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THE USE OF CANNABIS

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WHO SCIENTIFIC GROUP ON THE USE OF CANNABIS

Geneva, 8-14 December 1970

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THE USE OF CANNABIS

Report of a WHO Scientific Group

1. INTRODUCTION

A WHO Scientific Group on the Use of Cannabis met in Geneva from 8 to 14 December 1970.

Dr L. Bernard, Assistant Director-General, opened the meeting on behalf of the Director-General. He said that a variety of psychoactive cannabis preparations have been used for many centuries in some parts of the world, whereas in others they have been used little or not at all. Their use in a given locality has often been largely confined to particular socio-economic groups. There now appears to be a rapidly increasing number of persons in some traditionally low-use geographic areas and sociocultural groups who have at least tried these preparations. Those involved in this increased use are predominantly younger persons, and in numerous localities all the socio-economic groups appear to be represented.

In relation to the increased use of cannabis, an often spirited debate has developed in many parts of the world about the effects of cannabis on man and the need for legal restraints on the availability of cannabis preparations. An authoritative examination of the subject needs to be undertaken, from a scientific point of view, to assess present knowledge of the effects of the use of cannabis on man, to indicate where further research is needed, and to suggest possible approaches to such research. This was the task before the Group.

2. CANNABIS : BROAD PERSPECTIVES

2.1 The substance

Cannabis sativa L. is an annual plant normally occurring in male and female forms. It often grows to a height of about six feet, but under optimum conditions may reach 20 feet. It is probably indigenous to Central Asia (Bouquet, 1950) but now grows wild in most temperate to tropical areas; it is produced commercially in some places. It has a long history of cultivation, as a source both of fibre (hemp) and of psychoactive substances contained in its leaves and flowering tops. In the past, it was

very often grown for fibre with apparently no local awareness of its psychoactive properties.

Botanically, only one species of cannabis is now recognized (*C. sativa* L.), but in the past other designations were sometimes applied to plants found in different parts of the world (e.g., *C. indica* and *C. americana*).

There are, however, substantial differences in the amount of psychoactive material contained in what may be different varieties of *C. sativa* L. The amount is also influenced by variations in climate, weather, soil, time of harvest, and conditions and length of storage (Davis et al., 1963; Lerner & Zeffert, 1968; Joyce & Curry, 1970).

C. sativa L. produces a resinous substance which contains the major part of the psychoactive and intoxicating ingredients. It occurs primarily in the flowering tops and upper leaves and is sometimes separated from the rest of the plant for use as hashish. In a given plant the lower leaves contain less of these ingredients than do those at the top of the plant; the flowering tops contain the highest concentration. The stalk and seeds contain a negligible amount of psychoactive ingredients (Fetterman et al., in press; Valle, 1969).

Contrary to the widely held belief that only the female plant contains psychoactive substances, there is convincing evidence that the male plant also does (Fetterman et al., in press; Valle et al., 1968). However, the upper portions of the male plants tend to be smaller than those of the female plants and to wither after pollination. Thus the male plants are usually not reaped when the female plant is later harvested (Bouquet, 1950).

Materials from the cannabis plant are prepared for human consumption in many different ways. Known by hundreds of different local and more general names (United Nations, 1968), they may be classified according to the nature of the plant material contained. For the purposes of this report, preparations mostly containing leaves and flowering tops (with or without the inclusion of large stems and seeds) will be referred to as *marihuana*, preparations containing flowering tops but no leaves as *ganja*, and preparations containing primarily resin as *hashish*.¹

2.1.1 Recent advances in cannabinoid chemistry and measurement

The chemical constituents of *C. sativa* L. are quite complex. They include a unique group of chemicals called cannabinoids (Mechoulam, 1970)

¹ In the literature and among users, *marihuana* usually refers to a mixture of leaves and flowering tops. Other terms often applied to such a mixture are : *bhanga* (India, often only leaves); *maconha* (Brazil); *kif* (Morocco); and *dagga* (South Africa). The term and preparation *ganja* are used chiefly in India. *Hashish* is widely used as the designation for the resin, but in some countries, such as Egypt, it may apply to any cannabis preparation. *Charas* is the term most commonly used in India to designate a primarily resinous preparation.

together with waxes, starches, terpenes, oils, and trace amounts of other as yet unidentified substances. The five most important cannabinoids, as far as the biological potency of cannabis is concerned, are the (—)- Δ^9 -*trans*-tetrahydrocannabinol (Δ^9 -THC),¹ (—)- Δ^8 -*trans*-tetrahydrocannabinol (Δ^8 -THC),² Δ^9 -*trans*-tetrahydrocannabinolic acid (THC-acid), cannabinol (CBN), and cannabidiol (CBD). The first two are psychoactive when taken orally or by smoking. THC-acid is not active when taken orally, but is partly converted to the active Δ^9 or Δ^8 when smoked (Mechoulam, 1970). Knowledge of the extent of this conversion is incomplete. CBN and CBD have very little psychoactivity but are present in fairly large amounts. They appear to have an inverse quantitative relationship to the highly active Δ^9 -THC and Δ^8 -THC. Δ^8 -THC, discovered by Hively et al. (1966), occurs in very small amounts as compared to Δ^9 -THC, except in aged hashish (Lerner & Zeffert, 1968).

Δ^9 -THC produces most of the effects of cannabis or extracts of cannabis in both animals and man. It is therefore believed, but not entirely proved, that Δ^9 -THC accounts for most of the pharmacological activity of cannabis. At least thirty other cannabinoids have been isolated from cannabis (Mechoulam, 1970), but relatively little information about their biological activity is available. In addition, trace amounts have been reported of an alkaloid or alkaloids as yet chemically uncharacterized. The presence of an atropine-like substance and trigonelline in a commercial preparation of cannabis has been reported (Gill et al., 1970).

Δ^9 -THC and Δ^8 -THC volatilize readily when smoked (Manno et al., 1970) and are rapidly absorbed from human lungs. They are also absorbed, but more slowly, from the gastrointestinal tract.

In animals, both Δ^9 -THC and Δ^8 -THC are bound to serum protein. Only small amounts are found in the brain. They are metabolized in the liver, and the metabolites are excreted in the bile³ and re-absorbed from the gastrointestinal tract; an enterohepatic circulation therefore exists. The metabolites of Δ^9 -THC and Δ^8 -THC first formed in the liver are 11-hydroxyl derivatives (11-OH- Δ^9 -THC and 11-OH- Δ^8 -THC). In later steps additional hydroxylations occur on the rings. The 11-hydroxyl derivatives of Δ^9 -THC and Δ^8 -THC possess pharmacological activity (Mechoulam, 1970), and it has been postulated, but not proved, that they, rather than the THC's themselves, are the compounds responsible for the pharmacological activity. The metabolites of the THC's persist in the bodies of animals for long periods of time. Δ^8 -THC and Δ^9 -THC disappear from blood rapidly, so that neither can be found in blood 15 minutes after intravenous injection (Klausner & Dingell, 1970). Δ^8 -THC and

¹ Also known as (—)- Δ^1 -*trans*-tetrahydrocannabinol (Δ^1 -THC).

² Also known as (—)- $\Delta^{1(6)}$ -*trans*-tetrahydrocannabinol (Δ^6 -THC).

³ Ben-Zvi et al., 1970; Burstein et al., 1970; Foltz et al., 1970; Nilsson et al., 1970.

Δ^9 -THC are not excreted as such in the urine. These phenomena mean that present chemical methods for the detection of these THC's will not be useful for determining the presence of cannabis in man. Attention must therefore be turned to methods for detecting the metabolites rather than the THC's themselves. Radioimmune assays may prove useful.

For purposes of comparison, three of the older synthetic tetrahydrocannabinols deserve mention: $(\pm)$ - $\Delta^{6a,10a}$ -THC; $(\pm)$ - $\Delta^{6a,10a}$ -5-*n*-hexyl-tetrahydrocannabinol (called synhexyl or parahexyl); and $(\pm)$ $\Delta^{6a,10a}$ -5-dimethyl-octylheptyl-tetrahydrocannabinol (DHMP). The first is a synthetic tetrahydrocannabinol but possesses only about one-fourteenth of the biological activity of the natural Δ^9 -THC (Loewe, 1950). The second (synhexyl) possesses marihuana-like activity (Loewe, 1950) and underwent a limited clinical trial as an antidepressant (Parker & Wrigley, 1950). The third (DHMP) is a very potent drug which, in doses of 1-2 mg orally in man, produces cannabis-like subjective effects, marked sedation, and profound postural hypotension (Isbell, unpublished data).

The chemistry of the major cannabinoids was investigated extensively from about 1936 to 1941 by Adams and co-workers in the USA (Adams, 1942) and by Todd and co-workers in the United Kingdom (Todd, 1940). These two groups of workers determined the chemical structure of cannabinol, cannabidiol, and tetrahydrocannabinol, except that neither group was able to establish the position of the double bond in the non-phenolic ring of either cannabidiol or tetrahydrocannabinol. Mechoulam & Shvo (1963) identified the position of the double bond in natural cannabidiol as being located in the Δ^9 position, and Mechoulam et al. (1967) and Petrzilka et al. (1967) developed two different methods for the synthesis of Δ^8 -THC and Δ^9 -THC.

It is now possible to determine the amount of Δ^9 -THC, Δ^8 -THC, CBD, and CBN in the cannabis plant by gas-liquid chromatography (Lerner & Zeffert, 1968; Lerner, 1969). Cannabis grown in the same soil and the same climate from authenticated samples of seed collected in Canada, the USA, and Western Europe have produced plants that, as a group, contain a low Δ^9 -THC content (average 0.2% by weight) but a high cannabidiol content (Fetterman et al., in press). Seed from Mexico and Thailand, on the other hand, produced plants with a high content (1.5-2.0%) of Δ^9 -THC.¹ Some samples of naturalized or wild cannabis growing in the USA contain as little as 0.09% of Δ^9 -THC, while a sample from Thailand contained 4.89% (Turk, 1970).

The Δ^9 -THC content of cannabis preparations is influenced not only by the characteristics of the plant and the place and circumstances of its growth but also by such factors as the age and methods of storage of the

¹ The cannabis preparations analysed were marihuana without seeds, stalks, and main stems.

harvested materials. All active substances contained in preparations of cannabis deteriorate with time, the Δ^9 -THC being converted to cannabinol. Inactivation of Δ^9 -THC is particularly rapid if the herbal material is exposed to or stored at high temperatures (Lerner, 1969). If cannabis preparations are stored at -10°C , the Δ^9 -THC content remains much the same for periods of at least two years (Isbell, unpublished data). It follows that the Δ^9 -THC content of preparations in use in experimental work must be carefully and frequently monitored.

The average Δ^9 -THC content of marihuana believed to be of Mexican origin and obtained from the illicit market is around 1%, although it varies widely (Lerner & Zeffert, 1968). The Δ^9 -THC content of samples of hashish has ranged from 1% to 15%, with an average of about 5% (Lerner & Zeffert, 1968; Mechoulam, 1970; Turk, 1970). Very little information is available about the THC content of marihuana-type preparations available in many parts of the world or about ganja in India.

With the data available, however, it is possible to establish a rough scale of relative potency for the purpose of making broad or order-of-magnitude comparisons of the amounts of Δ^9 -THC contained in the cannabis preparations commonly consumed. For this purpose, marihuana (bhang, kif, etc.), ganja, and hashish (charas) are assumed to average respectively about 1%, 3% and 5% by weight of Δ^9 -THC.

2.2 Historical trends

Only the use of cannabis preparations for intoxicant, medical, and religious purposes is considered here. The only comment on the cultivation of cannabis for the production of fibre is that such cultivation was at one time or another very widespread and doubtless contributed to the existence of naturalized or wild cannabis plants in many parts of the world.

The intoxicating properties of certain cannabis preparations were probably known in India before the Christian era; however, a direct reference to their use in ayurveda, the traditional Hindu system of medicine, does not appear until the eighth century A.D.¹ Since antiquity it has been used quite widely by religious mendicants, mystics, and others. Bhang has been and still is widely taken as a drink or eaten as an ingredient in a confection or other foods among all social classes in certain parts of India, particularly on festivals and in the worship of the Lord Shiva (Chopra & Chopra, 1939; Wig, unpublished data). In some sections of the country, ganja is smoked fairly commonly by men of certain lower socio-economic groups. Women are said to smoke it only rarely. Only very recently

¹ Bouquet, 1950 & 1951; Dwarakanath, 1965; Walton, 1938.

has the smoking of cannabis preparations by students and other young people from a wide range of social classes become noticeable, and it is still apparently much less widespread than in some Western countries. Cannabis has been used in indigenous systems of medicine in India for many centuries (Chopra & Chopra, 1957; Dwarakanath, 1965) because of its sedative, mild analgesic, and other alleged properties (Chopra & Chopra, 1939).

The area west of India and the Eastern Mediterranean region apparently became acquainted with cannabis preparations around the seventh century A.D. (Bouquet, 1950). The preparations were both taken orally and smoked.

In North Africa cannabis was and still is taken chiefly by smoking marihuana (kif) and hashish. In most North African countries the practice was perhaps more prevalent among males of the lower socio-economic classes, although in some areas it was adopted by significant numbers of persons from other classes (Roland & Teste, 1958; Soueif, 1967). It is quite widespread in some North African countries in spite of strong legal sanctions against it. Those who take cannabis preparations once or several times a day usually form a minority of cannabis-users in both India and North Africa, but they tend to consume larger amounts than regular users do in most countries of Europe and the Western Hemisphere. Cannabis is also taken in the southern (Watt, 1961), eastern (Tanner, 1966), and western (Asuni, 1964) parts of Africa south of the Sahara. It is taken by some adults and more recently by young people who are said to be oriented towards Western culture. As in India, cannabis preparations are frequently used in local traditional systems of medicine in southern Africa (United Nations Economic and Social Council, 1955).

Cannabis preparations were introduced into central Europe, probably from North Africa, around 1800, but they generated little interest in the general population at that time, despite the publication of very detailed studies by Moreau de Tours (1845) and some colourful accounts of their effects by such literary figures as Baudelaire (1858) and Gautier (1843). The history of cannabis in Greece is more closely related to that of the Eastern Mediterranean region than to that of Europe. Cannabis preparations began to be widely used in Western European countries in the 1960s, as in many other countries of the world. Young people of all socio-economic classes have tried them in recent years, and in many countries adults have joined their ranks (Binnie, 1969; United Kingdom, Advisory Committee on Drug Dependence, 1968).

In Latin America, marihuana (maconha) has been utilized for its psychoactive properties for many years in some countries (Dewey, 1913), but in other countries scarcely at all. Its use was largely associated with men of the lower socio-economic classes until the quite recent upsurge in its use by young people of all classes. This upsurge has occurred both

in countries where cannabis had been used for some time and in those where its use was formerly almost non-existent.¹

Although cultivated for fibre for some 300 years in the area that is now the USA and southern Canada, cannabis was rarely used for its psychoactive properties in the USA until around the turn of the last century. It was at first largely restricted to lower socio-economic minority groups, especially in the south-western part of the country. It then spread in the 1920s to some jazz musicians and limited numbers of other persons. Only in the 1950s did its use begin to appear among all classes of youth, a trend that has accelerated rapidly in the last few years and is now to be found in Canada as well.² The groups now taking cannabis in North America are composed largely of middle-class and upper-class young persons of secondary-school and college age. The percentage is higher in selected populations and in the north-east and west coast areas. A recent sample survey of USA college students indicated that one-third has tried cannabis at some time (Berg, 1969). Among infrequent users, males outnumber females only slightly. However, among those who use cannabis at least two or three times a week, males outnumber females by two or three to one (Blum & Associates, 1969b).

Recent use among young people has been reported for certain South American countries. For example, about 1% of college and university students in the State of São Paulo, Brazil, are estimated to have tried cannabis at least once (Valle, unpublished data). Widespread recent use by young persons has been noted in several Western European countries³ and reports from some African countries indicate that young people are beginning to use cannabis there.⁴ In the United Kingdom, one small sample survey of a school population indicated that 2.5% had taken the drug at least once (Weiner, 1970). Larger surveys of university students showed that 4–10% had tried cannabis (Binnie, 1969; Lewis, 1968). On the other hand, there is no evidence of more than very occasional use in most Eastern European countries. In some North African countries with a long-established pattern of use among lower-class males, there appears to be no upsurge among youth or middle-class groups. In Morocco there are indications of an overall decline in cannabis use, associated with an increase in the use of alcohol (Defer, 1968).

¹ Dewey, 1913; El Mercurio, 1970; Valle, unpublished data.

² Addiction Research Foundation, 1970; Blum & Associates, 1969b; Smart et al., 1970a & b.

³ Booij, 1966 & 1971; Bschor, 1970; Buikhuisen, 1970; van Dijk et al., 1970; Kielholz & Ladewig, 1970.

⁴ Asuni, 1964; Lambo, 1965; Tanner, 1966; Watt, 1961.

2.3 Relation to use of other drugs

Very broadly, there has been a tendency to use cannabis as the principal intoxicant in some regions (e.g., the Indo-Pakistan subcontinent and North Africa), and alcohol in others (e.g., North America, Europe, and many areas of South America). In many countries the current trend appears to be towards using both alcohol and cannabis preparations, although in only a very few countries is there anything approaching the use of both to an equal extent.

A large proportion of cannabis users frequently take in addition psychoactive dependence-producing drugs of the alcohol, amphetamine, barbiturate, hallucinogen, and morphine types (Eddy et al., 1965), either at the same time or consecutively.¹ This greatly complicates the task of attributing drug effects to a single substance. Multiple drug use is perhaps more frequent in parts of Europe and North America than in the Indo-Pakistan subcontinent and Africa. In nearly all areas where cannabis is used, however, numerous other factors complicate the identification of individual drug effects.

2.3.1 *Progression to the use of other drugs*

The assertion is commonly made that the use of cannabis leads to the use of other drugs. This "stepping-stone" theory holds that adolescents begin with marihuana and later proceed to other drugs, often including heroin, in search of greater thrills. Most observers discount any pharmacological action disposing the cannabis user to resort to other drugs. In some countries most heroin users have taken cannabis preparations before trying heroin (Ball et al., 1968; United Kingdom, Advisory Committee on Drug Dependence, 1968), but the great majority of cannabis users never proceed to the use of morphine-type drugs. However, it is well established that marihuana use is positively correlated with at least experimental use of other drugs (Blum & Associates, 1969b). The probability in some countries of people taking strong hallucinogens such as lysergide (LSD) and other drugs increases greatly with increase in their use of marihuana (Goode, 1969). The longer cannabis is used, too, the greater the probability that opium will be used as well (Soueif, unpublished data). These associations are, of course, not sufficient to establish causal relationships between the use of one drug and another. It appears likely that important sociocultural and personal factors contribute to any apparent progression from cannabis preparations to other dependence-producing drugs. For example, many people who take marihuana frequently tend to limit their social life to the circle of drug-takers, particularly

¹ Goode, 1969; Kielholz & Ladewig, 1970; Popham, 1970; United Kingdom, Advisory Committee on Drug Dependence, 1968.

in areas where drug-taking is not socially acceptable. They are thus frequently given the opportunity to try other drugs (Goode, 1969). It is also possible that certain individuals have a greater personal need than others to experience the effects of drugs, and/or that chronic intoxication with cannabis contributes to a generally poor orientation to reality, especially among adolescents.

3. EPIDEMIOLOGICAL ASPECTS

In studying the epidemiology of cannabis use, it is important not only to inquire into the prevalence and incidence of such use in different localities and regions¹ but also to ascertain (a) the properties of various cannabis preparations used,² (b) the characteristics of persons who do and do not use such preparations,³ and (c) the sociocultural factors associated with their use in each locality studied.⁴

An element of communicability is associated with initiation into the use of cannabis preparations. Initial interest in taking these preparations appears often to be communicated directly or indirectly from a user to a non-user. This seems particularly relevant to the experimental or recreational use of cannabis by adolescents and young adults.

3.1 Manner of use (mode of consumption, frequency, amount, and duration)

The primary mode of consuming cannabis is by smoking, but it may be ingested as a food or beverage.⁵ India is the only country in which a significant amount is taken orally, in the form of a beverage made from bhang. Cannabis is also consumed in numerous confections and other food preparations, especially in India and sometimes in North Africa and other regions (Bouquet, 1951; Chopra & Chopra, 1939); however, in most parts of the world this mode of consumption is minor compared with smoking. The stronger preparations, e.g., ganja and hashish (or charas), are normally smoked in a pipe, which is sometimes so constructed that the smoke is first passed through water. The crude forms, which are less potent, may be smoked in either pipes or cigarettes.

¹ See section 2.2 for broad trends.

² See section 4.

³ See section 3.3.

⁴ See section 3.4.

⁵ The psychoactive components of cannabis are insoluble in water, and are therefore ineffective by the intravenous route. Furthermore, mixtures prepared from various preparations of cannabis contain macroscopic and microscopic particles and soluble pyrogens. A few attempts to inject suspensions of hashish or marihuana have been followed by severe physical symptoms (Gary & Keylon, 1970; Henderson & Pugsley, 1968; King & Cowen, 1969).

Another aspect related to patterns of use is the extent to which admixtures of other drugs are consumed together with cannabis. Tobacco is often a standard part of the smoking mixture in the Indo-Pakistan subcontinent and in some other regions of the world; however, mixtures with drugs other than tobacco appear to be relatively rare, except by persons who use cannabis in large amounts. In India and Pakistan *datura* (containing scopolamine, atropine, and other belladonna alkaloids) is occasionally added.¹

A meaningful evaluation of the consequences of cannabis use for the individual and society must take into account the frequency, amount, and duration of use and the relative numbers of persons conforming to various usage patterns. Studies in the USA indicate that occasional users far outnumber those who use cannabis daily,² whereas reports from the Indo-Pakistan subcontinent and North Africa are frequently concerned only with regular users; throughout the world, however, it appears that the majority of cannabis users take the drug occasionally rather than daily.³ In countries such as India and Morocco, where cannabis use has been more or less accepted, the daily use is measured in grams and only amounts in the upper range are considered "excessive". In India, the usage is considered moderate if around 1-2 g of ganja per day,⁴ or an estimated 30-60 mg of Δ^9 -THC.⁵ The majority of daily users are reported to fall within the moderate range. Chopra & Chopra (1939) conclude that, in India, "moderate use is much more common and excessive use is exceptional". The Indian Hemp Drugs Commission (1894) similarly estimated that excessive users represented only about 5% of ganja smokers.

While the amount of cannabis used daily is usually discussed in terms of moderate and excessive (terms that have different meanings in different reports), the amounts consumed probably exhibit the same type of unimodal frequency distribution as alcohol consumption, i.e., the large majority fall within the low end of the continuum, and progressively smaller frequencies are obtained as the high end of the scale is approached.⁶

The table shows various estimates of daily use, as well as estimates of the Δ^9 -THC content based on the assumption that marihuana (and equivalents), ganja, and hashish (charas) contain 1%, 3% and 5% of Δ^9 -THC respectively.⁷ In the compiling of these estimates, marihuana

¹ Bouquet, 1951; Chopra & Chopra, 1957; Indian Hemp Drugs Commission, 1894.

² Bromberg, 1934; Mayor's Committee on Marihuana, 1944; McGlothlin et al., 1970; United States, Select Committee on Crime, 1970.

³ Chopra & Chopra, 1939; Roland & Teste, 1958; Soueif, 1967.

⁴ Chopra, 1935; Chopra, 1940; Indian Hemp Drugs Commission, 1894.

⁵ Not all taken at once, and perhaps not in a single drug-taking session.

⁶ Ledermann, 1956; de Lint & Schmidt, 1968; Smart et al., 1970b.

⁷ See section 2.1.1.

ESTIMATES OF AMOUNT AND Δ^9 -THC CONTENT OF CANNABIS CONSUMED PER DAY *

Country	Preparation	Median daily dose		Maximum daily dose		Reference
		Weight (g)	Δ^9 -THC (mg)	Weight (g)	Δ^9 -THC (mg)	
Egypt	Hashish ^a	1.1 ^b	55	4	200	Souefi, 1967
Egypt	Hashish	—	—	4	200	Abdulla, 1953
India	Bhang	1.3	13	—	—	Chopra, 1940; Chopra & Chopra, 1939
	Bhang	6.0	60	24	240	Indian Hemp Drugs Commission, 1894
	Ganja	1.2	36	—	—	Chopra, 1940
	Ganja	1.9	57	—	—	Chopra, 1969
India (Bengal)	Ganja	1.0	30	12	360	Indian Hemp Drugs Commission, 1894
India (Punjab)	Ganja	2.2	66	—	—	Indian Hemp Drugs Commission, 1894
India	Ganja or charas	0.5	15 ^b	—	—	Chopra, 1935
India	Ganja or charas	5.0	150 ^b	24	720 ^b	Chopra & Chopra, 1939
Morecco	Kif	6.0	60	18	180	Sigg, 1963
South Africa (ad lib. experiments)	Dagga	1.3	13	2	20	Pretoria Mental Hospital Report, 1938
USA (ad lib. experiments)	Marihuana	2.5	25	10	100	Silar et al., 1933
	Marihuana	8.5	85	13	130	Williams et al., 1946
	Marihuana	4.2	42	8	80	Mayor's Committee on Marihuana, 1944
	Marihuana	2.5	25	5	50	Charen & Perelman, 1946
USA	Marihuana	4.0	40	5	50	Mayor's Committee on Marihuana, 1944
	Marihuana	1.5	15	—	—	Williams et al., 1946

* The estimates of Δ^9 -THC content are based on the rough guide of 1 %, 3 % and 5 % for marihuana, ganja, and hashish respectively (see section 2.1.1).^a Not necessarily used daily.^b Δ^9 -THC estimate based on ganja.

cigarettes were assumed to weigh 0.5 g. With the exception of one Indian study based on a sample of "heavy" users (Chopra & Chopra, 1939), the average daily dose of Δ^9 -THC for India and North Africa ranged from 13 to 66 mg. The maximum daily doses were in the range of 200–700 mg. The average amount of Δ^9 -THC consumed in *ad libitum* marihuana experiments in the USA,¹ and by daily users in the 1940s (Charen & Perelman, 1946; Mayor's Committee on Marihuana, 1944), was comparable to that for users in India and North Africa; however, the maximum amounts were substantially lower. The amounts indicated in the table contrast sharply with the typical consumption of one or two marihuana cigarettes (5–10 mg of Δ^9 -THC) per day during the recent wave of marihuana use in North America and some other areas.

The duration of cannabis use is important. Many authors imply that, once the use of cannabis is well established, it is likely to continue on a daily basis for many years and is not infrequently a lifetime practice (Bouquet, 1951; Chopra & Chopra, 1939). However, longitudinal data on representative samples of users are seldom if ever cited, and there is some indication that, in India and North Africa, the period of time over which cannabis is used by individuals may have been exaggerated (Soueif, 1967). In other parts of the world there are frequent references to discontinuation of its use after adolescence (Robins et al., 1970; South Africa, Inderdepartmental Committee, 1952) and to intermittent use among others (Mayor's Committee on Marihuana, 1944). In one follow-up study of regular marihuana users in the USA, one-half were still using marihuana twice or more a week after 20 years (McGlothlin et al., 1970).

3.2 Reasons for starting and continuing to use cannabis

Association with other users, curiosity as to the effects of cannabis, and a desire for relaxation, relief from tension, or a pleasurable feeling are widely cited as reasons for *starting* to use cannabis.² Becker (1953) stressed that initiation into the practice by other users plays an essential role, arguing that the novice must learn (a) to smoke effectively, (b) to recognize the effects, and (c) to define them as pleasurable. Especially in India, religious and medical purposes play a role in initiation (Chopra & Chopra, 1939). Many people said that they started using cannabis in an attempt to substitute it for alcohol, opium, cocaine, or other drugs (Chopra & Chopra, 1939; Ewens, 1904). The purported aphrodisiac property of cannabis is cited as a reason for starting its use by some individuals included in samples of users in India and North Africa (Chopra & Chopra, 1939; Soueif, 1967).

¹ For references, see table.

² California Legislature, 1970; Canada, Commission of Inquiry, 1970; Chopra & Chopra, 1939; Goode, 1969; Koppikar, 1948; Soueif, 1967.

One of the more frequently stated reasons for continuing to use cannabis moderately is the sense of well-being, relaxation, and relief from tension experienced.¹ It is used less frequently in an attempt to enhance sexual satisfaction² and to increase the enjoyment of music and food.³ It is also reportedly taken to alleviate hunger (Chopra & Chopra, 1957; Indian Hemp Drugs Commission, 1894). Another stated reason for its continued use is relief from boredom, frustration, and depression (McGlothlin et al., 1970).

There are a number of references to its use among labourers for the purpose of allaying fatigue and increasing endurance⁴ (cf. section 4.2.1). In Europe and North America, users sometimes cite enhanced performance in creative efforts as a reason for using cannabis (McGlothlin et al., 1970) (see section 4.2.1). In India, cannabis continues to be used for self-medication to relieve or prevent various symptoms (Chopra & Chopra, 1957). As noted earlier, there is a long history of cannabis use in religious practices, both in celebrating various religious holidays and in use by priests and other religious figures (Chopra & Chopra, 1939). Among the latter, it is used as an aid to meditation and to the attainment of mystical states. Wandering religious mendicants frequently remain in a state of chronic cannabis intoxication, which is interpreted as a religious trance by their followers (Chopra & Chopra, 1939; Indian Hemp Drugs Commission, 1894). The religious use of cannabis has been noted among certain cultural groups in Central and South Africa (Chopra, 1969), Brazil (Batista, 1959; Cordeiro de Farias, 1955), Jamaica (Blum & Associates, 1969a), and Mexico (Livet, 1920); it is generally limited to ceremonial use.

There are a few references to the use of cannabis in Africa to provide courage and bravado for fighting and sexual conquests,⁵ and an occasional mention in history of its use by certain warrior groups in India (Chopra & Chopra, 1939; Indian Hemp Drugs Commission, 1894). In general, its use for such purposes appears to be quite rare. According to Postel (1968), it is smoked by United States soldiers in Viet-Nam as a relaxant, but not in combat.

Social reasons are adduced for the use of cannabis. Cannabis, more than any other intoxicant, is used throughout the world in small social settings, so that the desire to achieve a sense of belonging to an intimate group is undoubtedly a significant factor both in beginning and in continuing to use it. The social intimacy may be intensified by the precautions required to avoid legal sanctions (Becker, 1953; Goode, 1969).

¹ Canada, Commission of Inquiry, 1970; Chopra & Chopra, 1957; McGlothlin et al., 1970; Roland & Teste, 1958; Tart, 1970.

² See section 4.2.

³ Chopra & Chopra, 1957; Goode, 1969; McGlothlin et al., 1970; Tart, 1970.

⁴ Ames, 1958; Chopra, 1940; Indian Hemp Drugs Commission, 1894.

⁵ Ames, 1958; Asuni, 1964; Watt, 1961.

3.3 User characteristics

Attempts to discover a common set of characteristics among cannabis users of different cultures quickly reveal the necessity of distinguishing between "moderate" and "heavy" users. For the most part, moderate use appears to be influenced, more than does heavy use, by such factors as local customs and attitudes, the availability and cost of the drug and, perhaps most important, association of the individual with a peer group using the drug.¹ However, users — though with numerous exceptions — tend to possess certain characteristics, despite differences in sociocultural setting and extent of use.

Cannabis use is related to age. It is generally most popular among adolescents and young adults;² however, consumption in India is said to show a fairly even age distribution at present (United Nations Economic and Social Council, 1957), while in Thailand it has reportedly been largely restricted to elderly persons (United Nations, Commission on Narcotic Drugs, 1965). At present initiation is most frequent during adolescence,³ but Chopra & Chopra (1939) found that 40% of their sample of regular users began after the age of 30 years.

The extent of cannabis use is closely related to sex. Except in Europe and North America, the extent to which females use it is extremely low. Even in these areas, the extent to which it is regularly used among women is low compared with that among men.

In general, cannabis users have tended to belong to certain socio-cultural groups. Except in relation to the current upsurge in Europe and North America, its use — especially its regular use — has been mostly restricted to the lower socio-economic groups. This was true also among earlier users in Europe and North America.⁴ At one time cannabis preparations were widely used by the upper classes in India (Indian Hemp Drugs Commission, 1894), among whom the occasional ceremonial use of bhang is still quite common. A few authors indicate that the use of cannabis preparations is widespread, but not readily apparent, among the upper sociocultural classes of North Africa (Bouquet, 1951; Roland & Teste, 1958). However, the use — especially the regular use — of cannabis is currently held in low esteem in almost all countries of the world. Its generally illegal status contributes to this attitude, although disapproval generally preceded rather than followed the imposition of legal controls (Indian Hemp Drugs Commission, 1894).

¹ See section 3.4.

² Manheimer et al., 1969; Soueif, 1967; Watt, 1961.

³ Robins et al., 1970; Sigg, 1963; Soueif, 1967; Watt, 1961.

⁴ Charen & Perelman, 1946; Freedman & Rockmore, 1946; Gaskill, 1945; Markovitz & Myers, 1944.

Within the broad "normal" range, certain personality characteristics are associated with some cannabis users. Individuals who appear to enjoy the effects of cannabis tend to prefer an unstructured and spontaneous style of life, are relatively prone to take risks, value states of altered consciousness, and tend to seek such effects both through drugs and through other methods (Cohen, 1970; McGlothlin et al., 1970). Thus cannabis users are most frequently young, male, unmarried, and exhibit some instability with respect to residence, work, school, and goals. Individuals who have no taste for the cannabis experience *per se* (regardless of moral or other considerations) are more apt to exhibit a preference for a controlled, structured, rational, and secure approach to life.

Excessive use is associated with personality inadequacies. Persons who exhibit emotional immaturity, low frustration tolerance, and a failure to assume responsibility tend to be over-represented in samples of heavy cannabis users.¹ In behavioural terms, these traits are manifested in an unrealistic emphasis on the present as opposed to the future, a tendency to drift along in a passive manner, failure to develop long-term disciplines and skills, and a tendency to favour regressive and magical to rational thinking.

3.4 Sociocultural factors

The taking of drugs, particularly cannabis, appears to be associated not only with certain individual and group beliefs and expectations about the effects but also with a broader system of beliefs and values concerning such matters as (a) the relative worth of material possessions and of spiritual, cultural, and traditional beliefs and experiences; (b) the respective importance of the rights, prerogatives, and responsibilities of the individual and of society; (c) the nature of practices that are considered good and evil; and (d) the meaning and value of life itself (Cameron, 1970).

Cannabis has been taken in modest amounts on a casual basis to foster a personal sense of ease, freedom, and relaxation, to serve as a social lubricant, and as evidence of friendship and of membership in a particular group.² This has occurred in many geographic areas, among many different sociocultural groups, and at various points in time.

Considerably more intensive use than that just mentioned, as regards frequency and quantity, is often strongly associated with powerful sociocultural forces in addition to those of friendship, peer group approval and pressures, and local customs. One such factor, associated with fairly regular and particularly with heavy use, is rapid sociocultural change.

¹ Mauer & Vogel, 1962; Mayor's Committee on Marihuana, 1944; Roland & Teste, 1958; Soueif, 1967.

² Chopra & Chopra, 1939; Roland & Teste, 1958; Smart & Jackson, 1969.

This is often found in situations involving, for example, industrialization, urbanization, social conflict, and transition between periods of war and peace; there may or may not be substantial migration within the area affected. In such circumstances an individual's system of values may be changing and he may find himself somewhat removed from the usual cultural restraints placed upon his overt behaviour. Such removal from restraints may result from separation from family, friends, and familiar peer groups, from affiliation with new peer groups, or from changes in the system of values within the larger culture. Apparent increases in the use of dependence-producing drugs have been reported in such circumstances.¹ In countries with a long history of cannabis use, extremely poor rural workers are often able to fit moderate use of cannabis into their routine of living, with little tendency to increase the frequency or amount; when they migrate to city slums, however, increased and undisciplined patterns of use often develop.²

Poverty has been reported as being associated with cannabis use, but recent patterns of use have clearly not been confined to the poorer sections of the community.

Various degrees of social alienation have been noted in connexion with some use of cannabis (Blum & Associates, 1969b).

Cannabis use is also associated with prior use by the father or other members of the family,³ and early initiation has been found to be positively correlated with long and heavy use by family members (Stringaris, 1933). Similar data have been reported for alcoholism.⁴

Sociocultural acceptance or rejection of particular behaviour is also an important epidemiological factor in drug use. As noted in section 3.1, alcohol consumption in a population tends to follow a unimodal frequency distribution. In addition, the proportion of the total population that consumes some amount of alcohol tends to be higher in cultures where social drinking is widely accepted than where it is less acceptable. Where drinking is widely accepted, too, the proportion of the total population that regularly consumes amounts above a given level tends to be larger than where it is less accepted (Ledermann, 1956; de Lint & Schmidt, 1968). It also follows logically that the proportion of the total population constituting a health problem because of heavy consumption will be greater in "wide-use" areas. If this were true for cannabis — the few studies carried out tend to suggest that it may be (Popham, unpublished data) — the

¹ Asuni, 1964; Chopra & Chopra, 1957; Lambo, 1965; Parreiras, 1949; Porot, 1942; Roland & Teste, 1958; Stringaris, 1933; Tanner, 1966.

² Chopra & Chopra, 1957; Indian Hemp Drugs Commission, 1894; Roland & Teste, 1958.

³ Blum & Associates, 1969b; Chopra & Chopra, 1939; Smart et al., 1970a; Soueif, 1967.

⁴ Jellinek, 1945; McCord & McCord, 1962; Robins et al., 1968.

implications for the total number of cannabis-dependent persons one might expect to find are rather obvious (Popham, 1970).

In summary, the epidemiology of cannabis use involves three factors : (a) the personal characteristics of the actual or potential user, (b) the socio-cultural pressures on him, and (c) the pharmacological properties of various cannabis preparations. The extent to which its use satisfies conscious (stated or unstated) or unconscious needs will help to determine whether or not the behaviour is sustained. The use of cannabis tends to " bind " the user to certain persons, while often " alienating " others.

4. EFFECTS ON MAN OF USING CANNABIS

4.1 Influence of different preparations, dose levels, and routes of administration

It is now generally believed that Δ^9 -THC accounts for a large part of the pharmacological activity of cannabis preparations (see section 2.1). The percentage of Δ^9 -THC in cannabis preparations varies markedly (see section 3.1). To a large extent, the potency of various preparations varies directly with their Δ^9 -THC concentration.

Because Δ^9 -THC is insoluble in water, the only practical routes of administration in man, as yet, are by ingestion and by inhalation of smoke (see section 3.1). In medicine and in much of the older experimental work, cannabis was administered orally as a concentrated and biologically standardized alcoholic extract.

To obtain the maximum effect from cannabis preparations they must be smoked by a technique that is somewhat different from that of smoking tobacco cigarettes and must be learned by practice.¹ When this technique is followed, about 50 % of the Δ^9 -THC in marijuana comes over in the smoke and most of the remainder is converted to CBN or CBD or both (Manno et al., 1970). Exhaled air contains practically no Δ^9 -THC when the specified technique is used. It is thus assumed that roughly 50 % of the Δ^9 -THC content of a marijuana cigarette is absorbed by the lungs and constitutes the dosage actually delivered to the smoker (Manno et al., 1970). Available data on the amounts of Δ^9 -THC delivered by smoking are relatively meagre; more research is needed on the variations in the dosage obtained from marijuana and other cannabis preparations when different smoking devices and techniques are used. Δ^9 -THC is about 3 times as potent when smoked as when ingested (Isbell et al., 1967). The subjective effect begins very rapidly when Δ^9 -THC or cannabis preparations are smoked, an experi-

¹ Failure to use this technique may partly account for the apparent lack of effect when cannabis is first smoked by a novice (Becker, 1953).

enced smoker being able to perceive subjective effects within a minute after one or two puffs of a potent preparation. The peak effects are probably reached within 20–30 minutes after smoking. In contrast, when Δ^9 -THC or extracts of cannabis are taken orally, about 30 minutes elapse before subjective effects are perceived. The duration of action varies with the dose, but the effects of a single administration are usually dissipated 3–4 hours after smoking or about 8 hours after oral administration.¹ The degree and duration of effect after smoking a given amount also probably vary with the speed of smoking.

4.2 Immediate effects

4.2.1 *Usual symptoms and signs*

Symptoms refer to subjective sensations reported by the user and signs to observable physiological and behavioural changes that the observer can quantify in some manner (e.g., pulse rate, blood pressure, conjunctival injection, increased laughter).

Symptoms after taking Δ^9 -THC or cannabis preparations depend on the dose,² as well as on the setting and the expectations and personality of the user. In experiments with one sample of Δ^9 -THC, threshold doses of 50 $\mu\text{g/kg}$ by smoking, or 120 $\mu\text{g/kg}$ orally, caused chiefly mild euphoria (Isbell et al., 1967). With doses of 100 $\mu\text{g/kg}$ by smoking, or 240 $\mu\text{g/kg}$ orally, some perceptual and sensory changes also occurred. Doses of 200–250 $\mu\text{g/kg}$ by smoking, or 300–480 $\mu\text{g/kg}$ orally, resulted in marked distortion of sensory perception, depersonalization, derealization, and both optical and auditory hallucinations. Hollister et al. (1968) administered oral doses ranging between 30 and 70 mg total dose (400 and 1 000 $\mu\text{g/kg}$), with a median dose of 50 mg (700 $\mu\text{g/kg}$). The characteristic syndrome was euphoria plus psychic changes similar to those reported by Isbell and co-workers after oral doses of 300–480 $\mu\text{g/kg}$. As these symptoms subsided they were followed by sedation and sleep. In the study by Mayor's Committee on Marihuana (1944), doses of an extract of cannabis, with an estimated content of 30–75 mg of Δ^9 -THC, caused symptoms similar to those reported by Isbell et al. and by Hollister et al.

Isbell et al. (1967) were unable to detect any significant qualitative differences in symptoms when the drug was given orally, as compared with smoking. The symptoms observed under laboratory conditions appear to be similar to those obtained by Tart (1970) in a retrospective study of marihuana smokers, who replied to a questionnaire concerning the symptoms they experienced after smoking cannabis in their usual environment.

The signs are few. They consist of injection of conjunctivae, a decrease

¹ Hollister et al., 1968; Isbell et al., 1967; Jones (unpublished data).

² Hollister et al., 1968; Isbell et al., 1967; Manno et al., 1970.

in muscular strength, as measured with a finger ergograph, and an increase in pulse rate; these effects do not regularly occur with a placebo and the increase in pulse rate parallels the intensity of the subjective effects at peak time. Resting systolic and diastolic blood pressure, respiration rate, body temperature, threshold for eliciting the knee jerk, and pupil size are not affected.¹

Only minimal changes have been reported in the resting electroencephalogram, namely, a slight decrease in alpha percentage and sometimes a slight drop in alpha frequency.²

Reports of increased hunger for sweets during intoxication with cannabis have focused attention on possible decreases in blood sugar level. Early investigators did report decreases (Beringer, 1932; Lindemann, 1933), but more recent studies have demonstrated no change (Hollister et al., 1968; Weil et al., 1968) or a slight increase (Mayor's Committee on Marihuana, 1944).

Various doses of cannabis preparations produce some impairment of body and hand steadiness, which persists as long as the effects of the drug (Mayor's Committee on Marihuana, 1944). However, gross ataxia does not generally result, even at "high" doses. Speed of tapping and simple reaction time are only slightly impaired, but a 20% decrease in complex reaction time has been measured for an oral dose estimated at 75 mg of Δ^9 -THC (Clark & Nakashima, 1968; Mayor's Committee on Marihuana, 1944). When smoked, doses of marihuana that on assay contained 5.0–10.0 mg of Δ^9 -THC produced impairment of pursuit rotor tests (Manno et al., 1970; Weil et al., 1968). One preliminary study showed the smoking of two marihuana cigarettes to have little effect on the more complex task of operating a driving simulator (Crancer et al., 1969), although the subjects in that study reported achieving a "social high". However, there is some uncertainty about the potency of the preparation used, since other investigators using different samples from the same batch of cannabis found their samples to contain less Δ^9 -THC than had been stated by those furnishing the materials (Rodin et al., 1970). The matter deserves further investigation, with attention to the effect of cannabis at various dose levels not only on psychomotor performance but also on the attention and judgement required of drivers (Kalant, 1969). Measurements of muscle strength under the influence of cannabis generally indicate impairment.³ The degree of impairment of psychomotor performance, as indicated in the above paragraph, is larger for "naive" subjects (i.e., those who have never, or only rarely, taken cannabis previously), for large doses, and for complex tasks.

¹ Hollister et al., 1968; Isbell et al., 1967; Manno et al., 1970.

² Rodin et al., 1970; Wikler & Lloyd, 1945; Williams et al., 1946.

³ Féré, 1901; Hollister et al., 1968; Mayor's Committee on Marihuana, 1944; Pond, 1948.

Among the more frequently reported effects of cannabis are sensory and perceptual distortion, particularly of the sense of time. Most often, time is perceived as being longer than clock time. This phenomenon has been experimentally confirmed by many investigators;¹ it is more evident for "filled" time, i.e., when the subject makes an estimate of the time that has elapsed during the performance of a task, than for "unfilled" time.

Cannabis users often report increased auditory sensitivity and enhanced appreciation of music. Tests of pitch discrimination and other measures purported to measure musical aptitude were, however, unchanged or impaired following the administration of cannabis or synhexyl to non-musicians,² although some studies have suggested an enhancement of auditory acuity (Williams et al., 1946; Walton, 1938, citing Kant and Kraft). In one interview study of 357 jazz musicians, 19% of subjects felt after taking cannabis that the musical performance of musicians to whom they listened had been improved, while 31% indicated that the performers' ability had been impaired (Winick, 1960). The remainder perceived no difference or could not decide.

Some people have reported a subjective sense of enhanced touch, taste, and smell while using cannabis (Tart, 1970). However, measurements of threshold for touch, vibration, two-point discrimination, olfactory acuity, and visual brightness have shown no change (Caldwell et al., 1969; Williams et al., 1946).³

Consistent reports of interference by cannabis with short-term and immediate memory functions have focused experimental investigation on these and other cognitive areas. Measurement of very simple tasks, such as ability to repeat a series of digits (digit span), has given mixed results.⁴ Ability to recall objects and reproduce designs after brief exposures was slightly to moderately impaired (Mayor's Committee on Marihuana, 1944). The more complex tasks of performing arithmetical calculations aimed at reaching a specified goal showed much greater impairment and are clearly dose-dependent (Melges et al., 1970).

¹ Ames, 1958; Clark et al., 1970; Jones (unpublished data); Weil et al., 1968; Williams et al., 1946.

² Aldrich, 1944; Mayor's Committee on Marihuana, 1944; Williams et al., 1946.

³ The discrepancies noted in this section between reported subjective feelings and objective measurements are not intended to disprove the existence of the former, nor their "reality" for the person experiencing the sensation. Objective measurements of performance are not necessarily relevant to the existence of reported subjective experiences. The relationship between cannabis use and sexual gratification is illustrative. At the subjective level, cannabis (a) often enhances touch and other senses, (b) generally prolongs the perception of time, and (c) sometimes imparts novelty to familiar objects and activities. All these may enhance the sense of gratification experienced by some people during the sexual act, whether or not enhancement of sensations or of performance can be verified by objective measurements.

⁴ Mayor's Committee on Marihuana, 1944; Melges et al., 1970; Waskow et al., 1970.

An oral dose of 20 mg of Δ^9 -THC resulted in decreased accuracy of serial addition in "naive" subjects (Waskow et al., 1970). When marihuana was smoked, doses that on assay contained 10.0 mg of Δ^9 -THC caused a significant decrease in accuracy in this type of task when the subject was distracted by delayed audio-feedback (Manno et al., 1970).

Oral doses of cannabis (an estimated 20 mg of Δ^9 -THC) given to "naive" subjects severely impeded a learning task that required the subject to discover and remember several associations via trial and error. It also significantly impaired reading comprehension (Clark et al., 1970). In experienced users the smoking of cannabis (an estimated 18 mg of Δ^9 -THC), caused a pronounced decrease in the coherence, clarity, and time orientation of speech and an increase in free association and dream-like imagery (Weil & Zinberg, 1969). The impairment in performance of these more complex tasks appears to arise from difficulty in maintaining a logical train of thought.

Various other psychological tests, e.g., the digit-symbol substitution task, generally show a moderate impairment of performance, which increases for more complex tasks, larger doses, and "naive" subjects.¹

In summary, cannabis significantly impairs cognitive functions, the impairment increasing in magnitude as the dose increases or the task is more complex or both.

4.2.2 *Acute psychotoxic reactions*

As noted already, the nature and intensity of the symptoms and signs resulting from the use of cannabis generally increase with the size of the dose. At the higher dose levels indicated in section 4.2.1 a state of acute intoxication is usually seen, the major manifestations of which often include paranoid ideas, illusions, hallucinations, depersonalization, delusions, confusion, restlessness, and excitement.² Such a syndrome may resemble an acute psychotic episode. In occasional instances, there may be additional features of a toxic psychosis, such as delirium, disorientation, and marked clouding of consciousness. In still other cases, marked agitation and excitement with apparent fear may be particularly prominent. In most cases such acute effects are temporary and disappear within a few hours, although in some instances they may persist for 1-3 days and occasionally up to 7 days. Syndromes resembling acute intoxication may occur following relatively small doses of cannabis, e.g., after smoking one cigarette, especially among "naive" users.³

¹ Hollister & Gillespie, 1970; Jones (unpublished data); Weil et al., 1968.

² Baker & Lucas, 1969; Bromberg, 1934; Chopra & Chopra, 1957; Dally, 1967; Watt, 1961.

³ Bromberg, 1934; Defer, 1968; Roland & Teste, 1958; Talbott & Teague, 1969.

Another type of acute psychotoxic reaction is seen in persons who appear to be overwhelmed by marked anxiety, fear, and panic (e.g., fear of death or of "going crazy"). Such persons are usually agitated and depressed, and occasionally withdrawn. There is usually very little or no evidence of disorientation, delusions, illusions, or hallucinations (Weil, 1970). The presence of a reassuring person significantly reduces the likelihood of this syndrome occurring and alleviates the symptoms if it does occur. Its duration may be from a few hours to, more rarely, a few days. This syndrome tends to occur after relatively small doses (e.g., the equivalent of one or two marihuana cigarettes), as well as after larger ones. It has been observed in persons who later insisted that it followed their first experience with cannabis.¹ Newly initiated users are also reported occasionally to develop a depressive syndrome after small doses (Weil, 1970).

4.3 Delayed phenomena

The "usual symptoms and signs" and "acute psychotoxic reactions", described in section 4.2, are consistently and closely related in time to the smoking or ingestion of cannabis preparations or Δ^9 -THC. In addition to these immediate manifestations after the use of cannabis, other phenomena have been described as being associated with repeated or long-term cannabis use; the latter phenomena occur between, as well as during, periods of intoxication. In general, however, the degree and nature of any relationships that may exist between these "delayed phenomena" and the prolonged and/or intensive use of cannabis have not been established.

4.3.1 *Physical disorders*

Many predominantly physical effects have been attributed to the use of cannabis, but few can consistently be related to it. There is general agreement that persistent physical effects of a significant nature are uncommon following even prolonged use of bhang, if ingested in "moderate" quantity (Chopra & Chopra, 1957). However, it has been reported in India that the smoking of ganja and hashish over long periods of time leads to various respiratory disorders (e.g., chronic bronchitis). Since cannabis is usually combined with tobacco for smoking in that country, it is difficult to assess the role of cannabis in the etiology of such conditions. It is questionable whether weight loss, emaciation, anaemia, constipation, etc., which have been reported to be associated with cannabis smoking in India, are due to the drug or to poverty, poor nutritional status, and intercurrent infections. Studies in the USA have, by and large, failed to show any significant physical deterioration after an average of 7-8 years

¹ Bromberg, 1934; Talbott & Teague, 1969; Weil, 1970.

of marihuana use (Freedman & Rockmore, 1946; Mayor's Committee on Marihuana, 1944).

In a recent study in Morocco, a high proportion of relatively heavy kif (marihuana) users were found to have arteritis, and a positive correlation was postulated between the intensity of the inflammation and fluctuations in the use of kif (Sterne & Ducastaing, 1960).

Reports from India have stressed the occurrence of eye changes following long-term use of charas and ganja. The conjunctival injection seen during acute intoxication persists even when the drug is not being used and the conjunctiva as a whole assumes a somewhat dull appearance (Chopra & Chopra, 1957; Dhunjibhoy, 1928).

Preliminary reports of *in vitro* studies have not shown any cannabis-related increases in chromosomal abnormalities in rats or man (Martin, 1969; Neu et al., 1969). Nor have teratogenic effects of cannabis been observed in man, although they have been found in rats, hamsters, and rabbits when high doses of cannabis extracts were administered.¹

4.3.2 *The question of psychoses*

Various psychiatric conditions purportedly related to or associated with the use of cannabis have been described, covering a wide range of disorders and situations.² They can be considered as comprising the following groups :

- (1) Specific cannabis disorders :
 - (a) acute and subacute disorders
 - (b) residual psychoses
 - (c) personality deterioration following prolonged use
- (2) Other psychiatric disorders, precipitated or aggravated by the use of cannabis
- (3) Coincidental association of a psychiatric disorder with cannabis use.

Certain "acute psychotoxic reactions", such as those discussed in section 4.2.2, would be included in group 1 (a). They may or may not be "delayed phenomena", depending on whether they occur in newly initiated or long-term users. They are, however, always closely associated in time with cannabis use and are usually of quite short duration, i.e., a few hours to a few days. These reactions, a significant number of which are of psychotic proportions, appear to comprise the majority of the acute specific cannabis disorders.

¹ Geber & Schramm, 1969a, 1969b; Persaud & Ellington, 1968.

² Bromberg, 1934; Chopra & Chopra, 1957; Christozov, 1965; Dally, 1967; Defer & Diehl, 1968; Roland & Teste, 1958; Talbott & Teague, 1969; Watt, 1961.

Also included in group 1 (a) would be a group of psychotic reactions generally associated with "heavy" cannabis use,¹ lasting from 1 to 6 weeks,² and presenting quite varied symptomatology, often including schizophrenic, manic, or acute organic features.³ Residual amnesia is also characteristic.⁴

The following three factors tend to support the hypothesis that the clinical pattern described in the preceding paragraph is causally related to "heavy" cannabis use: (a) the close temporal association between cannabis use and the disorder, (b) the relatively short duration of the syndrome as compared with functional psychoses,⁵ (c) a reported decline in the incidence of "cannabis-related" psychiatric hospital admissions accompanying the replacement of hashish by crude preparations (Bouquet, 1951; Porot, 1942). Some authors have noted that "heavy" cannabis use and the development of cannabis-related mental disturbances are to be found almost exclusively among males (Bouquet, 1951; Warnock, 1903) in the areas from which the reports were made; however, male hospitalized psychotics far outnumber females, even after the removal of cases attributed to cannabis (Dhunjibhoy, 1928; Ewens, 1904). More importantly, the substantial variety of clinical symptomatology reported does not support the hypothesis, particularly when insufficient information is available on the following points: (a) the prevalence of various patterns of cannabis use in the general population and among persons admitted to hospital, and (b) the prevalence and incidence of various psychiatric syndromes among adequately matched comparison groups of cannabis users and non-users. In summary, only limited, presumptive evidence is available in favour of the existence of a specific cannabis psychosis of the type described in the preceding paragraph. The evidence is sufficient, however, to warrant the initiation of carefully controlled investigations.

The question of residual, specific cannabis psychoses is related to the doubts concerning the existence of acute and subacute psychiatric disorders caused by, or otherwise closely associated with, a particular pattern of cannabis use. If there were no such specific cannabis disorders, the matter of "residual" states would not arise. If specific cannabis disorders do exist, it remains to be determined whether some affected patients do develop a prolonged, chronic, or "residual" state. Should

¹ Chopra et al., 1942; Defer & Diehl, 1968; Roland & Teste, 1958.

² Asuni, 1964; Christozov, 1965; Dhunjibhoy, 1930; Ewens, 1904; Indian Hemp Drugs Commission, 1894; Sigg, 1963.

³ Chopra et al., 1942; Indian Hemp Drugs Commission, 1894; Roland & Teste, 1958; Warnock, 1903.

⁴ Chopra et al., 1942; Defer & Diehl, 1968; Dhunjibhoy, 1930; Roland & Teste, 1958.

⁵ Asuni, 1964; Christozov, 1965; Dhunjibhoy, 1930; Ewens, 1904; Indian Hemp Drugs Commission, 1894.

this prove to be so, it would be useful to determine what factors appear to be associated with the process.

The literature often mentions the existence of a characteristic personality deterioration among older habitual users after prolonged "excessive" use.¹ Such individuals are frequently described as showing a simple-minded, carefree state, the following terms being typically applied: "chronic, cheerful mania"; "kif-happy vagabonds"; and "hilarious and full of a sense of well-being". No systematic scientific study has been made to assess their previous personalities, the social factors involved, and the occurrence of such a syndrome among non-users of cannabis. This syndrome could, in theory, be a primary specific cannabis disorder as well as a residual effect of a more acute disturbance. Hence it is not subsumed entirely under "residual psychoses" in the classification given at the beginning of this section.

Roland & Teste (1958) indicate that cannabis may precipitate latent psychiatric disorders, or aggravate existing psychiatric problems, or do both. To help determine the validity of this clinical observation, it will be necessary to determine the prevalence and incidence of various psychiatric disorders among groups of persons, drawn from the general population, who differ only in their cannabis-taking patterns, including a comparison group of non-users. Such studies would also help to clarify questions about the existence of specific cannabis disorders. Of less importance, they would provide objective data about the extent to which psychiatric disorders are only coincidentally associated with different levels of cannabis use in various cultures.

4.3.3 *Some psychosomatic aspects*

Keeler et al., (1968) reported the spontaneous recurrence of unusual somatic and visual sensations originally experienced during reactions to marihuana. These recurrences were intermittent, and all occurred during the period immediately following the use of marihuana, the length of this period varying from 2 days to 3 weeks for different persons. None of the 4 subjects of the report had taken other psychoactive drugs. There are a number of reports of these "flash-back" phenomena among the users of lysergide (LSD).² Weil (1970) reports that marihuana precipitates flash-backs in persons who have also taken LSD. Since many users of marihuana have also used LSD, the report of Keeler et al. is of particular interest.³ In some instances, persons experiencing the effects ordinarily

¹ Chopra et al., 1942; Christozov, 1965; Indian Hemp Drugs Commission, 1894; Roland & Teste, 1958; Warnock, 1903.

² Frosch et al., 1965; Louri, 1968; Smart & Bateman, 1967.

³ It should be noted that the flash-back phenomena associated with the use of LSD sometimes occur at substantial intervals after the last drug dose.

produced by taking cannabis, but occurring after the usual period of drug effect, found the experience enjoyable, as they did when the sensation was experienced during drug intoxication. Others, however, became so apprehensive as to require hospitalization.

There is evidence that, under certain conditions, the regular use of cannabis for several years is associated with measurable deficits in a number of psychomotor and cognitive functions. In a study of 850 hashish users and 839 non-users as controls, drawn from a population of prisoners in Egypt, Soueif (unpublished data) showed differences between users and controls in a number of standardized objective tests. These assessed speed and accuracy of psychomotor performance, initial reaction time, memory for digits, and memory for designs. Comparisons were made between subgroups of test and control subjects equated for education. In most of the tests used, the hashish users had poorer scores than the controls. In general, the higher the level of education of the users and non-users the larger was the discrepancy between their respective test scores. It must be stressed that the association between cannabis use and the reported deficits does not necessarily indicate a causal relationship. The differences might pre-exist or might be related, for example, to changes in life style occasioned by regular participation in socially disapproved and unlawful activities.

A number of authors claim a fairly consistent association between "heavy" use of cannabis and a characteristic symptomatology, sometimes called the "amotivational syndrome". It has been especially emphasized with cannabis use among young persons in Europe and the USA. Among the main characteristics usually cited are apathy, emphasis on the present rather than the future, preference for fantasy rather than rationality, child-like thinking, and preference for a loosely structured type of life rather than one that is well structured and goal-directed (McGlothlin & West, 1968). It has been suggested that the clinical picture resembles that of patients with an organic brain syndrome (Brill et al., 1970). However, the evidence might equally suggest a learned constellation of behaviour in which cannabis acts as a catalytic agent. Among impressionable adolescents, cannabis-induced suggestibility (Soueif, 1967; Zinberg & Weil, 1970) may facilitate the rapid adoption of new values and behaviour patterns, especially when the drug is taken in a socially alienated subculture that advocates and strongly reinforces such changes.

It is possible that some long-term behavioural effects attributed to cannabis use are due largely or in part to the sociocultural context in which the drug is taken. For example, in a society where cannabis use is illegal and generally disapproved of, the user is *ipso facto* engaged in non-conforming behaviour. This, in itself, may close various avenues of social adjustment to him, and lead to the adoption of a different style of life. The latter may involve a number of characteristic behaviour

patterns developed independently of drug use. Some of these patterns may be viewed as deviant by a majority of the society, but one would not be justified in attributing them to the pharmacological action of the drug.

4.3.4 *Cannabis and crime*

The arguments purporting to relate cannabis use to crime fall generally into 3 categories :

(a) Loss of control during cannabis intoxication may result in violence or other forms of impulsive behaviour.

(b) Cannabis-induced lethargy may lead to loss of legitimate earnings and hence to petty thieving.

(c) Cannabis may provide persons predisposed to criminality with the courage to commit antisocial acts.

The evidence in support of the first argument is generally anecdotal, although it appears that, of those cases coming to the attention of the authorities, violent and impulsive behaviour is not infrequent among persons with relatively acute psychotic reactions to cannabis.¹ On the other hand, disruptive behaviour plays a significant role in determining whether or not an individual with an acute cannabis psychosis is hospitalized (Indian Hemp Drugs Commission, 1894; Peebles & Mann, 1914), so that those exhibiting violent behaviour are probably over-represented in the hospitalized samples. Some authors in the USA have attempted to establish the direct role of cannabis in violent acts,² but these reports are of little value because there is usually no effort to establish the validity of the claimed relationship, nor is information provided on the relative incidence of such cases among otherwise comparable populations of users and non-users.

Several investigators have sought to establish the overall prevalence of detected crime among users.³ Their studies show a correlation of cannabis use with crime, but do not establish causal relationships. They show an association between cannabis use and minor asocial or antisocial behaviour, but not between cannabis use and major crime. Those studies that begin with a sample of persons arrested for using cannabis generally show a much higher positive correlation with subsequent delinquent behaviour than do studies that begin with a more representative sampling

¹ Bouquet, 1951; Chopra et al., 1942; Christozov, 1965; Roland & Teste, 1958; Warnock, 1903.

² Merrill, 1938; Munch, 1966; Wolff, 1949.

³ Bromberg, 1934; Chopra et al., 1942; Gardikas, 1950; Polansky, 1967; Robins et al., 1970.

of cannabis users (Blum et al., 1969b). Indeed, even among persons who have never used cannabis, a positive correlation exists between arrest and subsequent delinquent behaviour (Lunden, 1964).

Three military studies found that marihuana users exhibited poor adjustment to military life but little aggressive criminality.¹ Two studies of Brazilian prisoners similarly concluded that cannabis played a minimal role in crimes of violence (Moraes Andrade, 1964; da Veiga & de Pinho, 1962).

In the USA, the relation of marihuana to crime has been studied by observers living in the culture. The Mayor's Committee on Marihuana (1944) found that many marihuana users committed petty crimes, but found no evidence that the practice was associated with violence or major crime. A recent study of juvenile drug users, mostly from lower-class minority groups, found that marihuana users were less likely to show aggressive behaviour than were the group who preferred alcohol (Blumer et al., 1967). Moreover, they found that a shift from alcohol to marihuana was likely to be accompanied by a tendency towards less delinquent behaviour.

Some reports from West and South Africa have indicated that cannabis is occasionally used to provide courage to perform criminal acts.² Blumer et al. (1967) also described one type of user who takes marihuana to fortify himself in criminal operations, although amphetamines and barbiturates tended to be preferred for this purpose.

A revealing way to assess the contribution of cannabis to crime and violence is through a comparison with alcohol. The latter provides an established base-line, both from everyday experience and from reliable statistics. On the basis of such comparisons, most authors are of the opinion that alcohol is much more closely associated with aggression and violence than is cannabis.³

4.4 Questions of tolerance and physical and psychic dependence

In a description of drug dependence of the cannabis (marihuana) type (Eddy et al., 1965) the following characteristics were listed : (a) moderate to strong psychic dependence on account of the desired subjective effects; (b) absence of physical dependence, so that there is no characteristic abstinence syndrome when the drug is discontinued; (c) little tendency to increase the dose and no evidence of tolerance. These characteristics must now be re-examined because of subsequent findings.

¹ Bromberg & Rodgers, 1946; Freedman & Rockmore, 1946; Siler et al., 1933.

² Ames, 1958; Asuni, 1964; Watt, 1961.

³ Anonymous, 1951; Bouquet, 1951; Chopra et al., 1942; Indian Hemp Drugs Commission, 1894; Murphy, 1963; Tinklenberg & Stillman, 1970.

4.4.1 Tolerance

Tolerance is "an adaptive state characterized by diminished response to the same quantity of a drug" (Eddy et al., 1965). Recent animal experiments have shown rapid development of high degrees of tolerance to Δ^9 -THC and extracts of cannabis in pigeons,¹ mice and rats (Carlini, 1968; Moreton & Davis, 1970), and dogs (Dewey et al., 1969).

Some evidence of tolerance in "heavy" users has been reported.² In an experimental study in which subjects smoked marihuana *ad libitum* for 39 days, the number of cigarettes taken daily slowly increased throughout the period, while the characteristic euphoric reaction and the increase in pulse rate disappeared after the first few days (Williams et al., 1946). Some ganja and charas smokers in India consume daily amounts that can be estimated roughly to contain an average of 720 mg of Δ^9 -THC (Chopra & Chopra, 1939). It seems doubtful whether such large doses could be consumed unless some degree of tolerance developed. The question of tolerance to cannabis in man clearly deserves further investigation.

4.4.2 Physical dependence

Physical dependence has been described as "an adaptive state that manifests itself by intense physical disturbances when the administration of the drug is suspended... These disturbances, i.e., the withdrawal or abstinence syndromes, are made up of specific arrays of symptoms and signs of psychic and physical nature that are characteristic for each drug type" (Eddy et al., 1965). As noted above (section 4.4) these authors stated, on the basis of data then available, that cannabis did not cause physical dependence. Certainly there was no evidence then, nor is there now, to suggest that the withdrawal of cannabis even from an extremely "heavy" user produces an abstinence syndrome that begins to approach in severity those produced by drugs of the alcohol, barbiturate, and morphine types. However, reports of some degree of possible abstinence phenomena have been made.³ The phenomena described in most of these studies include mild to moderate anxiety, depression, weakness, sleep disturbances, sweating, and fine tremors. One author (Fraser, 1949) reports possible brief psychoses. Further study is necessary to determine more precisely the circumstances in which withdrawal-associated signs and symptoms may appear. If such signs and symptoms are consistently demonstrated in a substantial number of cases, it will be necessary to seek the mechanisms involved.

¹ Black et al., 1970; Frankenheim et al., 1970; McMillan et al., 1970.

² Chopra & Chopra, 1939; Dhunjibhoy, 1930; Ewens, 1904.

³ Bouquet, 1944; Chopra & Chopra, 1957; Christozov, 1965; Kielholz & Ladewig, 1970.

4.4.3 *Psychic dependence*

This has been described as a condition in which a drug produces "a feeling of satisfaction and a psychic drive that require periodic or continuous administration of the drug to produce pleasure or to avoid discomfort" (Eddy et al., 1965).

As in nearly all biological, and particularly behavioural, phenomena, there is no hard and fast line between a state of psychic dependence and its absence. Rather, there is a continuum of phenomena, at one end of which psychic dependence clearly does not exist, while at the other it clearly does. Between these extremes there is a zone of behaviour that is not sufficiently characteristic of either extreme for it to be said that psychic dependence does or does not exist. In judging the presence or absence of psychic dependence in an individual, it is important to ascertain how far the use of cannabis appears to be a life-organizing factor, or to take precedence over the use of other coping mechanisms, or both (Cameron, 1971). The Group was of the opinion that many regular (almost daily) users of cannabis exhibit psychic dependence, as do some less frequent but relatively "heavy" users, whereas the great majority of people who use it a few times on an experimental basis, or casually on a few festive occasions a year, could not be said to exhibit psychic or any other dependence on cannabis.

5. RESEARCH NEEDS

There is a substantial fund of knowledge about (a) the properties of *Cannabis sativa* L. and its various psychoactive preparations, (b) the general manner in which those substances are used in different parts of the world, (c) some of the individual and sociocultural factors associated with their use, and (d) the dose-related immediate effects on man of taking cannabis and Δ^9 -THC. There are, nevertheless, a number of important questions to be answered with respect to these areas. It is evident also that there are at present many more questions than answers concerning the effects on man of prolonged cannabis use.

In the past few years there has been a major expansion of research activities designed to increase available information about the psychoactive constituents of cannabis, their pharmacological and toxicological effects, and their mode of action (Miller, 1970; Waller, 1970). An acceleration of effort in these areas may be expected as preparations of active principles of known chemical content become increasingly available for studies involving man.

Knowledge resulting from recent research now makes it increasingly feasible and important to undertake a series of studies that can be carried

out only in relation to human beings who are taking cannabis or who have taken it for some time. The Group considered it especially important to intensify substantially current research on (a) major epidemiological problems in widely varying sociocultural settings, and (b) the effects on man of using various cannabis preparations in differing amounts for specified, particularly prolonged, periods of time. Research on these problems has so far received less support than is warranted by their importance. International collaboration would greatly enhance the value of such investigations. The following are among the areas of highest priority :

5.1 Determination of the cannabinoid content of cannabis preparations in use in different parts of the world

An initial broad study, followed by selective monitoring, is needed for the purposes of comparative epidemiology. It is advisable that a large number of representative samples be collected in each area studied, taking into account the types of preparations and, where possible, their age and source. The minimum information required on the chemical constituents is the Δ^9 -THC content. It would be desirable to determine also the content of Δ^8 -THC, Δ^9 -THC acid, CBN, and CBD.

5.2 Distribution of cannabis consumption in the populations of various countries

This requires attention to the modes and frequency of consumption and the average amount consumed on a given occasion (preferably expressed as Δ^9 -THC content). Longitudinal data are also required on the proportion of the population who use and later discontinue use of cannabis and on those who continue to use it sporadically or gradually increase their level and frequency of consumption. The relation of cannabis use to the use of other drugs should be investigated in this connexion. Social and personality factors associated with non-use, as well as with use, in a given sociocultural setting should be studied. Finally, the drugs used by a particular culture for non-medical purposes should be evaluated in order to assess their relative impact on the individual and society. The regions selected for study should represent different levels of acceptance of cannabis use in a variety of sociocultural settings.

5.3 The effects of long-term cannabis use

It would be highly desirable to correlate studies on the effects of long-term use with the distributional picture indicated in section 5.2. That is, samples of users should be selected for special study who are representative of various levels of use as regards quantity and frequency. These samples should be studied with special reference to the occurrence of

bronchopulmonary and cardiovascular diseases, chromosomal abnormalities, teratogenic effects, organic brain damage, deficits in cognitive and other skills, and social effects such as crime and other deviant behaviour. Evidence of changes in tolerance and characteristic abstinence symptoms and signs should also be sought. Comparisons should be made in all instances with suitable control samples of non-users. Because of methodological limitations, causal relationships often cannot be established. Nevertheless, such studies are useful since they establish the maximum effects that can be attributed to various levels of drug use. For instance, it would be useful to know the maximum effect on a particular variable that could be expected from the daily consumption of 1 g of ganja for 20 years.

5.3.1 *The relation of cannabis and psychoses*

In section 4.3.2, stress is placed on the need for studies on the prevalence and incidence of various psychiatric disorders in different groups of cannabis users (in relation to level and frequency of use) and in matched controls. In addition, since one of the more frequently mentioned distinguishing features of the "cannabis psychosis" is its relatively short duration as compared to functional psychoses, a prospective study comparing length of hospitalization for psychiatric admissions with and without a history of cannabis use might be useful. Better information on the history of onset is also needed.

5.4 Pharmacological research

Although such research is not the main subject of this section, certain areas are mentioned because of their close connexion with the above topics. Since cannabis is frequently used in combination with other drugs, e.g., tobacco and alcohol, or closely following them, experimental studies of the effects of such combinations are desirable. Further clarification of the relationship of response to dose and to route of administration is needed, from the standpoint both of acute effects and of the development of tolerance. There is also a need to assess further the acute effects of cannabis on attention, judgement, and psychomotor and other skills related to driving or to operating machinery.

6. RESEARCH STRATEGIES

In view of the complexity and cross-cultural nature of some of the more important research needs that have been mentioned, a number of observations and recommendations are offered on ways in which investigations might be encouraged and facilitated, and their productivity enhanced.

6.1 Provision for research access to cannabis and cannabis users

Laws and regulations concerning the control of cannabis and its preparations should take account of legitimate research needs. Where not already in existence, provisions should be considered that would permit (a) possession of needed research materials by accredited investigators, and (b) epidemiological research (e.g., surveys of patterns of use) without legal hazard to the investigator or user.

6.2 Comparability of cannabis materials involved in research studies

There is great variability in the degree of psychoactivity produced by different cannabis plants and preparations (see section 2.1). The following means are recommended to ensure the maximum comparability of results from studies in which the potency of cannabis materials is an important consideration.

(1) Standard materials of known chemical content should be available for experimental studies of acute and chronic effects.¹ If such materials are prepared in different laboratories, there should be common agreement on the chemical and biological criteria of potency.

(2) As noted in section 5.1, the cannabinoid content should be determined for cannabis preparations available in many parts of the world. It would be desirable for one organization to co-ordinate the collection and analysis of samples. Standard techniques of handling and analysing samples are essential.

(3) Research workers should have ready access to means of monitoring, by commonly agreed methods, the chemical and biological potency of materials under investigation.

6.3 Comparability of research approaches

Without underestimating the importance of endeavouring to develop new and increasingly effective approaches and methods for the study of complex problems, it must be stressed that the results of individual investigations can be better related to one another the more these investigations have in common as regards approach, method, and definition. Because they lack such elements in common, many reports in the cannabis literature must stand essentially alone, especially those dealing with various patterns of use and the phenomena associated with long-term use. Valid comparisons between such studies are frequently impossible. Moreover, the

¹ Substantial progress has recently been achieved in this field through the marijuana research programme of the National Institute of Mental Health in the U.S.A. (Miller, 1970; Waller, 1970).

lack of appropriate comparison groups within many of the studies permits only rather limited conclusions to be drawn, if any.

Means must be provided to foster the development of research programmes having sufficient comparability of approach and methods to permit increasingly informative comparisons and cross-cultural analyses to be made. The following proposals are made for this purpose.

(1) Provision should be made for the formation of a multidisciplinary group of research and other workers concerned with the epidemiology of cannabis use. These workers should be representative of each of the major areas of use in the world, and should meet periodically to develop common elements of approach, methods, and test instruments,¹ and to share experiences and pool data from their respective geographic areas and fields of competence. They group might be assigned the additional task of preparing periodic statistical and interpretative reports on the use of cannabis. Finally, selected members of the group might be called upon from time to time to constitute a team to assist in the development of epidemiological studies or to carry out time-limited studies in a particular area.

(2) Provision should be made for the convening of small groups of selected investigators who have entrée, in different regions of the world, to subcultures in which cannabis is used extensively. Discussions would centre on (a) their experiences in data collection, (b) the individual and social factors apparently associated with cannabis use and non-use in their localities, (c) the feasibility of collecting data with reasonably comparable parameters, and (d) the feasibility of establishing pilot programmes for cross-cultural collection and analyses of data.

(3) *Development of multidisciplinary research centres and information resources*

The importance of a multidisciplinary approach to the entire field of drug dependence has been stressed by the WHO Expert Committee on Mental Health (1967). Research designed to further knowledge about the extent and consequences of cannabis use is no exception. To stimulate further the development of much-needed research on cannabis in many parts of the world, it is recommended that WHO consider designating centres and individuals in appropriate regions of the world to assist in such endeavours. The Organization would be in a unique situation to foster collaboration among these centres and individuals, and their co-operation with other individuals and organizations concerned.

¹ In so far as possible, standard psychological and other test instruments and procedures should be identified that are relatively "culture-free" and capable of being adopted for local use in a variety of settings. They would not necessarily be the only tests used, but would provide a common bridge for purposes of comparison between projects.

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