana is usually smoked and typically deeply inhaled, adverse pulmonary effects may be expected. Based on both clinical observation and laboratory measurement, marijuana shows evidence of interfering with lung function and producing bronchial irritation in habitual users.[14] One study has found that smoking four or more "joints" per week decreases vital capacity—the amount of air the lungs can move following a deep breath—as much as smoking nearly a pack of cigarettes a day. This comparison, while widely quoted, needs confirmation by independent studies. As yet, there is no direct clinical evidence that marijuana smoking causes lung cancer. It has been reported that marijuana smoke contains more carcinogens than tobacco, that in animal testing the smoke residuals produce skin tumors, and there is laboratory evidence that human lung tissue exposed in the test tube to marijuana smoke shows more cellular changes than when exposed to similar amounts of standard tobacco smoke. Very heavy marijuana smoking by healthy young male subjects under controlled experimental conditions has been demonstrated to cause mild but statistically significant airway obstruction.[15] Under conditions of ready availability, there is also evidence that the number of marijuana cigarettes consumed (up to ten "joints" daily) may approach that of tobacco cigarettes.[16]

Animal research done under NIDA support by Dr. Harris Rosenkrantz, and reported at the Rheims Conference last year and at the recent 2nd Annual Conference on Marijuana held in New York City on June 28 and 29 of this year, also strongly supports the likelihood of lung damage from chronic marijuana use. Dr. Rosenkrantz gave marijuana by inhalation to rats in specially constructed equipment to produce blood levels of THC that closely approximated blood levels achieved from daily human use. After daily exposure for periods of from 3 months to 1 year, these animals showed extensive lung inflamation and other evidence of lung damage not found in animals exposed to tobacco or to inert marijuana smoke. The period of exposure would correspond to about one-eighth to one-half of the animal's normal lifespan.[17]

From the total body of clinical and experimental evidence accumulated to date, it appears highly likely that daily use of marijuana may lead to lung damage similar to that resulting from heavy cigarette smoking. Since marijuana smokers often smoke tobacco and marijuana, the effects of the combination require additional study. Earlier studies of this effect among chronic users in Jamaica, Greece, and Costa Rica may have presented misleading data in this respect since traditional users in those countries may not inhale as deeply or retain smoke in their lungs in the same way as do American users.[18]

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[13] Prakash, R. and Aronow, W.S. Effects of marihuana in coronary disease. Reply. Clinical Pharmacology and Therapeutics, 19(1):94–95. 1976.

[14] Henderson, R.L., Tennant, F.S., and Guerney, R. Respiratory manifestations of hashish smoking. Archives of Otolaryngology, 95:245–251, 1972.

[15] Tashkin, D.P., Shapiro, B.J., Lee, Y.E., and Harper, C.E. Subacute effects of Heavy marihuana smoking on pulmonary function in healthy men. New England Journal of Medicine, 294:125–129, 1976.

[16] Cohen, S., Lessin, P.J., Hahn, P.M., and Tyrrell, E.D. A 94-day cannabis study. In: Braude, M.C. and Szara, S., editors. Pharmacology of Medicine. New York: Raven Press. 1976. pp. 621–626.

[17] Rosenkrantz, H. and Fleischman, R. W. Effects of cannabis on lungs. In Nahas, G. and Paton, W., editors. "Marihuana: Biological Effects, Analysis, Metabolism, Cellular Responses, Reproduction and Brain." Proceedings of the Second Satellite Symposium on Marijuana 7th International Pharmacological Congress. New York: Pergamon Press, 1979.

[18] Peterson, R. C. Importance of inhalation patterns in determining effects of marihuana use. Lancet, vol. 1 for 1979 (8118):727, 1979.

EFFECTS ON THE IMMUNE SYSTEM

Research findings are divided as to whether marijuana use adversely affects the body's natural defenses against infection and disease. Of the studies reviewed, the majority have shown that such an alteration occurs. Whether or not such changes, when they are found, have practical implications for users is not known at this time.

Because of the importance of the body's immune response in the preservation of health, reports of impairment of this vital function by marijuana must be carefully considered. Two research reports, however, are germane to the issue. In one of these, 13 chronic (once a week or more for 1 year or more) male marijuana smokers from 22 to 26 years of age were compared to a sample of 8 matched nonsmokers.[19] A comparison of T-lymphocyte functions, white blood cell formation central to the immune response, was made. While it was found that marijuana smoking did affect T-cell function, the authors observe that "these effects are transitory, vary significantly from subject to subject, and are closely related to the time at which the samples (i.e., the blood samples tested) are obtained." They conclude that "If, in fact, the effects of marijuana smoking are deleterious to man, it would appear to us that the only way to determine this would be to identify a group of marijuana smokers who have demonstrated alterations in several T-cell functions and to follow them prospectively."

A second study of 10 chronic (2x/week or more) marijuana smokers who smoked from 5 to 12 marijuana cigarettes under closed ward experimental conditions found alteration in early T-cell rosette formation, although the total number of T-cells in peripheral blood remained unchanged. The authors report a reduction in early rosette formation has been noted in patients with known reductions in immunity (patients with cancer, some infectious disorders and those receiving immunosuppressive treatment), however, they conclude that the clinical significance of their findings remains in doubt in the absence of clinical evidence of greater disease susceptibility in marijuana smokers.[20]

Three reports based on work in two laboratories have reported reductions in the immune response in mice and rats treated with high, but humanly relevant, doses of inhaled marijuana smoke or oral THC in one laboratory and injected with THC in another. In both, there was a definite suppression of the animals' immune response.[21, 22]

Taking the body of animal and human evidence as a whole, the results to date are far from clearcut in establishing whether or not the human immune response is impaired by marijuana.

BRAIN DAMAGE RESEARCH

A British research report, which originally appeared in 1971, attributed brain atrophy to cannabis use in a group of young male users.[23] It continues to be widely cited, particularly in the mass media. In the original study, 10 patients, with histories of from 3 to 11 years of marijuana use, were examined by a neurological technique (air encephalography) used to detect gross brain changes. The authors concluded that their findings suggested that regular use of cannabis may produce brain atrophy. This research was faulted on several grounds: all of the patients had used other drugs, making the causal connection with marijuana use questionable; and the appropriateness of the comparison group and diagnostic technique was questionable. Although little new evidence has appeared, the potential seriousness of the original observations justifies a brief review of several subsequent studies bearing on the original British observations.

In a study of chronic Greek users, a different technique (echoencephalography) was employed to determine whether brain atrophy might be present in heavy users. (Air encephalography was not used because the hazards of that technique were not ethically justifiable for purely research purposes.) The findings from

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[19] Rosenthal, M. Marijuana and Effects on Adolescents. Paper presented at the Second Annual Conference on Marijuana, New York City, June 20, 1979.

[20] Cushman, P. and Khurana, R. A controlled cycle of tetrahydrocannabinol smoking: T and B cell rosette formation. Life Sciences, 20:971-980, 1977.

[21] Rosenkrantz, H. The immune response and marihuana. In: Nahas, G.G., editor. "Marihuana: Chemistry, Biochemistry and Cellular Effects." New York: Springer-Verlag, 1976.

[22] Zimmerman, S., Zimmerman, A.M., Cameron, I.L., Laurence, H.L. Delta-9-tetrahydrocannabinol, cannabidiol, and cannabinol effects on the immune response of mice. Pharmacology, 15:10-23, 1977.

[23] Campbell, A.M.G., Evans, M., Thompson, J.L.G., and Williams, M.R. Cerebral atrophy in young cannabis smokers. Lancet, (1219), 1971.

the Greek study were negative; that is, users were not found to differ from nonusers in terms of the size of their brain ventricles.[24]

Two studies were subsequently conducted in Missouri and Massachusetts.[25, 26] They examined two samples of young men with histories of heavy cannabis smoking using computerized transaxial tomography (CTT), a brain scanning technique for visualizing the anatomy of the brain. In both studies, the resulting brain scans were read by experienced neuroradiologists, independent of the drug histories. In neither was there any evidence of cerebral atrophy. Several additional points should, however, be stressed. Neither study rules out the possibility that more subtle and lasting changes of brain function may occur as a result of heavy and continued marijuana smoking. It is entirely possible to have impairment of brain function from toxic or other causes that is not apparent on gross examination of the brain in the living organism. One researcher has used electrodes implanted deep within the brains of monkeys instead of more conventional scalp recording techniques to record brain electrical activity changes related to marijuana use. He has found persistent changes related to chronic use.[27] This same investigator has reported that rhesus monkeys trained to smoke a joint of marijuana 5 days per week for 6 months show persistent microscopic changes in brain cellular structure following this treatment.[28]

While both these experiments demonstrate the possibility that more subtle changes in brain functioning or structure may occur as a result of marijuana smoking, at least in animals, the implications of these changes for subsequent human or animal behavior are at present unknown. Other studies, using more conventional EEG techniques to measure brain electrical activity, have found changes temporarily associated with acute use, but no evidence of persistently abnormal EEG findings related to chronic cannabis use.[29, 30]

As I indicated earlier, many clinicians feel that regular marijuana use may seriously interfere with psychological functioning and personality development, especially in childhood and adolescence.[10, 31] There is increasing clinical concern that at least some percentage of regular heavy daily users do develop a psychological dependence on marijuana to the extent that it interferes with functioning in a way analogous to heavy alcohol use.

The question of whether or not enduring psychological effects occur in chronic users remains to be resolved. While three more carefully controlled studies of heavy users in Jamaica, Greece, and Costa Rica [32, 33, 34] failed to find evidence of marijuana-related psychological impairment, it is possible that the mode of use there differed from American use. Overall, of the studies reviewed, the majority have suggested enduring impairment occurs. The quality of studies in this area, in particular, is highly variable, leaving the issue in significant doubt.

EFFECTS ON THE ENDOCRINE SYSTEM

There is evidence that marijuana can affect the network of glands and hormones which are involved in such functions as growth, energy levels and reproduction. Levels of the male hormone testosterone have been found to be

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[24] Stefanis, C., Dornbush, R. and Fox, M. (Eds.) "Hashish, Studies Long-Term Use." New York: Raven Press. 1977.

[25] Co, B.T., Goodwin, D.W., Gado, M., Mikhael, M., and Hill, S.Y. Absence of cerebral atrophy in chronic cannabis users. Journal of the American Medical Association, 237 (12) :1229–1230, 1977.

[26] Kuehnle, J., Mendelson, J.H., Davis, D.R., and New, P.F.J. Computed tomographic examination of heavy marihuana smokers. Journal of the American Medical Association, 237 (12) :1231–1242, 1977.

[27] Heath, R.G. Marihuana and delta-9-THC: Acute and chronic effects on brain function of monkeys. In: Braude, M.C. and Szara, S., editors. Pharmacology of Marihuana. New York: Raven Press. 1976. pp. 345–356.

[28] Harper, J.W., Heath, R.G., and Myers, W.A. Effects of cannabis sativa on ultra structure of the synapse on monkey brain. Journal of Neuroscience Research. 3 :87–93, 1977.

[29] Fink, M., Volavka, J., Panagiotopoulos, C.P., and Stefanis, C. Quantitative EEG studies of marihuana, delta–9–THC, and hashish in man. In: Braude, M.C. and Szara, S., editors. Pharmacology of Marihuana. New York: Raven Press. 1976. pp. 383–392.

[30] Klonoff, ?. and Low, M.D. Psychological and neurophysiological effects of marihuana in man: An interaction model. In: Miller, L.L., editor. "Marihuana: Effects on Human Behavior." New York: Academic Press. 1974. pp. 121–155.

[31] Voth, H. Marijuana and Effects on Young Adults. Paper presented at the Second Annual Conference on Marijuana. New York City. June 20, 1979.

[32] Coggins, W.J., Costa Rica cannabis project: An interim report on the medical aspects. In: Braude, M.C. and Szara, S., editors. "Pharmacology of Marihuana." New York: Raven Press. 1976. pp. 667–670.

[33] Rubin, V. and Comitas, L. "Ganja in Jamaica: The Effects of Marihuana." New York: Anchor/Doubleday. 1976.

[34] Levy, S. and McCallum, N.K. Cannabidiol and its pharmacokinetic interaction with delta-1-tetrahydrocannabinol. Experientia. 31 :1208–1209, 1975.

reduced (though still within normal range) in some, but not all, studies. There is animal and human preliminary evidence that relatively heavy use ranging from several times a week to daily use may reduce fertility in women. Of 11 studies dealing with these areas, 7 have reported endocrine changes, with 4 reporting no such change. The long-term significance of these results remains to be determined. Concern over possible effects on adolescent development and possible interference with sexual differentiation of the male fetus whose mother smokes marijuana during pregnancy has been expressed.

REPRODUCTIVE EFFECTS OF MARIJUANA

Because of the potential importance of marijuana's effects on reproduction and the publicity given some of the recent studies reported at a conference held in Rheims, France, a more detailed review of this area may be helpful. There are a variety of both animal and human studies suggesting that marijuana used daily and in substantial amounts similar to those of a regular heavy tobacco smoker may adversely impair aspects of the reproductive function. In one study of 16 male, healthy, chronic marijuana users smoking from 8 to 20 standard marijuana cigarettes per day for 4 weeks in a hospital environment, found a significant decline in sperm concentration and total sperm count.[35] Evidence was also found of a decrease in the motility of the sperm. In this and another study, abnormalities of structure in the sperm of heavy users were detected.

Three studies in animals of the effects of marijuana on testicular functioning, including the production of sperm, have also found adverse effects.[36, 37, 38] While the clinical implications of such findings are not yet known, and the effects noted may be reversible when marijuana use is stopped, they do indicate a basis for concern. Reduced levels of testosterone in male users, though still within the normal range, have been reported by some but not all the investigators.[39, 40, 41, 42]

Animal and human research on female reproductive function has detected changes that may have serious implications for human reproductive capacity. Because of the restrictions on experimental administration of marijuana to women, little is known about the effects of the drug on human female endocrine and sexual functioning. One recently completed study of 26 females who used "street" marijuana three times a week or more for 6 months or more found that these women had three times as many defective monthly cycles (38.3 percent defective vs. 12.5 percent of the cycles of nonusers) as nonusing women. By "defective" was meant a failure to produce a ripened egg during the cycle or a possibly shortened period of fertility. Unfortunately, since the marijuana-using women also used more alcohol, it cannot be assumed that the effects observed were necessarily the result of marijuana use.[43]

Several animal studies reported at the Rheims Conference are also relevant to female reproductive function. Using high but humanly relevant doses of marijuana or THC, five studies indicated a variety of possible problems.[44, 45,

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[35] Hembree, W., Huang H., and Nahas, G. Effects of marihuana smoking on gonadal function of man. In: Nahas, G. and Paton, W., editors. "Marihuana: Biological Effects." New York: Pergamon Press. 1979. (See reference 12).

[36] Harclerode, J., Nyquist, S.E., Nazar, B., and Lowe, D. Effects of cannabis on sex hormones and testicular enzymes of the rodent. In: Nahas, G. and Paton, W., editors. "Marihuana: Biological Effects." New York: Pergamon Press. 1979. (See reference 12).

[37] Zimmerman, M., Zimmerman, S., and Yesoda Raj, A. Effects of cannabinoids on spermatogenesis in mice. In: Nahas, G. and Paton, W., editors. "Marihuana: Biological Effects. New York: Pergamon Press. 1979. (See reference 12).

[38] Huang, H., Hembree, W., and Nahas, G. Effects of marihuana smoke on spermatogenesis in rats. In: Nahas, G. and Paton, W., editors. "Marihuana: Biological Effects." New York: Pergamon Press. 1979. (See reference 12).

[39] Kolodny, R.C., Masters, W.H., Kolodner, R.M., and Toro, G. Depression of plasma testosterone levels after chronic intensive marihuana use. New England Journal of Medicine, 290:872–874, 1974.

[40] Coggins, W.J. Costa Rica cannabis project: An interim report on the medical aspects. In: Braude, M.C. and Szara, S., editors. Pharmacology of Marihuana. New York: Raven Press. 1976. pp. 667–670.

[41] Cushman, P. Plasma testosterone levels in healthy male marihuana smokers. American Journal of Drug and Alcohol Abuse, 2:269–275, 1975.

[42] Mendelson, J.H., Rossi, A.M., and Meyer, R.E., editors. "The Use of Marihuana, a Psychological and Physiological Inquiry. New York: Plenum Press. 1974.

[43] Bauman, J.E., Kolodny, R.C., Dornbush, R.L., and Webster, S.K. Effect of Chronic Marijuana Use on the Endocrine Function of the Human Female. Paper presented at the Second Annual Conference on Marijuana. New York. June 28, 1979.

[44] Rosenkrantz, H. Effects of cannabis on mental development of rodents. In: Nahas, G. and Paton, W., editors. "Marihuana: Biological Effects." New York: Pergamon Press. 1979. (See reference 12).

[45] Sassenrath, E., Chapman, L.I., and Goo, G.P. Reproduction in Rhesus monkeys chronically exposed to delta-9-THC. In. Nahas, G. and Paton W., editors. "Marihuana: Biological Effects." New York: Pergamon Press. 1979. (See reference 12).

[46, 47, 48] In one study of rats it was found that marijuana administered orally and by a smoking machine to pregnant rats resulted in the early death of embryos and their reabsorption.[44] A study of rhesus monkeys using humanly relevant dose levels indicated that reproductive losses were higher among marijuana-treated females than among nontreated females.[45] As with other drugs, the birth weight of male infants born to the treated female monkeys was also lower than that of male offspring of untreated animals. This finding is consistent with the greater vulnerability of male fetuses to adverse prenatal influences. Other work, again using humanly relevant dose levels, has found reductions in ovary and uterine weight and estrogen production.[46, 47]

These and other studies using higher doses of marijuana or THC all underscore the undesirability of use, especially during pregnancy. Research directly concerning effects on human reproduction is, however, very limited. We know of no clinical reports directly linking marijuana use and birth abnormality.

CHROMOSOME ABNORMALITIES

There is no new evidence to report in this area. While there were earlier reports of increases in chromosomal breaks and abnormalities in human cell cultures, more recent results have been inconclusive. The three positive studies in humans that have been reported have decided limitations.[48, 49, 50] All were retrospective—i.e., studies of those who had already used marijuana as compared to nonusers. Such variables as differences in life style, exposure to viral infections and possible use of other drugs, all known to affect chromosome integrity, could not be reliably assessed. In two of the studies, the aberrations observed were found only in a minority of the users.

Three other studies done prospectively (i.e., before and after use) have been reported. All were negative, although they too can be faulted for a variety of reasons: most important, the subjects of all three had at least some prior experience with marijuana. It is possible that the baseline levels of chromosome deficits may have been elevated by earlier casual marijuana use, thus masking a drug-related effect.[51, 52, 53]

A team investigating the effect of marijuana smoke on human lung cells in laboratory culture has found an increase in the number of cells containing an abnormal number of chromosomes.[54] Another investigator who previously reported a high proportion of cells in marijuana smokers with reduced numbers of chromosomes has more recently reported that the addition of delta-9-THC (the principal psychoactive ingredient of marijuana) to human white blood cell cultures also resulted in an increased frequency of cells with abnormally low chromosome numbers.[55] The implications of these findings continue to be uncertain.

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[46] Fujimoto, G.I., Kostellow, A.B., Rosenbaum, R., Morrill, G.A., and Bloch, E. Effects of cannabinoids on reproductive organs in the female Fischer rat. In: Nahas, G. and Paton, W., editors. "Marihuana: Biological Effects." New York: Pergamon Press. 1979. (See reference 12).

[47] Smith, C.G., Smith, M.T., Besch, N.F., Smith, R.G., and Asch, R.H. Effect of delta-9-tetrahydrocannabinol (THC) on female reproductive function. In: Nahas, G. and Paton, W., editors. "Marihuana: Biological Effects." New York: Pergamon Press, 1979. (See reference 12).

[48] Cozens, D.D., Clark, R., Palmer, A.K., and Harvey, D.J. The effect of a crude marihuana extract on embryonic and foetal development of the rabbit. In: Nahas, G. and Paton, W., editors. "Marihuana: Biological Effects." New York: Pergamon Press. 1979. (See reference 12).

[49] Kumar, S. and Kunwar, K.B. Chromosome abnormalities in canabis addicts. Journal of the Association of Physicians of India. 19:193-195. 1972.

[50] Stenchever, M.A., Kunysz, T.J., and Allen, M.A., Chromosome breakage in users of marihuana. American Journal of Obstetrics and Gynecology, 118: 106-113. 1974.

[51] Matsuyama, S.S., Jarvik, L.F., Fu, T.K., and Yen, F.S. Chromosome studies before and after supervised marihuana smoking. In: Braude, M.C. and Szara, S., editors. "Pharmacology of Marihuana." New York: Raven Press. 1976. pp. 723-729.

[52] Matsuyama, S.S., Yen, F.S., Jarvik, L.F., Sparkes, R.S., Fu, T.K., Fisher, H., Reclus, N., and Frank I.M. In vivo marihuana exposure and human lymphocyte chromosomes. Mutation Research. 1977.

[53] Nichols, W.W., Miller, R.C., Heneen, W., Bradt, C., Hollister, L., and Kanter, S. Cytogenetic studies on human subjects receiving marihuana and delta-9-tetrahydrocannabinol. Mutation Research, 26:413-417, 1974.

[54] Leuchtenberger, C. and Leuchtenberger, R. Correlated cytological and cytochemical studies of the effects of fresh smoke from marihuana cigarettes on growth and DNA metabolism of animal and human lung cultures. In: Braude, M.C. and Szara, S., editors. "Pharmacology of Marihuana." New York: Raven Press. 1976. pp. 723-729.

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Overall, there continues to be no convincing evidence that marijuana use causes clinically significant chromosome damage. However, it should be emphasized that the limitations of the research to date preclude definitive conclusions.

THE HAZARDS OF MARIJUANA VS. OTHER RECREATIONAL DRUGS

A question that frequently arises is how hazardous is marijuana as compared to alcohol and tobacco. As appealing as such a comparison is, it is also misleading on several grounds. Any comparison of alcohol and tobacco use and that of marijuana compares drugs with great differences in social acceptability, period of use, and degree of availability. The hazards of alcohol and tobacco are reasonably well known and the social and public health costs quite high. For example, full 10 percent of alcohol users have been described as having an alcohol problem, and alcohol has been implicated in half the automotive fatalities in the United States. The health costs of alcohol in terms of cirrhosis, mental illness, crime and industrial accidents can also be documented. A similar analysis can be done for tobacco. By contrast, marijuana has only recently become a popular substance; it remains illegal and most use is not habitual at present. Moreover, unlike cigarettes and alcohol, for which the health hazards can be reasonably well specified, much less is known about the implications of marijuana use.

Any consideration of the hazard a drug poses must take into account not only its present use, but also use that might be reasonably expected in the future. At present, this involves many imponderables such as the parameters of risk for various groups in our society at different levels of use, the likely circumstances of use, effects on user functioning and motivation of heavier use patterns, degree of use restriction possible, combined use with other drugs—to name but a few. As the history of the introduction of alcohol demonstrates, it is very difficult to anticipate the problems which will arise in a given society in advance. Thus, any attempt to compare the health impact of marijuana with that of alcohol and tobacco at current levels of use is certain to minimize the hazards of marijuana. But any comparison at levels of anticipated use involves many assumptions that are at best dubious and at worst may be dangerously misleading. Such a comparison seems, therefore, useless and undesirable until such time as the parameters of risk are better specified than they can be at present.

I believe we can state that there is no controversy with respect to the hazards of use by children and young people. Studies by Dr. Gene Smith which involve nearly 12,000 junior and senior high school students in the Boston area indicate that the earlier marijuana use begins, the more likely is use to become heavy use and to include other illicit drugs.[56] In addition, although there is still much to be learned about the impact of heavier use on the physical functioning of the child or adolescent, studies indicate that use may cause alterations in endocrine functioning which are more serious than endocrine involvements in older mature users.[57]

Unfortunately, the hesitancy of the scientific community in not drawing unwarranted definitive conclusions from what are preliminary research findings has led many to conclude that marijuana is without serious medical hazard, even for the very young. In reality, the situation is more like that following the popularization of cigarette smoking at the time of World War I. It required 50 years of research for the truly serious implications of cigarette smoking to become apparent.

In view of the rapidly increasing numbers of high school students who use marijuana on a daily basis during the course of the school day, these findings are especially worrisome. For example, figures derived from an ongoing study of successive yearly nationwide samples of high school seniors indicate that as of 1978 one in nine smoked marijuana daily—nearly twice as many as in 1957.

In two states, Maryland[58] and Maine,[59] still more recent figures indicate nearly one in six high school students use marijuana daily or nearly daily.

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[56] Smith, G.M. and Fogg, C.P. High school performance and behavior before and after initiation of illicit drug use. Federation Proceedings, 35(3):564, 1976.

[57] National Institute on Drug Abuse, "Marihuana and Health: Seventh Annual Report to the U.S. Congress from the Secretary of Health, Education, and Welfare." National Institute on Drug Abuse.

[58] Maryland Department of Health and Mental Hygiene Drug Abuse Administration. "1978 Survey of Drug Abuse Among Adolescents"—General Report. Annapolis, Maryland, Mar. 23, 1979.

[59] State of Maine, Department of Human Services, Office of Alcoholism and Drug Abuse Prevention. "An Evaluation of the Decriminalization of Marijuana in Maine"—1978, Augusta, Maine, Jan. 5, 1979.

Our most recent national household survey [60] conducted in 1977, indicates that there was a significant increase of 25 percent over the 1976 level in the number of persons between the ages of 12 and 17 who had ever used marijuana. More importantly, there was a nearly 30 percent increase in the number currently using, i.e., those who had used in the preceding month. Moreover, as the figures from our annual survey of high school seniors indicate, there has been a significant trend toward beginning use at increasingly younger ages. While 16.9 percent of the Class of 1975 had used marijuana by the end of the ninth grade, 25.2 percent of the Class of 1978 did so.[60a]

Two days ago, we had the opportunity to hear a diversity of points of view on marijuana and its health consequences. Given the controversy surrounding the use of this drug, it is understandable that there is also a growing demand for certainty about its effects. But, as the reentry of Skylab last week demonstrated, even in physics exact prediction is sometimes difficult. When we turn to the biological sciences, certainty is even harder to achieve. The history of medicine is replete with examples of apparent certainty later determined to have been incorrect. When I was a medical student, for example, there was no question that the best treatment, indeed the only rational treatment, for breast cancer, was radical mastectomy. More recent systematic study of a succession of patients has now demonstrated that that apparent certainty is in serious doubt. If doubt and uncertainty have surrounded a surgical procedure that can be assessed by comparing five year survival figures with alternative therapies, how much more complicated is the assessment of a range of systemic effects which might be related to the use of marijuana.

During the last 15 years, the more widespread use of marijuana has served to some as flintstone to ignite many of their worst fears; for others it has been a symbol only of society's irrational response to an imagined threat. Both groups have sought prompt reassurance from the scientific community that their point of view is soundly based and ultimately defensible. In reality, the investigation of the possible impact of a new drug on the health and social well-being of a society is neither simple nor quickly resolved. The carefully devised animal model using pure materials under well-specified conditions may have only peripheral relevance to use of a highly variable drug under a wide range of conditions by humans who have widely differing susceptibility to its effects.

There are, of course, alternatives to the carefully controlled animal research or to the laboratory administration of a pure drug to human volunteers under well-specified conditions. Clinical observation is one. It was clinical observation, more than anything else, that originally linked thalidomide with birth defects—an observation later confirmed by research. However, whatever the strengths of the sometimes brilliant intuitive jump from clinical observation to cause, such observations can be and often are wrong. In the real world in which we must all function, we make use of many sources of data. And, if we must err, there are good arguments for erring on the side of caution. In my discussion today, I will be emphasizing what is known by the more rigorous methods of the health scientist, but I would be remiss were I not also to mention our concerns engendered by less certain, clinical impressions.

Finally, while much remains to be learned about the health implications of marijuana, I would like to emphasize that our present evidence clearly indicates that it is not a "safe" substance. As a psychiatrist, I would also like to stress that virtually all clinicians working with children and adolescents agree that regular use of marijuana by youngsters is highly undesirable. Although experimental evidence concerning the implications of use in this group is not easily obtained, there is little serious question that regular use of an intoxicant that blurs reality and encourages a kind of psychological escapism makes growing up more difficult. While there is controversy over the implications of present research concerning adult use, few would argue that every effort should be made to actively discourage use by children and adolescents.

I would be pleased at this time to respond to any questions you might have.

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[60] Abelson, H.I., Fishburne, P.M., and Cisin, I. "National Survey on Drug Abuse: 1977. National Institute on Drug Abuse, 1977.

[60a] Johnston, L.D., Bachman, J.G., and O'Malley, P.M. Highlights from: "Drug Use Among American High School Students, 1975-1978." National Institute on Drug Abuse. In Press.

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