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George U. Balis

The term "psychotomimetic" designates a large class of psychoactive compounds, variously known as hallucinogenic, psychedelic, psycholytic, psychotogenic, psychodysleptic, mysticomimetic, and phantastica. The decision as to which drugs should be included under these names is to some extent arbitrary, since there is no precise definition of the pharmacological category of these compounds. They are generally described as substances that produce primarily alterations in perception, thought, and mood in the absence of changes in conscious awareness. This definition excludes drugs that induce delirious states (deliriants), generally characterized by an altered state of consciousness accompanied by clouding of awareness, and also drugs that are variously classified as sedative-anesthetic, narcotic, inebriant, euphoriant, or stimulant. Nevertheless, there is considerable overlapping in the pharmacological profile of these drugs, since, one way or the other, they alter some aspect of the conscious experience, a psychotropic effect that greatly depends on dosage, route of administration, and combination with other drugs, as well as on the idiosyncrasy, personality, and mental set of the user, and the setting in which the drug is taken. In general, this chapter deals

with those drugs which alter the state of consciousness with regard to the quality and intensity of the various parameters of the conscious experience, especially perception, cognition, and affectivity.

When drug-induced changes in these experiential parameters occur in a clear sensorium, the effect is described in its typical form as “psychedelic” or “hallucinogenic.” On the other hand, when these changes occur in a clouded sensorium, that is, in a state of confusion, disorientation, diminished awareness, and impaired subsequent recall of the drug experience, the drug response is described as “delirium.” However, this distinction is to some extent arbitrary, because overlapping intermediate states may be induced by both categories of drugs. Furthermore, the two psychotomimetic syndromes reach “psychotic” proportions only when the mental functioning of the subject is sufficiently impaired to result in profound alterations of mood or in serious deficits in the areas of reality testing, perception, and cognition. Actually, the usual reaction to most of these drugs can hardly be described as “psychotic.” Since the most important characteristic of the effect of these drugs is alteration of consciousness, it is pertinent to consider in some detail the concept of consciousness and its vicissitudes under the influence of psychotomimetic drugs.

Drugs and the Vicissitudes of Consciousness

Attempting to define consciousness is fraught with as many difficulties as trying to define the "ghost in the machine." The class of phenomena denoted by the term "consciousness" represents not only a conceptual construct but also an empirical datum, the *sui generis* nature of which transcends any measure of objectivity. As a conceptual construct, the term has various meanings when used in a philosophical or metaphysical context, but has very little heuristic value in scientific research. As an empirical datum, consciousness was defined by Jaspers as a phenomenon of psychic life understandable in terms of our own introspection or of our patient's reported introspection, and constituting an immediate experience of the total psyche— analogous to a stage— within which the phenomena of perception, cognition, memory, and affect occur. Jaspers further distinguished three aspects of consciousness, namely, (i) the actual inner awareness that accompanies consciousness, (ii) the awareness that defines the boundaries of the self (the subject-object dichotomy), and (iii) the knowledge of the conscious self, or self-awareness. Another important aspect of consciousness is its "anticipatory" nature in the context of hindsight and foresight. The subjective experience of awareness, although a "private datum," represents the most substantive aspect of consciousness, the phenomenology of which can only be understood through introspection. On the other hand, the inspective study of observable behavioral and neuro-physiological variables associated with the phenomena of consciousness is primarily concerned with the subject's

responsiveness to his environment, but yields no information about the introspected or experienced aspect of this state. The reticular activating system seems to play an important role in the activation as well as the integration of the processes that subserve consciousness.

The state of consciousness may undergo alterations in many clinical conditions including epilepsy (twilight states), dissociative forms of hysteria (fugue states, somnambulism), psychoses, delirium, stupor, and coma, as well as in hypnotic states, dreaming, religious "conversion" experiences, and transcendental or mystical experiences. These conditions may involve changes in the content, intensity, and/or quality of the conscious experience. For instance, the content of consciousness—thoughts, memories, percepts—may become pathologic in nature, as in psychoses (delusions, hallucinations), or it may be quantitatively reduced, as in dementias. Disturbances related to the intensity gradient of consciousness—viewed as a continuum ranging from hypervigilance to coma—are seen in acute panic states or drug-induced stimulation on the one hand, and in the various stages of coma and anesthesia on the other. In describing the latter states, reference is made to levels or depths of coma or anesthesia. In delirious states, there is primarily an interference with integrative processes, which results in the dissolution of the "Gestalt" of consciousness that is referred to as awareness. In the psychedelic experience induced by hallucinogens, there is primarily an alteration in the quality of the introspected correlate of consciousness associated with

heightened awareness.

The “Psychedelic” (LSD) Experience

This drug response is induced by LSD-25, mescaline, psilocybin, and other hallucinogens. The experiential content of the reaction is greatly influenced by the “set” (the subject’s expectations of what the drug will do to him in relation to his personality) and the “setting” (the total milieu) in which the drug is taken. A description of the LSD-induced psychedelic experience will be presented as a prototype. The sequence of occurrences following the ingestion of effective doses of LSD—popularly known as the “trip”—usually begins half an hour after taking the drug, reaches a peak in about two to three hours, and terminates after a total duration of six to twelve hours. The reaction''' begins with a prodromal phase of autonomic effects, lasting about one hour, and including pupillary dilation, nausea and occasional vomiting, pallor or flushing, tremor, dizziness, and restlessness associated with dysphoria. The vegetative phase is followed by a period of perceptual changes involving distortions of body image characterized by sensations of changed body size and shape, and altered perceptions of the subject’s relationship to his body and its parts. Body boundaries may become fluid, or fused with the surroundings, or may acquire a pulsating quality. As the reaction progresses, the subject increasingly experiences feelings of derealization and depersonalization characterized by a peculiar awareness of “apartness” or a

feeling of “double consciousness,” in which there is a splitting of the self into a passive, detached, and observing monitor—the “spectator ego”—and an experiencing self. Other perceptual changes include vivid illusions which are mostly visual, distortions in the three-dimensional space, and, rarely, hallucinations. Freedman asserts that “illusions can be imaginatively or regressively elaborated in hallucinations,” and “memories can emerge as clear images competing for the status of current reality.” Subjects report a phantasmagoria of kaleidoscopically perceived visual experiences variously described as space full of geometric patterns and weird objects, brilliant colors, lights, objects which appear to fluctuate, to change in size and shape or fuse with the background, faces of people distorted in a caricaturistic or frightening way, fluid boundaries, perseveration of images, synesthesias, such as “color-hearing” and “sound-seeing,” and, in general, an endless description of perceptual alterations, the nature of which is greatly influenced by set and setting. Subjects may show the whole spectrum of affective responses ranging from exhilaration, ecstasy, and euphoria (accompanied by uncontrollable giggling and laughing) to depression, despair, or panic. Investigators have emphasized the subject’s fear of loss of control in the area of intellect, emotion, and bodily function, which may result in panic reactions. While some subjects show euphoria and “ego expansiveness,” others react with apathy, psychomotor retardation, and “ego constriction.” Most cognitive functions have been reported to suffer significant impairment, even under

moderate doses, especially immediate memory, attention, concentration, recognition and recall, problem-solving and spatial discrimination, judgment and comprehension, and learning. Reported disturbances of thought processes include blocking, flight of ideas, and incoherence. Rorschach responses reveal a tendency towards concrete thinking, decreased productivity of responses, and an exaggeration of basic personality characteristics. Perceptual tests have shown impairment in discrimination in color perception, alterations in perception of size, direction, and distance, and distortions in the sense of time. The telescoping of past and future and the overvaluation of "nowness" during the LSD-experience may be the result of the alterations in time perception, probably related to the impairment of immediate memory, a phenomenon also reported with marijuana smoking. The compelling immediacy of the psychedelic experience may also contribute to this "here-and-now" orientation. Other effects of the drug, which are greatly dependent on the expectations of the user, include the experience of a self-revealing transcendental state, the attainment of stunning "insights," and the enhancement of creativity, either during the experience or thereafter. These controversial effects have been attributed to subjective convictions resulting from the peculiar experiential state of the subject. Under the influence of the drug, objects that are void of any aesthetic, emotional, or intellectual connotation become overwhelmingly beautiful, or are invested with new and profound significance. According to Freedman, "qualities

become intense and gain a life of their own; redness is more interesting than the object which is red, meaningfulness more important than what is specifically meant. Connotations balloon into cosmic allusiveness. This can be experienced religiously, aesthetically, sensually." Also, in this state, the familiar acquires the characteristics of a *jamais vu* quality, and becomes novel and "portentous." It is "the capacity of the mind to see more than it can tell, to experience more than it can explicate, to believe in and be impressed with more than it can rationally justify, to experience boundlessness and 'boundaryless' events, from the banal to the profound," that Freedman calls "portentousness." The claim that the drug experience enhances creativity has been challenged by several writers. Mamlet has called attention to the "consciousness-limiting" side effects of these so-called consciousness-expanding drugs. Others believe that these potential forms of consciousness may open up avenues of creativity but are not creative themselves, or, as William James asserts, they "may determine attitudes though they cannot furnish formulas and open a region though they fail to give a map."

The "Euphoric" (Marijuana) Experience

The term "euphoria" is loosely used in the literature to describe a variety of affective states including a heightened sense of wellbeing, or a pleasurable (hedonic) feeling of variable quality. Euphoria does not seem to represent a distinct affect or to be associated with a specific stimulus or a

specific psychological state. It is an over-inclusive term that encompasses such qualitatively different feelings as those induced by narcotics (opiates), inebriants and intoxicants (ethanol, ether), stimulants (amphetamines), or moods experienced by manic patients. The euphoric experience or "high" induced by marijuana and its products is a complex psychological response characteristic of this drug. Although with small doses the marijuana effect is primarily euphoric and comparable to that of alcohol, with larger doses it is mainly "psychedelic" comparable to that of LSD. There is wide variation of response to marijuana, depending not only on the type and quality of the cannabis product (tetrahydrocannabinol content), but also on the user (his personality, motivation, expectations, and previous experience with the drug), and the environment in which it is taken. There are also variations in the effect, depending on whether marijuana is smoked or ingested. With marijuana smoking the effects occur rapidly (within ten to thirty minutes) and last for two to four hours; also, the level of intoxication can be easily titrated. With oral administration, the onset is slower (thirty minutes to one hour) and the effects last longer (five to twelve hours).- The initial effects of marijuana on the naive user have been described as unpleasant or ambiguous. It has been suggested that "before the smoker can derive agreeable sensations from cannabis, he must first go through the discomforts of habituation," a phenomenon that has been attributed to a learning process involving not only the learning of the correct technique of inhaling but also

learning to appreciate and define the effects of the drug as pleasurable. The alternative hypothesis, however, “that getting high on marijuana occurs only after some sort of pharmacological sensitization takes place” has received recent support from metabolic studies on tetrahydrocannabinol which indicate that active metabolites are formed in the liver by inducible enzymes activated by repeated exposures to the drug. A characteristic aspect of marijuana effect is its wave-like quality, a waxing and waning phenomenon which has also been reported to characterize the psychedelic experience produced by hallucinogens, like LSD. The predominant psychological effect is euphoria. Other affective changes may include elation and sense of well-being, confidence, and adequacy, hilarity and uncontrollable laughter. Anxiety has been frequently reported, especially in the inexperienced user, and when the drug is taken in nonsupportive settings. Somnolence is invariably present. Perceptual changes include heightened sensitivity to external stimuli, shifting attention with focusing on details that would ordinarily be overlooked, micropsias and occasionally macropsias, disturbances of body image, depersonalization and the phenomenon of “double consciousness,” distortions in the perception of time and space, and enhancement in the aesthetic appreciation or insightful understanding of what is perceived or experienced. Other, less frequently reported perceptual changes include synesthesias,'' illusions, and hallucinatory-like experiences. In a recent questionnaire study of forty-two marijuana users, Keeler et al. found that

about 40 percent of the subjects had experienced hallucinations. In another questionnaire study by Tart, marijuana users reported the following perceptual changes experienced under the influence of the drug:

"When looking at pictures, they may acquire an element of visual depth, a third dimensional aspect . . . contours stand out more sharply against the background." When listening to music, the subjects felt that "spatial separation between various instruments sounds greater, as if they were physically apart," and with eyes closed, they felt that the space "becomes an auditory space, a space where things are arranged according to their sound characteristics instead of visual geometric characteristics." There were also distortions from other sensory modalities: "My sense of touch is more exciting, more sensual . . . Smells become richer and more unique . . . Taste sensations take on new qualities," "distances seem to get greater," "time passes very slowly . . . certain experiences seem outside of time, are timeless."

The exaggeration of the sense of time is considered as one of the most conspicuous effects of marijuana and has been attributed to a characteristic cognitive impairment involving primarily immediate memory. The interrelationship between changes in time perception and impairment of immediate memory was ingeniously demonstrated by Melges and associates, who found that subjects given marijuana-extracted tetrahydrocannabinol show a definite impairment on a complex test for immediate memory. The

impairment was labeled “temporal disintegration,” which they defined as “difficulty in retaining, coordinating, and serially indexing those memories, perceptions, and expectations that are relevant to the goal . . . (an individual) is pursuing.” Temporal disintegration was also found to be associated with the loosening of verbal associations and the lack of goal-directedness in speech.

In another study, using a test in which the subjects judged for themselves how well they were able to co-ordinate the past, present, and future, as well as how well goal-directed they felt, Melges and associates concluded that the distorted time perception induced by marijuana was also associated with the subject’s tendency to focus on the present to the exclusion of the past and future. This telescoping of time, also reported with LSD, was closely related to the degree of depersonalization experienced by the subject. There is considerable controversy as to whether marijuana smoking produces any significant impairment in cognitive functions and task performance. In general, marijuana users feel that they can “turn off” the “high” at will, and that they have a degree of self-control that allows them to pursue any goal-directed activity. This ability to “compensate” when performing on a task has been reported by several investigators,’”’ who have found that the administration of marijuana does not produce any significant impairment in various simple motor and mental performance tests. Weil and associates reported that although marijuana-naive persons demonstrate impaired

performance on simple intellectual and psychomotor tests, experienced marijuana users show very little impairment. Similarly, Crancer and associates, using experienced marijuana smokers to compare the effect of alcohol and marijuana on performance in a driving simulator apparatus, found that there were no significant differences in terms of total scores, except for speedometer errors, when the subjects were under the influence of marijuana, whereas there was marked impairment in all measures of the test, with the exception of steering errors, when the subjects were under the influence of alcohol. It has been suggested that Crancer's enthusiastic marijuana smokers were probably eager to prove that marijuana is safe and alcohol dangerous.

More recently, Meyer and associates compared the effect of marijuana on heavy and casual marijuana users by using a placebo, a fixed dose of marijuana, and a self-selected ad lib dose. Their subjects showed a modest decrease in perception and psychomotor task performance with both types of marijuana dose, though casual users demonstrated a greater degree of impairment than did heavy users. Other investigators have similarly reported that the administration of increased doses of marijuana does not produce increased performance decrements. The question of dose-response relationship in perceptual and cognitive functions was recently studied by Dornbush and associates, who found that memory and retention time were significantly affected by the higher doses, whereas time estimation was not

differentially affected by either lower or higher doses. Studies using more complex tests have shown that marijuana produces considerable impairment in performance. Thus, Clark and associates, using tests which involved a prolonged and intricate task, concluded that "marijuana intoxication has significant effects on complex reaction time (largely through sporadic impairment of vigilance), recent memory, recall and comprehension of written information, and accuracy of time estimation," and also that "the processes involved in selective perception (and, conversely, habituation to irrelevant stimuli), immediate recall of preceding thoughts in order to keep on track, and capacity for goal-directed systematic thinking are particularly sensitive to relatively low doses of marijuana." In spite of this cognitive impairment, many marijuana users claim that the drug makes them think insightfully and creatively. Using objective measures of perceptiveness, Jones and Stones found that subjects under the influence of marijuana were less perceptive than when sober, and retrospectively regarded many of their marijuana-produced "insights" as nonsense. It is likely that the marijuana-induced feeling that things look novel and original, a phenomenon comparable to the clinically occurring experiences of *jamais vu,* might account for the subjective reports of originality, insightfulness, and creativity. Others have attributed it to heightened suggestibility and faulty perception, impaired judgment, and enhanced awareness. The effects of tetrahydrocannabinol (THC)—the major psychoactive substance contained in cannabis—were first

studied by Isbell and associates. These investigators administered progressively increasing doses of THC by smoking (50 to 200 mcg./kg) and oral ingestion (120 to 480 mcg./kg). The psychological changes induced by the drug were dose-dependent. Lower doses produced euphoria, alterations in sense of time, and heightened visual and auditory perception. Higher doses produced marked perceptual distortions, derealization, depersonalization, and hallucinations, both auditory and visual. Studies comparing the subjective experience produced by THC and LSD have shown that the effect of the two drugs is very similar. The only significant difference is that with LSD the subjects are extremely alert, whereas with THC they become sedated and fall asleep. Also, THC tends to produce prominent and persistent euphoria; on the other hand, the prominent effect in LSD experience is awe and fear. Subjects generally describe the THC experience as more pleasant than that of LSD.

The "Delirious" (Toxic) Experience

This is a primitive "high" characterized by gross disturbances of consciousness and cognitive functions, frequently associated with perceptual distortions and affective changes ranging from euphoria to panic or rage. It represents a crude assault to conscious experience and is sought primarily for the initial inebriating effect that precedes the confusional excitement. Deliriant drugs commonly used to obtain this type of "high" include ether, nitrous oxide, and various industrial solvents containing hydrocarbons (e.g.,

glue-sniffing). In general, the drug response is the result of an acute brain syndrome characteristic of a "toxic psychosis." In delirium, there is characteristic reduction of the level of awareness, ranging from mild sluggishness of grasp to stupor or unconsciousness. In a typical case, the patient is disoriented, confused, bewildered, and incoherent. In more severe cases, thinking is disjoined, irrelevant, and frequently delusional. Delusional ideas are poorly organized, shifting in content, dreamlike, and often persecutory in nature. They usually occur in the context of perceptual distortions, illusory misinterpretations (usually misinterpreting the unfamiliar for the familiar), and hallucinatory experiences, mainly visual. The mood of the delirious patient is often characterized by perplexity, apprehension, and fear, which often reaches panicky proportions. In his panic, the patient may become highly impulsive, destructive, and suicidal. Motor activity may vary from marked retardation to severe excitement with uncontrollable hyperactivity. The electroencephalographic (EEG) findings in delirium consist of generalized slow frequencies in the delta-theta range. The degree of synchronization of the EEG seems to correlate with the severity of the disturbances of consciousness. Upon recovery from the episode, the patient shows spotty amnesia of his experiences during the delirium; the amnesia is proportional to the degree of the impairment of consciousness.

Pharmacology of Psychotomimetic Drugs

Classification

The psychotomimetic drugs may be classified into two major categories: (1) Those producing heightened awareness, properly labeled as "psychedelic;" and (2) those producing clouded awareness, known as "deliriant."

1. *The Psychedelic Group* includes a number of drugs of synthetic or plant origin which can be subdivided, from a chemical point of view, into the following three subgroups:

    a. *The Indole (Tryptamine) Compounds,* which include LSD-25 (d-lysergic acid diethylamide), psilocybin (4-phosphoryloxy-N,N-dimeth-oxytryptamine), psilocin (dephosphorylated derivative of psilocybin), and the dimethyl homolog of psilocin, DMT (N,N-dimethyltryptamine), DET (N,N-diethyltryptamine), DPT (N,N-dipropyltryptamine), Alpha-MT (dl-alpha-methyltryptamine), harmine and its tetra-hydrogenated derivative, tetrahydroharmine, and ibogaine. The psychotomimetic action of two other indole derivatives, bufotenin and serotonin, is not definitely established. A number of plants shown to possess psychotomimetic properties associated with naturally occurring indole compounds are also included in this group. The snuff called "cohoba" prepared by Haitian natives from the seeds of *Piptadenia peregrina* contains bufotenin, DMT, and several other indoles. The Mexican "hallucinogenic" mushrooms ("teonanactyl") which belong to the *Psilocybe* species contain psilocybin. The fly agaric mushrooms (*Amanita muscaria)*

contain bufotenin, muscarine, and piltzatropine. The African shrub "iboga" (*Tabernanthe iboga),* used by some inhabitants of West Africa and Congo to increase endurance and as an aphrodisiac, contains ibogaine. The psychotomimetic substances contained in the plants *Banisteropsis caapi* and *Prestonia amazonicum,* which are used by the Indians of Peru, Ecuador, Colombia, and Brazil for their hallucinogenic properties, include harmine and tetrahydroharmine. Finally, the morning glory plants (*Ololiuqui*), which belong to the *Convolvulaceae* species (*Rivea corymbosa),* contain several ergot alkaloids, including lysergic acid amide and isolysergic acid amide.

b. *The Catecholamine (Adrenaline) Compounds* include the *phenylethylamine derivatives,* the most important member of which is mescaline (3,4,5-trimethoxyphenyethylamine), and the *amphetamine derivatives,* which include TMA (trimethoxyamphetamine), MDA (methylenedioxyamphetamine), DMA (2,5-di-methoxyamphetamine), DOM (2,5-dimethoxy-4-methylamphetamine), known in the hippie vernacular as "STP," DOET (2,5-dimethoxy-4-ethylamphetamine), MMDA (3-methoxy-4,5 -methylenedioxyamphetamine), and DMMDA (2,5-di-methoxy-3,4-methylenedioxyamphetamine).

In this category belong the following psychotomimetic plants containing adrenaline-type derivatives: The cactus plant peyote, which contains mescaline; nutmeg, a household spice derived from the tree *Myristica fragrans* grown in the

Molucca Islands, and which contains the psychoactive substance myristicin, a methylenedioxy-substituted compound resembling mescaline and ephedrine; khat, derived from the plant *Catha edulis,* is a mild stimulant and euphoriant widely used in many parts of Africa and Arabia, which contains the ephedrine-like compounds cathine, cathidine, and cathinine; kava-kava, derived from the plant *Piper methysticum,* is another mild social euphoriant containing the active substance methysticin, used by the inhabitants of the Pacific islands in the form of a beverage.

Finally, we will add to this category the various *sympathomimetic amines,* which include amphetamine, methamphetamine (Methedrine), methylphenidate (Ritalin), and phenmetrazine (Preludin). These central stimulants, although not psychotomimetic in the usual clinical doses, do produce psychotomimetic reactions when given in toxic doses.

c. *Tetrahydrocannabinols,* of which Delta-g-tetrahydrocannabinol (TCH) is considered to be the active substance contained in marijuana (*Cannabis sativa)* and other hemp products (hashish).

2. *The Deliriant Group* is the second large category of psychotomimetic drugs. The deliriants may further be classified into the following three subgroups:

a. *Anticholinergic Compounds,* which include the belladonna alkaloids (atropine), the piperydil-benzilates (Ditran), the diphenylmethane compounds (diethazine), and a number of

other anticholinergic compounds (antiparkinsonian drugs).

b. *Anesthetic Compounds,* including Sernyl, alpha chloralose, and other anesthetic drugs which are characterized by a prolonged Stage II anesthesia (chloroform, ether, nitrous oxide).

c. *Various Volatile Hydrocarbons,* used primarily as industrial solvents (benzene, toluene, carbon tetrachloride), the sniffing of which represents an increasing aberrant behavior among young adolescents.

LSD-25

LSD is a semisynthetic derivative of the fungus ergot of rye and belongs to the ergobasine group. Its psychotomimetic effect was discovered accidentally by Hofmann in 1943. In the past twenty-five years there has been published a voluminous literature on the actions of this drug, stimulated primarily by the interest in producing a "model psychosis" for the understanding of schizophrenia, and by the controversial use of the drug as a psychotherapeutic tool. The widespread abuse of the drug by the young during the 1960s, and the possible dangers associated with it, gave a new impetus to LSD research and added new controversies. The "serotonin hypothesis" concerning the biochemical site of action of LSD is based on the notion that the drug may produce its effect by interfering with the action of serotonin in the brain. Although most of the data tend to support the view

that LSD alters synaptic transmission by antagonizing serotonin, the hypothesis still remains unproven. The literature on this subject has been reviewed elsewhere. The neurophysiological actions of LSD, and its effects on animal behavior have also been reviewed elsewhere. The minimal effective (threshold) dose of LSD in humans is 25 meg. However, the usual effective dose for eliciting a typical psychedelic experience ranges from 100 to 250 meg, although much higher doses have been used by various investigators. The duration of the reaction to LSD (eight to twelve hours), and the variations of its intensity correlate with the biological half-life of the drug in the plasma. Chronic administration of LSD does not result in physical dependence or withdrawal reaction. There is, however, a dose-contingent tolerance, which develops rapidly after repeated doses, requiring a free period of four to six days before a complete experience can recur. Cross-tolerance among various hallucinogens (LSD, mescaline, psilocybin) has been demonstrated in both animals'' and man. There is no cross-tolerance, however, between LSD and amphetamine or tetrahydrocannabinol. Drugs which tend to enhance and prolong the subjective experience to LSD include reserpine, sympathomimetic amines, and anticholinergic drugs; on the other hand, chlorpromazine and other phenothiazines are very effective in attenuating the LSD effect. LSD has a mild desynchronizing effect on the electroencephalogram characterized by a reduction in alpha frequency and an increase in beta activity. Monroe and associates, using depth electrodes,

reported that LSD and mescaline produce subcortical paroxysmal activity in the hippocampal, amygdaloid, and septal regions, and that this activity correlated with an increase of psychotic behavior in schizophrenic subjects; these changes were blocked by chlorpromazine but not by reserpine. Many investigators have studied the effect of LSD on schizophrenic patients and have reported controversial findings as to whether these patients react in the same way as normals, whether they are more resistant in terms of dose, and whether they develop tolerance more quickly.'' The physiological changes induced by LSD in human subjects consist primarily of pupillary dilatation and increase in deep tendon reflexes, an increase in pulse rate, and a rather inconsistent rise in systolic blood pressure; LSD has also been reported to produce slight ataxia, analgesia, increased salivation, and antidiuretic effect.' The only significant biochemical changes induced by LSD consist of an increase in free fatty acid levels, and a decrease in inorganic phosphorus excretion.

Other Indole (Tryptamine) Derivatives

Psilocybin. The psychotomimetic compound contained in the mushrooms of the *Psilocybe* species, which have been used by Mexican Indians for centuries in religious and ceremonial practices. The psychotomimetic effect of psilocybin is very similar to that induced by LSD, though shorter in duration. The clinical changes after parenteral injection

start within five minutes and terminate after five hours; the intensity of the experience is dose-dependent. Threshold doses up to 4 mg. of psilocybin produce a pleasant sensation of relaxation associated with feelings of mild detachment, and floating sensations. With higher doses (5 to 12 mg.) a typical psychotomimetic experience is elicited, characterized by perceptual alterations, depersonalization, heightened awareness, and mood changes. As with other hallucinogens, the reaction is preceded by vegetative symptoms. The phenomena of tolerance and cross-tolerance with other hallucinogens have been reported in repeated uses of psilocybin.

DMT (N,N-dimethyltryptamine). An idole derivative which occurs naturally in various plants *(Piptadenia peregrina, Prestonia amazonicum),* used by South American Indians as a snuff (cohoba) for ceremonial and religious purposes. In doses of 20 to 75 mg., DMT produces a short but intense psychotomimetic reaction, which develops rapidly and is characterized by a greater variety of visual experiences; strong feelings of loss of control may lead to panic states. With 75 mg. of DMT, given intramuscularly, Szara reported strong autonomic changes consisting of nausea, mydriasis, increased blood pressure and pulse rate, trembling and choreoathetoid movements, as well as euphoria and vivid illusory-hallucinatory experiences; the symptoms disappeared after three-quarters to one hour.

DET (N,N-diethyltryptamine). Also a potent hallucinogen whose action has been compared to that of DMT. With intramuscular doses ranging from 0.70 to 0.80 mg./kg. of weight, DET has been reported to produce vegetative symptoms, paresthesias, and psychic changes characteristic of other psychotomimetic drugs; however, the majority of cases experience some clouding of consciousness characteristic of delirious states. Other indole derivatives which have been demonstrated to possess psychotomimetic activity include DPT, alpha-MT, ibogaine, and harmine.

Mescaline

Mescaline is the principal psychoactive substance contained in the peyote, a cactus plant *(Lophophora williamsii)* found in the southwestern part of the United States and the northern part of Mexico. Peyote has been used for centuries by Mexican Indians in the context of religious ceremonies, and in the past one hundred years by the members of the native American Church of North America, a Christian-derived religion followed by North American Indians. The members of this religious group eat liberal amounts of peyote during collective all-night "meetings" held in the home of one of the participating families, a sacramental practice that enables the faithful to commune with God for curative and other beneficial purposes. Weir Mitchell, Havelock Ellis, and more recently, Aldous Huxley, have written fascinating descriptions of the mescaline effects in self-experimentation. Louis Lewin, in

his classic 1924 monograph, “Phantastica, Narcotic and Stimulating Drugs,” presented a thorough discussion of the mescaline-induced psychological changes. In the early 1900s, there was considerable research interest in investigating the pharmacological properties of the drug, and this early work represents the first scientific attempts to study the phenomena associated with the use of psychotomimetic drugs. Peyote contains numerous alkaloids which are bio genetically interrelated, including two major classes: (a) the phenylethylamines, among which the most important is mescaline, and (b) the tetrahydroisoquinolines. Most of the phenylethylamines present in the cactus have sympathomimetic properties and produce experimental catatonia in animals. The reported pharmacological, physiological, and behavioral effects of mescaline are very similar to those of LSD. The active psychotomimetic dose of mescaline is in the range of 300 to 500 mg. The clinical effects of this drug are also similar to those of LSD, with minor differences : The duration of the action of mescaline is longer than that of LSD and is characterized by stronger autonomic effects; it is also thought that mescaline produces a more “sensual” experience than does LSD. Tolerance develops after repeated doses of mescaline, although more slowly than with LSD.

Mescaline Analogs (Amphetamine Derivatives)

The psychotomimetic effects of these drugs are much less known, but

appear to be similar to those produced by LSD and other hallucinogens, with some differences in the nuances of the subjective effects, and variations in onset and duration of action.

DOM (2,5-dimethoxy-4-methylamphetamine). Known in the "hippie" subculture as "STP," DOM has been shown to produce in doses greater than 5 mg. pronounced hallucinogenic effects, which begin about one hour after administration of the drug, reach a peak between three and five hours, and subside after seven to eight hours.'' The somatic, perceptual, and psychic changes are similar to those of LSD. In lower doses, it produces mild euphoria; the minimal perceptible dose is 2 mg. Although DOM was rumored to be more potent than LSD ("mega-hallucinogen"), recent findings indicate that it is only about one-thirtieth as potent as LSD. The illicit product STP has been reported to produce severe and prolonged psychotic-like reactions which may persist for seventy-two hours, and that administration of chlorpromazine may precipitate cardiovascular shock, with fatal consequences in some cases, attributed to an alleged atropine-like effect of the drug. However, Synder and associates have demonstrated that there is no accentuation of any DOM effects by chlorpromazine; this finding suggests that street STP might contain atropine-like substances, which might also account for the reported prolonged reactions.

DOET (2,5-dimethoxy-4-ethylamphetamine). The ethyl homologue of

DOM, the action of which appears to differ in its spectrum of psychological effects from other psychotomimetic drugs. Over a five-fold range of dosage (0.75 to 4 mg.), DOET was shown to produce mild euphoria and enhanced self-awareness in the absence of hallucinogenic or other psychotomimetic effects. The drug produced no changes in blood pressure and pulse rate; there was slight pupil dilation with effects most marked at four hours.

TMA (3,4,5-trimethoxyamphetamine). The amphetamine analogue of mescaline, TMA is an active psychotomimetic agent, twice as potent as mescaline. Doses of 50 to 100 mg. of TMA produce giddiness and excitement characterized by hyperactivity, talkativeness, and decreased inhibitions, while at higher doses (200 mg.) it induces marked psychological changes (hostility, grandiosity, euphoria, and visual imagery) preceded by prodromal autonomic symptoms.

A large number of isomers of amphetamine derivatives (trimethoxyamphetamines, methylenedioxyamphetamines, methoxymethylenedioxyamphetamines, dimethoxymethylenedioxyamphetamines) have been synthesized; the relative activities of several of these compounds have been confirmed in animal behavioral tests. MDA and MMDA have been reported to produce psychotomimetic effects in man in the same dose range as mescaline.

Amphetamines and Other Sympathomimetic Amines

These compounds, although not psychotomimetic by definition, are included here because they produce psychotomimetic-like syndromes when given in large doses, and especially through the intravenous route. they include amphetamine, dextroamphetamine (Dexedrine), methamphetamine (Methedrine), phenmetrazine (Preludin), methylphenidate (Ritalin), and diethylpropion hydrochloride (Tenuate). It appears that the central stimulatory action of amphetamine and its peripheral sympathomimetic effects are mediated through the release of catecholamines. Numerous studies have demonstrated that amphetamine has facilitating effects on learning and goal-directed or operant behavior. The central adrenergic effects of amphetamines include arousal and heightened awareness, wakefulness, euphoria, mild antidepressant effect, and hyperactivity. These drugs produce desynchronized electroencephalographic patterns characterized by a decrease in the abundance of alpha activity and an increase in beta frequencies. With therapeutic doses, amphetamines commonly produce anorexia, dryness of the mouth, tachycardia, restlessness, and insomnia; with larger doses, subjects show marked euphoria, pressure of speech, restlessness, and irritability. Other effects include mydriasis, elevation of blood pressure, brisk reflexes, fine tremor of the limbs, cardiac arrhythmias, palpitation, dizziness, vasomotor disturbances, as well as dysphoria, apprehension, and agitation. Chlorpromazine has been reported to be

effective in the symptomatic treatment of acute amphetamine poisoning. There is recently accumulating evidence which suggests that the intravenous use of large doses of amphetamines and related compounds may produce predictable psychotomimetic reactions, characterized primarily by paranoid ideation. Louria reports that in Sweden the major drug problem is the intravenous administration of amphetamine-type drugs, especially phenmetrazine (Preludin). These drugs are believed to have a substantial aphrodisiac effect when taken intravenously. During a "central-stimulant binge," popularly known as "speeding," there is a cyclic pattern in the intravenous use of these drugs, characterized by repeated injections ("runs") of increasing amounts of the drug every few hours around the clock for a period of three to six days. After each injection, the user experiences a sudden overwhelming, pleasurable feeling called a "flash" or a "rush." With increasing doses in each "run" (as tolerance to the drug develops), the subject shows "recurrent affective lability," hyperacusis, compulsive patterns of behavior (a stereotyped mechanical-like hyperactivity), and finally he may develop paranoid ideas and illusory experiences. After the cycle is terminated—often by the administration of a barbiturate— the subject goes into profound and prolonged sleep, and upon awakening he feels lethargic, apathetic, and depressed ("crushed"), and experiences marked hunger for food. When the drug use becomes an established pattern, the dosage ranges from 100 to 300 mg. of methamphetamine, although much higher doses have been reported.

Although chronic use of amphetamines leads to the development of tolerance and psychological dependence, there is no convincing evidence of physiological dependence. The lethargy and depression that invariably follow the discontinuation of the drug after prolonged use has been described as representing an abstinence syndrome by some writers,' but this has been disputed by others.

Marijuana and Tetrahydrocannabinol

Cannabis sativa (or C. *indica,* or *C. americana*), commonly known as hemp or marijuana, has been used for its psychoactive properties since ancient times. Until about 1000 a.d., cannabis was mainly used in India and to much lesser extent in China. In the following centuries, its use spread to the Middle East and Near East, and in the nineteenth century, during the Napoleonic era, it was introduced from Egypt to Europe. It was during this period that the first literary and medical descriptions of marijuana effects were published in the Western world. Theophile Gautier, Charles Baudelaire, and Alexander Dumas wrote colorful and perceptive accounts of their hashish experiences. Cannabis extracts became a popular medication, prescribed for a variety of conditions, and especially used as sedative, analgesic, muscle relaxant, and anticonvulsant. The use of cannabis in medical practice gradually declined, mainly because of the variable potency of its preparations and its replacement by more effective anodynes and sedatives. The use of

marijuana as a euphoriant drug was first introduced to the United States during the first quarter of this century, via Mexico to New Orleans, where it was reported to have reached epidemic proportions in the 1920s and 1930s. It was during this period that marijuana received its publicity as the "marijuana menace" and the "killer drug," and the public upheaval created by the news media finally culminated with the passing of the Marijuana Tax Act in 1936.

Cannabis sativa is a ubiquitous annual plant, varying in botanical characteristics and properties according to the geographic and climatic conditions in which it is grown. Strains grown in warmer climates (Mexico, India) are reported to produce more of the resin that contains the psychoactive material than strains from colder climates. Other factors that determine the psychoactive potency of cannabis include conditions of cultivation, and conditions of harvesting, preparation, and storage. There are three rough grades of intoxicating material that are usually prepared from cannabis: (a) Low potency forms, prepared chiefly from the leaves of the entire plant, and variously known as marijuana (United States), bhang (India), dagga (S. Africa), or kif (N. Africa); (b) medium potency forms, ganja (India), prepared from the leaves of the flowering tops; and (c) high potency forms, containing pure resin scraped from the leaves near the flowering tops, and known as hashish or charas (India). The variable content of these products in psychoactive material is the most significant factor that accounts for the

reported great differences in their pharmacological effects.

Cannabis Chemistry and Metabolism

Although the major active components of cannabis, the cannabinoids, had been known for several decades, a number of them were subsequently proven to be psychotomimetically inactive (cannabinol, cannabidiol, cannabichromene, cannabinoid acids). With the isolation and synthesis of tetrahydrocannabinol (THC), a number of derivatives have been synthesized, characterized by variable potency and properties. Research during the last few years has shown that the major psychoactive THC contained in cannabis is Delta 9-THC (or Delta l-THC). However, the active Delta 8-THC (or Delta 1 (6)-THC) isomer may also be present in varying amounts. Delta g-THC is a labile resinous substance that is easily isomerized by acids to the more stable Delta 8-THC, and is slowly oxidized by air to cannabinol. On the other hand, there is evidence indicating that during smoking of marijuana the inactive cannabidiol may be partially converted into Delta 9-THC through the pyrolytic process. This finding may partly explain the observation that cannabis is more active when smoked than when taken orally. Although the THC content of marijuana varies greatly, it is estimated that marijuana generally available in the United States averages about 1 percent THC. In view that approximately 50 percent of the THC originally contained in a marijuana cigarette is destroyed by the combustion process, it is estimated that a

cigarette (1 gram) can deliver a maximum of 5 mg. THC.

Several *in vitro* studies have shown that the metabolism of Delta 9-and Delta 8-THC by the post-mitochondrial fraction obtained from the liver homogenates of various species proceeds by allylic hydroxylation to 11-hydroxy metabolites. Although the potency of these compounds varies depending on structure and route of administration, they produce similar behavior effects in animals. The 11-hydroxy-Delta 9-THC has been shown in mice to be fifteen to twenty times more active than the parent compound, and it is postulated that it may represent the active form of Delta 9-THC on the molecular level.' It has been suggested that these hydroxylated metabolites of THC are formed in the liver, possibly by inducible microsomal enzymes. Induction of these enzymes is implied by the observation of shortened barbiturate sleeping time in animals pretreated with THC. These findings may partly explain the phenomenon of "inverse tolerance" reported in experienced marijuana users, who may have a ready supply of the microsomal oxidase for a rapid conversion of THC to the 11-hydroxy metabolite. Recent studies show that THC and its metabolites can be found in body tissues for a considerable length of time after administration. In man, THC metabolites continue to circulate for at least eight days after administration. The plasma half-life of injected radioactive THC was found to be fifty-six hours in marijuana naive subjects, but much shorter in the experienced user.

Pharmacological Effects of Marijuana and THC

As Grinspoon points out, “In evaluating the various reports of the effects of marijuana, the problem of relative potency, stability, dosage level, and means of administration of marijuana or synthetic analogues rates second to bias or prejudice.” The most consistent physiological changes during marijuana or THC intoxication, regardless of route of administration, include injection of conjunctivae and increased pulse rate. Both these signs tend to parallel clinical effects. Increased appetite, especially for sweets, is commonly reported, although less consistently. Several studies have shown that the marijuana-induced hunger is not related to changes in blood glucose levels. Although several writers have reported pupillary dilatation, recent evidence’ has failed to corroborate this finding. Also, contrary to earlier reports, marijuana, as well as THC, do not appear to affect respiratory rate, systolic and diastolic blood pressure, or tendon reflexes.’’ Other less frequently reported symptoms include incoordination, tremors, ataxia, and muscle weakness, as well as thirst, dryness of the mouth and throat, nausea, vomiting, diarrhea, headache, vertigo, perspiration, palpitations, urinary urgency, and paresthesias. There are inconsistent reports about the electroencephalographic (EEG) effects of marijuana. Dornbush and associates recently reported EEG changes consisting of transient increase in percent time alpha and decrease in percent time theta and beta activities. Contrary to the reported “inverse tolerance” in experienced users, recent evidence

indicates that tolerance does develop to the effects of marijuana and THC in animals and in man. Tolerance to THC is marked and rapid and extends across species; it is also prolonged. There is cross-tolerance among tetrahydrocannabinols, but not to LSD and mescaline. No withdrawal syndrome develops following abrupt discontinuation of marijuana or THC. With regard to psychological changes, marijuana has a biphasic action, with an initial period of stimulation (anxiety, heightened perception, euphoria) followed by a period of sedation and somnolence. Higher doses produce definite psychotomimetic effects.

Deliriant Psychotomimetic Compounds

Anticholinergic Drugs

This group includes the belladonna alkaloids (atropine, l-hyoscyamine, and l-scopolamine), the synthetic piperydil-benzilates (Ditran), diphenylmethane compounds (benactyzine), and other anticholinergic drugs (diethazine, procyclidine, benzotropine, methane sulfate, trihexyphenidyl, and others). The solanaceae (belladonna alkaloids) have been known for inducing psychosis since ancient times. The clinical picture of atropine psychosis is characterized by confusion, drowsiness, ataxia, dysarthria, restlessness, over-activity, visual hallucinations, and excitement; the reaction may last several days. Scopolamine has a strong narcotic effect and, for this

reason, it was used to produce a “twilight sleep” during labor. The EEG changes induced by atropine and scopolamine consist of a disappearance of alpha activity and a decrease in amplitudes with a concurrent increase in theta and beta activities. The piperydil-benzilates (glycolate esters) include a large series of anticholinergic compounds, many of which have been shown to possess psychotomimetic activity.’ Among them, Ditran, when given in doses of 10 to 20 mg., produces excitement, hallucinations, confusion, disorientation, confabulation, and considerable amnesia for the delirious episode.

Anesthetic Drugs

A number of anesthetic drugs, including phencyclidine (Sernyl), alpha chloralose and, in general, anesthetics whose action is characterized by a prolonged Stage II anesthesia (e.g., chloroform, nitrous oxide, ether), produce psychotomimetic effects of the delirious type. Phencyclidine administered intravenously (0.1 mg./kg.) induces feelings of depersonalization and derealization, hallucinations, delusions, loss of sense of time, hostile attitudes, and panic. Alpha chloralose, used as an EEG activating agent, may induce psychotic-like reactions. Also, nitrous oxide (laughing gas) is a well-known deliriant with a considerable potential for abuse.

Volatile Hydrocarbons (Solvent Sniffing)

In the past ten years, there has been a marked increase in the use by inhalation of a wide variety of volatile organic solvents for the purpose of inducing states of intoxication.'' This form of drug abuse is most common among juveniles between the ages of ten to fifteen. The industrial products involved in solvent sniffing (plastic cements, model cements, and household cements or glues, fingernail polish remover, lacquer thinners, lighter fluid, cleaning fluid, gasoline) contain various volatile hydrocarbons, including toluene, acetone, aliphatic acetates, benzene, petroleum naphtha, perchlorethylene, tricholorethane, carbon tetrachloride, and others. In general, the acute effects of inhaling the vapors of these compounds are similar to those produced by the inhalation of anesthetic drugs (ether, nitrous oxide). The initial state of intoxication is characterized by mild euphoria, feelings of drunkenness, dizziness, and impaired control and judgment. During this phase, the user may experience “feelings of reckless abandon, grandiosity and omnipotence,” which may presumably account for the impulsive and antisocial behavior that has often been reported to occur in these individuals during a “high.” Depending upon the intensity of the exposure, this phase may progress into a transient overt psychotic behavior of a delirious nature characterized by excitation, perceptual distortions of space, delusions, and sometimes hallucinations occurring in a state of variable clouding of consciousness, and with subsequent spotty amnesia of the events surrounding the intoxication. Hallucinogenic activity has been reported to be

associated with the sniffing of gasoline, toluene,'' and lighter fluid. With increasing concentrations, the narcotic effect of these substances may result in loss of consciousness. The duration of the acute effects is variable, depending on the intensity of the exposure, and may range from fifteen minutes to a few hours. Tolerance has been reported to develop with most of these substances in chronic sniffers.''' There is no clear evidence that the chronic use of these, substances produces physical dependence. Also, there is no sufficient evidence at the present to support the claims that solvent sniffing produces transient or permanent brain damage, although this possibility has not been ruled out. However, a number of fatalities related to solvent sniffing have been reported, most of them attributed to suffocation by the plastic bag used in the method of inhalation.

Adverse Effects of Psychotomimetic Drugs

LSD and Other Hallucinogens

The widespread illicit use of LSD and other psychotomimetic drugs in the recent years has resulted in an alarming number of reports of acute and long-term adverse drug effects. These adverse effects may be classified into (a) psychological and (b) mutagenic (teratogenic).

Adverse Psychological Reactions

Since the first reports were published, there has been considerable literature accumulated which has unequivocally established the dangerous psychological consequences associated with the misuse or abuse of LSD and related drugs. It is estimated that approximately 10 percent of LSD "trips" can be potentially upsetting. On the other hand, with skilled therapists using LSD, 1 percent or less of drug experiences may be traumatic. These reactions may be classified into the following categories:

a. *Acute panic reactions* ("bad trips" or "freak-outs") occur while the subject is under the influence of the drug. This is the most common adverse effect, and it usually consists of a transient panic reaction which subsides within twenty-four hours. These reactions are greatly dependent on the affective and anticipatory state of the individual and on the setting in which the drug is taken, and are usually associated with a fear of loss of control or fear of "losing one's mind" in the absence of outside support and reality orientation. Confused motives and unstable nonsupportive environments are likely to precipitate them. The majority of the cases do not require hospitalization and are effectively managed with proper support and reassurance. More severe cases failing to respond to this approach may require the use of sedatives (e.g., pentobarbital), minor tranquilizers (e.g., chlordiazepoxide), or phenothiazines (e.g., chlorpromazine). It is generally advisable, however, to avoid the administration of drugs because of the potential risk of precipitating serious complications in an individual who has

taken an unknown drug, not infrequently available in the illicit market in combination with other drugs, such as atropine (i.e., "STP"), strychnine, opiates, or animal tranquilizers.

b. *Acute psychotic episodes* represent more serious psychiatric complications which may or may not be dependent on the occurrence of a panic reaction. In the state of hypervigilance, impaired control of critical and discriminatory functions, dissolution of "body ego" organization, impaired autonomy and labile effect of the psychedelic experience, there is a tenuous contact with reality which may easily lead to misinterpretations, ideas of reference, delusions, or catatonic-like postures, to impulsive, aggressive, or self-destructive behavior, and to marked disorganization of personality. These reactions are usually diagnosed as acute schizophrenic episodes, dissociative states, or acute brain syndromes (toxic psychosis), may last several days, and generally require hospitalization. Treatment is primarily supportive and may necessitate the administration of phenothiazines or other antipsychotic agents for the control of symptoms.

c. *Prolonged psychotic reactions,* such as schizophrenia or schizophreniform psychosis, may develop in certain "predisposed" individuals following the use of these drugs. They are believed to be of a functional origin, making (he significance of the drug incidental rather than causative. The premorbid personality of these individuals has been described

as unstable, schizoid, paranoid, hysterical, borderline, or psychopathic. It is of interest, however, that several investigators have failed to find any significant premorbid psychopathology in many of these patients.' It is not clear, therefore, whether some of these protracted psychotic reactions associated with repeated use of LSD might represent a type of psychosis in which LSD is more than a precipitating factor. The therapeutic management of these cases is similar to that of the spontaneously occurring psychoses. Some of these patients require prolonged treatment or show a refractory response to it.

d. *Intermittent recurrence of LSD-related symptoms,* commonly called "flashbacks," involve the recurrence of various symptoms experienced during a previous LSD exposure, and may include anxiety, paranoid feelings, or hallucinations, described as a type of "echo phenomenon." They may occur days, weeks, or even months after the drug was taken, and are characteristically elicited during some stressful situation, or following the ingestion of other drugs, such as marijuana or amphetamine. Although the experience may be a pleasant one, most frequently it is dysphoric and is usually associated with the fear of losing one's mind. Their occurrence while driving may become a hazard.

e. *Chronic personality changes,* attributed to the effects of continued and frequent use of LSD and related drugs among the so-called "acid-heads," represent a controversial issue. Reports are often presumptive or based on

retrospective evaluations. The common pattern of multiple drug use among the chronic users renders the identification of LSD effects even more difficult. The so-called "amotivational syndrome," which is thought to occur in chronic marijuana smokers, has also been associated with the chronic use of LSD.> There is no evidence that repeated use of LSD might result in demonstrable brain damage.- The rate of serious emotional disturbances among peyote-(mescaline) using American Indians has been reported to be very low.

Mutagenic and Teratogenic Effects of LSD

Since 1967, there has been considerable research activity centered around the possible genetic damage resulting from LSD. This research was stimulated by the initial report of Cohen and associates which indicated a higher chromosomal aberration rate in cultures of white blood cells (WBC) to which LSD was added (6.7 to 36.8 percent) than in untreated control cultures (3.7 percent). This *in vitro* study was followed by a series of *in vivo* studies on LSD users, which resulted in both positive and negative correlations. Subsequent studies have focused on investigating the effect of LSD on the chromosomes of germ cells—reporting both positive and negative findings—and on the drug's ultimate effect on the offspring of animals (teratogenicity). Positive results on the teratogenic effect of LSD administered to pregnant animals have not been corroborated by others. Several studies concerning the effect of LSD on the human fetus, in women who had taken the drug during

pregnancy, have reported high incidence of abortion, few cases of congenital malformations of the extremities, and persisting chromosomal defects that tended to repair incompletely. It has been suggested that future sterility and reproduction of congenital defects in next-generation offsprings may result from such unrepaired chromosomal defects. There is considerable skepticism regarding studies on alleged human LSD users because the purity of the illicitly obtained drug cannot be accurately determined. Furthermore, these subjects frequently experiment simultaneously with other psychotomimetic drugs. Factors underlying the reported contradictory findings in animals may include strain differences, individual threshold differences, genetic susceptibility, coexisting subclinical viral infections, purity of the drug, and other factors. In conclusion, the evidence that the drug produces embryonic malformations and chromosomal damage in human users and animals is inconsistent and continues to remain equivocal.

Adverse Effects of Marijuana

In the past decade there has been an unprecedented increase in the use of marijuana in this country, especially among high school and college students, a phenomenon that has raised highly controversial issues centering primarily on evaluating the dangers associated with the use of this drug. Among the alleged dangers that have been used as reasons to justify strict legal control of marijuana are that its use is criminogenic, addicting, leading

to sexual promiscuity and to the use of narcotics ("stepping stone" theory). Since it is beyond the scope of this chapter to discuss all these issues at any length, the reader is referred to the available literature. We will limit our discussion to the adverse psychological effects of the drug. There is no doubt that the use of cannabis may result in one of several types of adverse psychological effects, variously described by different authors as "panic reactions," "toxic psychosis," "psychotomimetic reactions," "flashbacks," "depressive reactions," and "functional psychoses." The development of these reactions appears to be overdetermined, that is, multiple factors contribute to their occurrence, although in varying degrees, depending on the nature of the reaction. Thus, some of these effects are primarily dose-dependent (psychotomimetic reactions), while others are greatly influenced by the set and setting (panic reactions), others by "idiosyncratic" factors (toxic psychosis), and others by factors related to the underlying basic personality structure of the individual (functional psychosis).

Panic Reactions

These are acute anxiety reactions of variable intensity which may reach panic proportions and constitute by far the majority of the adverse reactions to marijuana in this country. These reactions can be best understood in terms of the subject's psychological response to the experience of the marijuana effect, within the context of his anticipatory attitudes towards it and its

consequences, and in relation to his conscious and unconscious interpretive distortions of the drug effect, as perceived by him in terms of the significant experiences of his past life, and as reflected in his immediate relationships with others. During this reaction, the subject may feel that he is dying or "losing his mind" and, in general, he perceives the drug effects (depersonalization, derealization) and their consequences as catastrophic. Sometimes, this state of anticipatory hypervigilance may result in the emergence of paranoid ideas which are commonly associated with the subject's apprehensive expectation of retaliatory retributions for using the drug, an act considered illicit in this country and, largely, culturally deviant. This adverse effect is mostly commonly seen among novice users of marijuana, and especially those who are ambivalently motivated in using it. The significant role that the set and setting play in the occurrence of these reactions is exemplified by Weil's observation that their frequency varies greatly in different communities. They may be extremely rare (e.g., 1 percent of all reactions to marijuana) in communities where marijuana is well accepted as a "recreational intoxicant," or, on the other hand, very common (25 percent of the persons trying it for the first time) in places where use of the drug represents a greater degree of social deviance. These reactions are generally self-limited and show a marked response to simple reassurance. It is possible, however, that the occurrence of panic reaction in subjects with an unstable or precariously compensated personality may produce a much more

serious ego disorganization, characteristic of a psychotic state, the outcome of which may crucially depend on a number of factors related not only to the individual's capacity for reintegration but also to the support he receives from others, and most importantly, to the way he is handled by the physician.

Psychotic Reactions

One of the most controversial issues about marijuana is its alleged role in precipitating a "true" psychosis, such as schizophrenia, or producing a psychosis specific for the drug, referred to as "cannabis psychosis." The literature is replete with polarized categorical views, as well as "objective" analyses of the problem, in which the subtlety of creeping biases becomes the main virtue of objectivity. There are few, if any, reliable data, a fact that makes obvious the need for more and better studies. In reviewing the world literature, there is a definite dichotomy on this subject. Authors from Eastern countries (India, Egypt, Morocco) are largely in agreement that there is direct relationship of cannabis (charas, hashish) to the development of psychosis. On the other hand, Western literature (especially American) generally presents a contrary view. This controversy is not by any means recent. A voluminous literature on "cannabis insanity" had already been accumulated during the latter part of the nineteenth century. These reports have been criticized on the grounds that they were largely based on inadequate and circumstantial evidence. The *Report of the Indian Hemp Commission*—

appointed in 1893 by the British government to investigate all facts about hemp drugs in India—concluded that "Moderate use of these drugs produced no injurious effect except in persons with a marked neurotic diathesis. Excessive use indicates and intensifies mental instability. Moderate use produces no moral injury whatsoever." Two major studies conducted in India and Morocco have reported a high incidence of psychosis secondary to the chronic use of the more potent cannabis preparations, charas and hashish. Both studies, however, have been criticized on several accounts, including inadequate methodology, and a tenuous cause and effect relationship. In the United States, there have been few studies, and they consist primarily of sporadic clinical case reports.'' The findings of the *LaGuardia Report,191* conducted by a committee charged with the task of assessing the marijuana problem in New York City, were largely similar to those reported by the Indian Hemp Commission. Several earlier survey studies involving chronic marijuana users in this country revealed no cases of psychosis.'' Also, recent survey studies of drug abusers, seen in hospitals or clinics, report no cases of marijuana psychosis.' It appears, therefore, that the current pattern of marijuana use in this country does not constitute a significant danger with regard to the development of prolonged psychotic reactions.

Acute Toxic Psychosis

Cannabis may induce clinical syndromes characteristic of a toxic

psychosis and consisting of confusion, disorientation, and cognitive impairment of various degrees. These symptoms may be associated with vivid illusory and hallucinatory experiences, suspiciousness and paranoid thinking, excitement and marked affective changes, characterized predominantly by anxiety or panic. Patients recover invariably within a few days, as is the case with delirious reactions. It has been suggested that confusional psychosis is dose-dependent, and more common when marijuana is taken orally. Nevertheless, high doses of THC, administered orally or by smoking, have been shown to produce typical psychotomimetic reactions of the LSD-type, without clouding of consciousness. Idiosyncratic factors might be important; it is also likely that other substances contained in cannabis might have toxic effects responsible for the development of the delirium.

Depressive Reactions

Sporadic cases of transient depressive reactions, most commonly of the reactive type, have been reported.'' Clinical material is too limited to warrant any further discussion.

Recurrence of Psychotomimetic Symptoms

The phenomenon of recurrences (flashbacks) has also been reported to occur after the use of marijuana. They mainly consist of a recurrence of feelings of unreality and altered perception experienced during a marijuana

"high." Marijuana may also elicit a "flashback" to a previous LSD experience.

Long-Term Personality Changes

Habitual use of marijuana has been reported to lead to serious personality changes, described in the earlier literature as "deterioration," and more recently as the "amotivational syndrome."' Although a highly controversial issue, it appears that a potential long-term effect of marijuana (and especially hashish) on personality deserves the most compelling consideration. The reports presented by the Indian Hemp Commission, the LaGuardia Committee, and the British Advisory Committee on Drug Dependence, and several other studies,' have asserted that there are no reliable observations to support the alleged syndrome of mental deterioration from the habitual use of cannabis. It appears that the term "deterioration," which reflects the prevailing biases about marijuana, has been used to imply not only gross intellectual and psychological impairment but also social, cultural, and even moral deficit. Nevertheless, one common observation that emerges from many Eastern studies is the description of the chronic cannabis user as passive and nonproductive. In a recent study conducted in Greece, Miras described marked personality changes in a group of chronic heavy hashish smokers, including loss of drive and ambition, apathy, and social disengagement.

Similar personality changes have been described in chronic marijuana users ("pot-heads") in this country, constituting what is referred to as the "amotivational syndrome," and including apathy, loss of effectiveness, inward turning and passivity, loss of drive for achievement, tendency toward magical thinking, and other amotivational personality characteristics leading to a state of relaxed and careless drifting.'" These subjects were also described as being "less able to carry out long-term plans, endure frustration, concentrate for extended periods, follow routines, or successfully master new material (learning) with the same ease as before." However, the causal relationship between chronic marijuana use and the development of the "amotivational syndrome" reported in these retrospective studies has been challenged on the grounds that these alleged personality characteristics have probably existed prior to the use of marijuana. Grinspoon argues that "assuming this is a clinical entity . . . there is the question whether or not this syndrome is truly a manifestation of personality deterioration or even change" rather than "manifestations of a purposeful and extensive change in life style, one involving ideology, values, attitudes, dress, social norms, and many aspects of behavior." It appears that there are some striking similarities when one attempts to compare the alleged personality characteristics attributed to the "amotivational syndrome" of the "potheads" with the ideology and life style of the emergent hippie subculture of the 1960s. The intimate relationship that exists between this youth subculture and the use of marijuana and LSD does

not seem to represent a simple cause-effect relationship but rather a complex and multilevel interrelationship in which drug use is only one aspect of a pluralistic and overdetermined phenomenon. The habitual marijuana and LSD users or "heads," as described by Carey, have minimal attachments to customary institutions of society, and show signs of estrangement in their appearance, which are also sources of commitment to their style of life. Their ethos includes the rejection of societal values, the dropping out of conventional social affiliations, and the dissociation from conventional roles. Their distinctive attitude towards time, characterized by a focus of interest in the present, is intimately connected with the disavowal of ambition, and the life style of "hanging out." Several other studies have emphasized in these subjects such personality and cultural characteristics as humanistic and social orientation, passivity and unaggressiveness, nonconformism, introspectiveness, pleasure-seeking, and rejection of societal values and norms, especially those regarding competitiveness and achievement. The reported "cultogenic" and "sociogenic" effects of LSD and marijuana are thought to contribute to the formation of the tribal affiliations of fringe groups and the development of the characteristic drug subculture of the "heads," who generally view the use of these drugs as the central and most significant aspect of their life-patterns. In a study of chronic LSD users, Blacker and associates noted that the group shared a set of mystical-magical beliefs and profound nonaggressive attitudes, which were attributed to

learned consequences of frequent, intense LSD experiences in susceptible individuals. A study by McGlothlin and associates on the effect of one LSD experience on the personality of normal subjects revealed some evidence of a more introspective and passive orientation in the experimental group in the postdrug period. On the other hand, the findings relating personality variables to attitude toward and response to the taking of LSD confirmed the commonly reported observation that persons who place strong emphasis on structure and control generally have no interest in the experience, and tend to respond minimally if exposed. Those who respond intensely tend to prefer a more unstructured, spontaneous, inward-turning life, and to be less aggressive, less competitive, and less conforming. One might hypothesize that individuals possessing the latter personality characteristics to a marked degree, when repeatedly exposed to the effects of hallucinogenic drugs or marijuana, are more likely to continue taking these drugs and to adopt the values, attitudes, and life styles of a suitable ideology. Those aspects of LSD and marijuana experience that might be most significant in enhancing these personality characteristics may include the blurring of spatial and temporal boundaries, as experienced in the feelings of depersonalization and derealization, as well as the experience of compelling immediacy in the LSD effects, and the phenomenon of "temporal disintegration" described in the marijuana effects, both of which diminish the importance of past and future and result in the overvaluation of "nowness" and loss of goal-directedness. It

is likely that the process of "temporal disintegration" in the marijuana user and its consequent telescoping effect on the subject's ability to project himself into past and future, when experienced repeatedly by certain predisposed individuals, may result in the enhancement of some of the alleged long-term personality changes associated with the "amotivational syndrome." Furthermore, this pathogenetic mechanism may involve an operant reinforcement of these personality changes, which are consciously rationalized and further reinforced by the adoption of a suitable ideological framework provided by the hippie subculture.

Adverse Effects of Amphetamines

The recent increase of amphetamine abuse in this country, as well as in Sweden, England, and other countries, has raised great concern about the possible dangers associated with the use of these drugs, especially with regard to the development of the so-called amphetamine psychosis. The clinical picture of this psychosis is characterized by ideas of reference, delusions of persecution, and auditory and visual hallucinations in a setting of clear consciousness, and is described as being indistinguishable from that of paranoid schizophrenia. These reactions are usually short-lived, although prolonged psychotic states, some of them refractory to treatment, may also occur. They are thought to develop in certain susceptible individuals. However, in a recent study by Griffith and associates, it was demonstrated

that repeated and progressively increasing intravenous doses of d-amphetamine can precipitate a brief paranoid psychotic reaction resembling a schizophrenic psychosis, without causing appreciable alterations in sensorium or orientation, and it was concluded that a personality defect is not an essential factor for its occurrence. It was also noted that the sequence of symptoms preceding the onset of psychosis and the type of psychosis elicited were remarkably similar in all subjects. In the prodromal phase, once the cumulative dose exceeded 50 mg., the initial mild euphoria observed with smaller doses was followed by depressive-like symptoms, some loss of interest, and hypochondriasis. Several hours before the onset of the psychotic episode, the subjects became withdrawn and taciturn. The psychotic reaction developed quite abruptly and was characterized by ideas of reference and paranoid ideas of a persecutory nature; there were no visual or auditory hallucinations. There is no evidence to support the claim that amphetamine psychosis is a withdrawal phenomenon. Also, the reported chronic brain damage in chronic amphetamine users requires further substantiation. The observed syndrome of apathy, lethargy, and depression, which invariably follows the discontinuation of a prolonged use of excessive doses of amphetamines, does not seem to represent a withdrawal reaction, for it has primarily the features of a depletion state rather than of a release phenomenon.

Therapeutic Uses of Psychotomimetic Drugs (LSD)

The dramatic psychic changes experienced under the influence of psychotomimetic drugs, and especially LSD, have led many investigators to formulate hypotheses about their potential therapeutic use in psychiatry, and therefore, to apply them in the treatment of various psychiatric conditions, including alcoholism, drug addiction, psychoneuroses, homosexuality, psychopathy, chronic schizophrenia, as well as in autistic children and dying patients. Although chemical abreactive aids to psychotherapy (e.g., sodium amytal, methedrine) have been used since World War II, it was Busch and Johnson who first introduced in 1950 the use of LSD as a means of facilitating recall and bringing about a cathartic release of emotions during psychotherapy. The use of LSD as an adjunct to psychotherapy received considerable popularity in the subsequent years, especially with regard to the treatment of chronic alcoholism, and has resulted in the publication of many enthusiastic reports that have become the focus of a continuing controversy. The techniques employed in LSD therapy vary greatly, according to the theoretical framework that is used to conceptualize the mechanism or the process by which the desired therapeutic effect is achieved. Thus, LSD has been used for emotional abreactions, for facilitating insight psychotherapy as in psychoanalysis ' (removing resistances, increasing tolerance to anxiety, intensifying transference phenomena), for enhancing the patient's emotional tone, or for inducing regression to an earlier period of his life and the relieving of emotionally charged memories, or for producing a profound

psychedelic experience of a spiritual, mystical, or transcendental nature.' These techniques are generally classified into psychedelic, psycholytic and hypnodelic.

a. *Psychedelic therapy.* This technique was originally developed for the treatment of alcoholics, and was based on the assumption that alcoholic patients view the occurrence of delirium tremens as a "turning point" in their struggle for sobriety, a change in orientation thought to be associated with the realization of "hitting bottom." It was hypothesized that the LSD-induced psychotomimetic effect might serve as a model experience of "hitting bottom" and thus become the springboard for establishing sobriety. The recognition of the occurrence of mystical or transcendental ("psychedelic") experiences under LSD led later to an emphasis on the manipulation of the setting as a means of facilitating and enhancing the occurrence of the psychedelic experience. Typically, the procedure involves a single session with a large dose of LSD (300 to 600 meg.). As modified by Savage and associates, the procedure consists of several weeks of intensive psychotherapy, incorporating one high-dose LSD session.

b. *Psycholytic therapy.* This technique consists of a series of drug sessions in which small doses of LSD (100 to 200 meg.), are given to a number of patients in an outpatient setting. These sessions are associated with individual or group therapy and involve an interpretive handling of the

material experienced under LSD within the psychoanalytic frame of reference. The method was developed by Leuner and is the most popular LSD therapy in Europe.

c. Hypnodelic therapy. This utilizes the combined use of hypnosis and LSD.

The reported therapeutic efficacy of the psychedelic drugs in the treatment of alcoholism and other conditions has been the subject of several reviews and has been challenged in heated controversies. Criticism has primarily centered on methodological grounds: lack of objective criteria for measuring change, insufficient follow-up, insufficient control groups, inadequate statistical analysis of data, and uncritical or even biased reporting. Others have found it difficult to accept the apparent absurdity of producing a transient "psychosis" for therapeutic purposes, or to condone a practice that allegedly takes unwarranted risks with a drug that is reputed to be dangerous. With regard to the treatment of chronic alcoholism, the reported high rates of improvement in the earlier studies were subsequently shown to disappear when controlled and longer follow-up studies were used. Although several other studies have shown variable success, it appears that improvement occurs with both LSD and control treatments and that in the majority of cases it is not maintained beyond the initial post-treatment period.

Use and Abuse of Psychotomimetic Drugs

Defining a pattern of drug use as "abuse" is a controversial matter. The term "abuse" is variously employed to describe a certain type of behavior which may be viewed as socially deviant, pathological, or criminal, depending on one's biases and perspectives. The politics of semantics in this area reflect the prevailing radicalization of views on a complex and poorly understood phenomenon, whose definition as a "problem" has various social, political, medical, and legal implications. For instance, Szasz regards freedom of self-medication as a fundamental human right and feels that the term "drug abuse" places this behavior in the category of ethics, "for it is ethics that deals with the right and wrong uses of man's power and possessions." However, many view this issue within the context of restrictive practices that have emerged from "the interaction between the rights and responsibilities of the individual and of his society," a position which, although universally accepted, has always been the focus of controversy as to how one defines the collective rights and obligations of the state and those of the individual. Criteria for defining a certain pattern of drug use as dangerous to the individual or to his society vary greatly, depending not only on the amount of scientific knowledge of the drug's action that is available, but also on the prevailing cultural values and social norms that characterize a particular period of man's history. The recent widespread use of drugs among the young represents an unprecedented phenomenon with regard to its magnitude, epidemiological

characteristics, and social implications. It has raised questions that go far beyond mere medical or public health considerations; it has been associated with such issues as ideology, social change, and the quality of man's life.

Prevalence and Patterns of Drag Use

For epidemiological purposes, drug users are usually classified in terms of frequency of and motivation for drug use, as well as in terms of single or multiple drug use. There are four major categories with regard to frequency: (i) the "experimenting" user (maximum of few drug trials); (ii) the "casual" user, who uses drugs occasionally and sporadically, and generally when offered the opportunity; (iii) the "social" or "recreational" user, who takes drugs regularly but infrequently; and (iv) the "habitual" user or "head," whose drug-dependent behavior is an established pattern characterized by a regular and frequent use of drugs. This last group is characterized by considerable psychopathology, which seems to play a part in the motivation to use drugs. The great majority of drug users fall into the first three categories. Geller and Boas divided marijuana users into five categories: (i) urban minority groups (Negroes, Puerto Ricans); (ii) rural minority groups (Mexican Americans and Negroes); (iii) white middle-class students; (iv) hippies; and (v) over-thirty artists, intellectuals, and writers.

Any meaningful discussion of prevalence of drug use must take into

consideration the rapid changes that the "drug scene" is constantly undergoing. As Scher pointed out, "So varied, complex and changing is drug use, depending on shifting styles of use or abuse, altering availability, the introduction of new agents, changing group structure, membership, or mores in one location or different sections of the country, as well as police or legislative intensifications, that the picture is one of kaleidoscopic twists, and turns at any particular moment." Consequently, little is known about incidence and prevalence of current drug use. Most of the available evidence is concerned with drug use by college students. Estimates vary greatly. Studies conducted at various campuses before or during 1967 showed rates of marijuana use ranging from 12 to 20 percent, and LSD use from 2 to 9 percent. Blum's survey of five campuses, which ended in 1967, reported an incidence of marijuana use from 10 to 33 percent, and LSD from 2 to 9 percent. One campus which was resurveyed one-and-a-half years later showed an increase in marijuana use from 21 to 57 percent, and in LSD use from 6 to 17 percent. In a large survey of college student drug use in the Denver-Boulder metropolitan area, conducted in the fall of 1968, Mizner and associates found that 26 percent of the students had used marijuana, 5 percent had used LSD, and 26 percent amphetamines without a doctor's prescription. Almost half of the users reported that they had used only marijuana, and 14 percent had used only amphetamines; almost all LSD users had also tried marijuana and most had also used amphetamines. Of the single

drug users, 76 percent fell into the experimental (maximum of two trials) and casual (maximum of nine trials) use category. Of the polydrug users, 75 percent were in the moderate to heavy category (ten trials or more). On the other hand, current drug use for the total sample was estimated to be 2.8 percent for LSD, 7.4 percent for amphetamines, and 16.4 percent for marijuana. Their data also supported Blum's observation that the drug use rate in college populations tends to be higher in private schools with a predominance of students of upper socioeconomic status, and among students majoring in the humanities and social sciences. Engineering and physical science students are less likely to experiment with drugs. Drug use is also reported to be higher in the East and West Coast states. Keniston draws a close correlation between the "intellectual climate" of a college and the incidence of drug use on its campus. The highest rates are found at small, progressive liberal arts colleges which place higher value on academic independence and intellectual interest for students. The lowest rates occur in colleges noted for their practical orientation, and an emphasis on fraternity life and sports. In a recent survey of medical students at four medical schools in different geographic regions, it was found that 50 percent of the students had tried marijuana at least once, and 30 percent identified themselves as current users. Nearly 10 percent of the total sample had used marijuana over one hundred times, and of them, 93 percent said that they were using it currently. There were significant differences in the rates among the four

schools, ranging from 17 to 70 percent. On the basis of the students' responses, it was also suggested that marijuana use could be expected to increase with a favorable change in its legal status.

Data concerning the rates of drug use among adults are very limited. In a sequence of studies conducted in the San Francisco Bay area in 1969, it was found that 14 percent of adults in San Francisco and 12 percent in the Contra Costa suburbs had used marijuana at least once. In spite of differences in population composition, there were no striking differences between city and suburb in major correlates of marijuana use. In both locales, about half of the young men aged eighteen to twenty-four and about one-third of the women in the same age range reported having used marijuana at some time. In both locales, the use rate among persons aged eighteen to thirty-four was 29 percent. Those who were more likely to have used marijuana were tobacco smokers, heavier alcohol drinkers, single persons, childless married persons, individuals who were prone to take drugs without prescription, and persons who had sought help from a psychiatrist. Data regarding drug use among Negroes are also sparse. Marijuana appears to be the most widely available and extensively used drug among both Negro teenagers and adult Negro men. Several studies have surveyed the incidence of drug use among enlisted men in the army. In a sample of 5,482 enlisted men on active duty, Black and associates found that 27 percent of the subjects reported having used marijuana, amphetamines, LSD, or heroin. Of those admitting drug use, 83

percent had used marijuana, 26 percent had used LSD, and 37 percent had used amphetamines. Also, 61 percent of the marijuana users had used the drug more than ten times and 30 percent had used it over one-hundred times. A recent review of the literature on the use of marijuana by GI's in Vietnam concluded that there has been an increasing rate of use of the drug among lower-grade enlisted men. The two most recent studies showed that 25 to 31 percent of the users are beyond the experimentation stage.

Profiles of Drug Users

The fluidity of the ideology, ethos, and lifestyle that characterizes the drug subculture makes any description of the profiles of drug users obsolete. In general, the most important groups are the "social" users and the "habitual" users.

"Social" or "Recreational" Users

According to Carey, these users represent a cross-section of student population, and constitute the majority of those who use drugs. They use mainly marijuana in a fairly regular way, especially during leisure time. Many of them have tried other drugs, particularly LSD, but few use them with any regularity. Their views of drugs are essentially an extension of attitudes about alcohol. Keniston, however, believes that they use marijuana to explore new domains of awareness in their search for "truth and meaningful experience."

They are more likely to be found in liberal colleges of higher "intellectual climate," or majoring in one of the social sciences or humanities. They consider themselves as liberals or radicals politically, as well as critical, open-minded, sensitive, and intellectually oriented. Their lives are very much patterned by their student status. Although disillusioned with society and quite critical of its values, they are closely tied to the conventional world in terms of friendships and career aspirations and, in general, they are not in any systematic way "alienated" from American society.

"Habitual" Users or "Heads"

They are popularly known as "potheads" (marijuana users), "acidheads" (LSD users), and "pill-heads" (multiple drug users), and are found among those who use drugs with considerable frequency. They generally live in a distinct subculture, with its own values, life style, and particular rituals, and jargon. Drugs are a focal point in their lives and are used with great casualness and regularity, particularly marijuana, which is smoked every day or several times a day. The use of LSD is not likely to occur more than once a week. The amphetamines are used by some of them. Many of them use LSD as a means of expanding self-awareness and cosmic consciousness, as an avenue for mystical or religious experience, and as a way of finding solutions to personal problems. Marijuana is an important aspect of this culture and is thought by some to provide a "social ritual," "a focus of guiltless lawbreaking,"

and a means to "relieve undesired feelings of anger and aggression." The "heads," according to Carey, are "status disclaimers," reject the traditional values and roles of society, and place a great deal of emphasis on "choice that gives one the unlimited freedom to change." "The major choice is to drop out of conventional society and opt for independence in personal relationships." Keniston described them along the same lines, as "genuinely alienated from American society," and rejecting the prevalent social values which they criticize largely on cultural and humanistic grounds. They rarely stay involved for long in the pursuit of political or social causes, because for them the "basic societal problem is not so much political as aesthetic." "What matters is the interior world and, in the exploration of that world, drugs play a major role." In classifying marijuana users, Bloomquist refers to an "upper-caste" and "lower-caste." The lower-caste user has a hedonistic orientation and is merely interested in experiencing "the bizarre effect of the drug for the effect alone." Until recently, most marijuana users belonged to the lower-caste; however, with "the entrance of the intellectual into the cannabis drug community," according to Bloomquist, there is a growing group of users, constituting the upper-caste, the members of which "take the drug to 'maintain' and to explore themselves and the infinite. To 'maintain' ... is to defer the enjoyment to better understand one's inner self and rid oneself of his hang-ups." As Grinspoon points out, Bloomquist's dichotomy assumes an evaluative-judgmental stance closely related to the Puritan ethic.

Determinants of Drug Use

Drug use is an extraordinarily complex phenomenon that can only be understood in a multidimensional frame of reference. As Keniston points out, ". . . like any broad social phenomenon, [it] must be viewed simultaneously in two contexts: in the context of each individual life in which it occurs, and in the context of the social, political and historical situation of the generation in which it occurs."

Historical-Ideological Perspective

Man's "chemophilic" interest in the use of drugs as a means of altering his conscious experience dates probably back to the primordial era of his emergence as an introspective being capable of manipulating his unique ability for self-awareness. By accident or serendipity, he learned to appreciate and respect their effects, to seek the euphoria, blissfulness, awe, or fear produced by them, and look upon them, not only as a source of pleasure, but also as a means for mystical and religious experiences. Whether it was alcohol, opium, cannabis, peyote, or hallucinogenic mushrooms, man has always associated the use of psychoactive drugs with both hedonistic-convivial or mystical-ceremonial practices. This dichotomy, reflecting man's eternal philosophical vacillation between a "Dionysian" and an "Apollonian" view of himself, is exemplified by such drug practices as the orgiastic excitement of the Dionysian festivals or the Pythian oracles of the Delphic

mysteries in ancient Greece; the use of cannabis for escapism and pleasure by the poor outcast, or for mystical revelation by the ascetic in India; the use of the fly-agaric mushrooms by the "berserkers" among the Vikings and the Siberian Koryaks, or the use of peyote for religious purposes by the Mexican Indians; and in our contemporary society, the use of marijuana by a hedonistic lower-caste and a revelation-seeking upper-caste.

The current "drug scene" in this country is intimately connected with the ideological currents and the sociocultural changes that occurred during the 1960s, a period characterized by such historical events as the civil-rights movement, the black ghetto uprisings, the campus revolts, the assassination of political leaders, the hippie movement, and the war in Indochina. Seen from a vantage point that is still too close for proper perspective, this decade's mood, style, and reverberating themes have been described in terms of a "counterculture," a "social revolution" or a "protest movement" associated with a "greening" change in national "consciousness" that brought out a chasmal "generation gap." This has been the epoch of confrontation by an iconoclastic youth that challenged traditional values and symbols, tampered with old taboos, rejected parental authority, as well as established institutional order and structure, and sought to bring about a pervasive change in every aspect of life style and social conduct. Although one can easily understand the concurrent "black movement" within traditional historical precedents, the counterculture of the 1960s represents a historical paradox, a

middle-class phenomenon, which sprang explosively in the midst of economic affluence as an expression of protest by a "privileged" youth that felt oppressed. The major characteristics of this youth movement include freedom from binding and constrictive social rituals, and freedom to experiment and to seek the novel, a preoccupation with nonconformism, a need for commitment and involvement coupled with a demand for participation in the institutionalized decision-making process, a quest for relevancy and meaning, and a hedonistic focusing on the "here-and-now" that emphasizes the supremacy of the immediate experience over the contemplation of the future and the reverence of the past. The extreme fringes of this movement represent radical departures from most established norms of current social behavior, characterized by a radical activism or anarchism on the one hand, and the hippie subculture on the other hand; they espouse an escape from technological society and bring a message of a psychedelically-induced transcendental union among all mankind within the ideology of a quasi-religious mysticism, sloganeering love, peace, and brotherhood. The glorification of deviance in both behavior and ideology in this latter group, couched in a new and ever-changing language, became intimately connected with the use of psychedelic drugs.

Those outside the counterculture interpreted it as an expression of defiance of parental authority, a rebellion against societal restrictions, or a reaction to the Indochina war, the threat of an atomic holocaust,

environmental pollution, urban decay, racial injustice, or rapid social change. Others viewed it as the primitization of man's experience, or the vulgarization of culture, or as a flight into Utopia. Some saw in the new ethos the messianic salvation of man from himself, the ascendancy of the "psychological man" whose ecstatic venture into the mystical and visionary experience of the occult—instantly gained through the use of drugs—would lead to his blissful union with the universe and to the redemption of his lost soul. Others saw in it the alienated man's escape from his anomic loneliness and powerlessness imposed upon him by a technocratic society, or his quest to recapture the experience of intimacy, compassion, and togetherness, as well as his long-cherished ideals of free choice, self-determination and self-actualization, by seeking the emotional exchange of an "encounter" and the revelations of confrontation. Commenting on the "insurgent mood" of the 1960s, Hughes emphasized "its peculiar blend of political puritanism and personal license, its cult of 'confrontation' as a quasi-religious act of witness," "a basically unpolitical aspiration to see through, to unmask, to strip," the goal of which was psychological or spiritual. Various attempts to understand the preceding "silent generation" of the 1950s have been based on the machine ideal that emerged from the postwar triumph of technology and the system of free enterprise. The young collegians of that era were described as earnest, ambitious, pragmatic, and reality-oriented conformists, pursuing conventional roles that promised maximum engagement into the established

social system. Their value system emphasized success, comfort, security, status-striving, competition, power, and role-playing.'" They were described as having a "hyperactive and rigid ego," leading to a state of "ego restriction." The younger generation of the 1960s, on the other hand, is thought to represent the postindustrial man whose values include the establishment of personal identity, cooperation, mutuality, and the pursuit of "authentic" relations with others. The emphasis, as Evans points out, is on what might be called "ego relaxation," referring to the demand for immediacy, sensuality, and regressive experiences, as well as receptivity to new experiences, confrontation, and action.

The prevailing ideologies of the counterculture are drawn primarily from the writings of the existentialists (J.-P. Sartre, Simone de Beauvoir, A. Camus), the "beats" (A. Ginsberg, J.C. Holmes), and the mystical writings of the East, especially Zen Buddhism, popularized by Alan Watts and others. Roszak points out that one can discern "a continuum of thought and experience among the young which links together the New Left sociology of Mills, the Freudian Marxism of Herbert Marcuse, the Gestalt-therapy anarchism of Paul Goodman, the apocalyptic body mysticism of Norman Brown, the Zen-based psychotherapy of Alan Watts, and finally Timothy Leary's impenetrably occult narcissism." The renaissance of the mystical-religious interest and the widespread preoccupation with the occult (Zen, Hinduism, primitive shamanism, theosophy, astrology, numerology) are seen by Roszak as the

youthful opposition to the skeptical intellectuality and positivism of a severely secularized technocratic society that has no place for mystery, myth, and ritual, the cultural elements that "weave together the collective fabric of society" and which "are meant to be shared in for the purpose of enriching life by experience of awe and splendor." Roszak views the "disaffected" youth's effort to capture the "counterfeit infinity" through the use of psychedelic drugs as essentially "an exploration of the politics of consciousness" and as representing youth's most radical rejection of the parental society. He further asserts that the psychedelic preoccupation at the level of the alienated youth is a symptom of cultural impoverishment, diminishing consciousness by way of fixation, and reducing culture to an esoteric collection of peer-group symbols and slogans. He points out that ". . . instead of culture, we get collage: a miscellaneous heaping together, as if one had simply ransacked the Encyclopedia of Religion and Ethics and the *Celestia Arcana* for exotic tidbits." According to Brody, "Values are part of the cultural symbolic-meaningful matrix in which all behavior occurs" and are regarded "as key elements of the shared symbolic experience that constitutes the cultural mainstream holding the members of any society together." He further views values as "the organizing factors in all ideologies and hence in most sustained collective behaviors." They develop "through social interaction as signs become invested with meaning through shared cumulative experience and move away from the status of representing particular external-world entities. This

movement in the direction of abstraction and generalization results ultimately in the development of relative autonomy for the symbol as a method of transmitting information, motivating behavior, or categorizing individual experience." With regard to the subculture of the disaffiliated youth, there is a continuous shifting of values and symbols, which fail to become integrated into a "cultural symbolic-meaningful matrix," emerging and submerging as transient phenomena characterizing a developmentally transient adolescent population. Such fluid cultural systems fail to become institutionalized and traditionalized, with the result of having a tenuous impact on the individual and little sustaining effect on the collective behaviors of the group. They represent abortive imitations and caricatures of the cultogenic process, a sort of "instant culture" which is not internalized but acted out.

Social Determinants of Drug Use

The sociological approach to the understanding of the motivation for drug use takes into consideration such variables as social disorganization, alienation, anomie, rapid culture change, role conflict or value conflict, peer pressure, and others. Drug use, viewed in the context of deviant behavior, is thus conceptualized as being the result of a dysfunctional social structure, regardless of the personality characteristics of the individual. This dysfunctional social structure has been viewed as creating a dissociation

between culturally defined aspirations and socially structured means to achieve these aspirations, resulting in the inaccessibility of legitimate avenues for attainment and self-fulfillment, thus forcing the individual to adopt deviant patterns of behavior. This process, as well as the syndrome produced by it, has been described as "alienation." The concept of alienation has been widely used to understand a number of contemporary problems, including youth rebellion and drug use. It was Durkheim, in his study of suicide, who first focused on alienation by his concern with modern man's isolation from traditional society, and resultant state of "anomie." He identified industrialism, secularism, and mass democracy as the alienating factors. To Fromm, alienated is the person who has become estranged from himself and from others as a result of his loss of control over a complicated social machine which was created to administer an ever-expanding technological world. Alienation has been traditionally associated with poverty, old age, minority groups, social exclusion, oppression, and lack of choice and opportunity. With the urbanization of the industrial man, the disappearance of close relationships between people, and the dissolution of the extended family—especially in the large metropolitan areas where life has become anonymous and impersonal, and work mechanized and bureaucratic—have resulted in cultural disaffection and social isolation. According to Keniston, what is new about alienation in our modern society is a sense of estrangement secondary to affluence, increasing rates of social change, lack of creativity in work, and a

decline in utopian ideas. Also, automation together with increased longevity has resulted in dramatic changes in work practices and has given modern man a large measure of free time and leisure, for which he is emotionally unprepared, leading him to alienation from self. Among the most important conditions for the development of the drug subculture, Carey asserts, "is the unavailability of means to express protest or grievances among a population suffering from some kind of strain." One factor that contributes to this strain is the "deprivation of participation," and the sense of powerlessness that leads to disaffection and disillusionment. He further postulates that this social strain was produced by "internal migration" that led to the concentration of population in large cities after World War II, and a shift in the composition of the population secondary to increased birth rate. The "baby boom" of the preceding decades that has resulted in the contemporary adolescent population explosion has not only disturbed the balance of inter-generational dynamics, but it has also taxed the available community resources, social systems, and institutions that are responsive to the needs of youth.

Carey emphasizes the sense of "disillusionment" and consequent alienation that leads to questioning the legitimacy of society's norms as the initial stage in the sequence of events in the involvement in the drug scene. Furthermore, the potential user must be in a setting where drugs are available and also he must be introduced to drugs by someone he holds in esteem. With regard to marijuana, Becker' believes that the whole sequence,

from curious experimentation to habitual use of the drug, comprises a definite learning process in which there are three distinct consecutive phases: The first step is learning the proper technique of its use through participation in a marijuana-using group; second, the naive user must learn to perceive the effects of being "high"; and finally, he must learn to enjoy the effect that he has previously learned to perceive. His further use of the drug depends not only on his ability to continue to answer "Yes" to the question, "Is it fun?" but also on his response to awareness that society disapproves of his smoking of marijuana. Becker focuses on the sequence of events which allegedly constitute the causal process of drug-taking behavior; in his framework, the motives do not precede this behavior but are generated in the process of its development. He also places major emphasis on the role that the group plays in influencing this process. Marijuana, LSD, and other hallucinogens have been described as exerting a "sociogenic" or "cultogenic" effect. Drug taking is a communal affair. Goode asserts that "being 'turned on' for the first time is a group experience" and that "marijuana use, even in its very inception, is *simultaneously participation in a specific social group."* He further states that "Marijuana is not merely smoked in groups, but is also smoked in *intimate* groups. The others with whom one is smoking are overwhelmingly *significant* others." The continuous use of the drug serves as "a catalyst in generating and reaffirming commitment to a drug using subculture," and is richly invested with the elements of a "tribal ritual," including its symbolic reaffirmation of

membership in the sub-community of users, the strong feelings of brotherhood, belonging, and loyalty, the sharing of something of value and of special meaning, and the development of a distinct mythology. According to Freedman, “For this group, magical transformation of reality, omniscient union rather than painful confrontation of separateness and effort is a lure.” It has been shown that LSD is a mutual component with heavy marijuana use and that the more one uses marijuana, the greater is the likelihood that the user will take at least one of the psychedelic drugs. Peer or group pressure associated with curiosity has been cited as a major motivation for experimentation with drugs. Taking the drug does not only satisfy the urgent adolescent need for belonging, but also provides the user with the opportunity for a challenging deed that evokes interest among friends and can offer the basis for a loose group cohesion. Several commentators have attributed the spread of the “psychedelic mystique” to the “irresponsible, alluring and provocative advertising” of the mass communication media, to the “glorification of the hippie culture by the establishment, and the exploration of the psychedelic movement by business,” and to the proselytizing ideology of the “apologists” of the psychedelic use. Other factors that have been mentioned to be related to the development of the “drug epidemic” include inadequate leadership, parental hypocrisy, excessive permissiveness in both family and society, disorganization of the family unit, poverty with its compelling need to escape from a boring and frustrating

reality, and economic affluence. For some, affluence results in a "sensate society, the ascendancy of hedonism, the cult of experience," and for others, in an immense prolongation of adolescence through prolongation of education, a new stage of life in which "individuals are in an experimental age, a stage of seeking for meaning and significance, often sought through drugs."

Psychological Determinants of Drug Use

The psychological approach to the understanding of the motives for habitual drug use is based on two major theoretical assumptions: (i) the concept of "psychological dependence," and (ii) the concept of "susceptibility" or "predisposition" to drug use as determined by pre-existing personality factors and the inherent vulnerabilities associated with the developmental vicissitudes of adolescence.

Psychological Dependence

The concept of psychological dependence refers to a pattern of repetitive use of drugs assumed to be maintained by irresistible psychological factors. It is postulated that these factors reach certain autonomy in the psychic organization of the so-called habitual user, and operate as an acquired drive system that is motivating drug-dependent behavior. It is further assumed that there is a prerequisite state of individual predisposition or susceptibility ("psychological readiness") which requires the presence of

certain environmental contingencies (social milieu, availability of drugs, culture values, ideology) for the pattern to develop. The affective component of this pre-dispositional state has been variously described as tension, anxiety, depression, boredom, feelings of alienation, or "tense depression," thus implying a psychopathological origin of this state. Frustration is the most commonly mentioned underlying determinant of the affective component of this state. In this context, the alloplastic pattern of drug use serves as a means of relieving the dysphoria produced by frustrating experiences, and subsequently, this tension-reducing mechanism further reinforces the drug-dependent behavior as a conditioned response of the operant paradigm. The hedonistic variant of this hypothesis conceptualizes the pre-dispositional state as being characterized by an ascendancy of pleasure-seeking behavior, described in terms of experiencing euphoria ("getting high"), or as an intellectually rewarding pursuit rationalized as gaining insights or expanding conscious experience.

Drug-dependent behavior, maintained by factors related to psychological dependence, can be viewed within the framework of the drive theory as representing a substitutive behavior response pattern for "frustrated" drives (e.g., sexual, aggressive, achievement, self-fulfillment) whose original responses or goals have been thwarted or have failed to occur. These responses generally have the characteristics of short-term goals, that is, urgency and immediacy of action, and upon repetition are highly learnable.

In this situation, the "excitatory" component of the frustrated drive continues to energize the behavior of the individual, while the "directional" component of the same drive undergoes changes and becomes redirected, resulting in the substitutive response of drug-taking, further maintained through the reinforcing effect of frustration reduction (discharge of tension) produced by the drug. It is generally assumed that the motivational state of the individual who is prone to develop psychological dependence on a drug is characterized primarily by ascendant drives for immediate goals, which tend to pre-empt drives for long-term goals. Habitual drug users, as well as alcoholics, are described as "narcissistic" individuals who are motivated by "immature" drives for immediate goals, and who demand immediate gratification of their exaggerated needs. Furthermore, these individuals are described as being continuously frustrated, due to excessive needs which they are unable to satisfy.

Developmental-Psychodynamic Approach

Drug-taking behavior among the young does not appear to represent an obligatory component of any particular syndrome or personality pattern. It is generally viewed as a maturational phenomenon associated with the nature of adolescent process, which in our culture has further extended into early adulthood. In our modern society, the adolescent's difficult developmental task of reaching integration of individual maturation that leads to the

formation of a stable identity and to the acceptance of adult roles has been further burdened by a number of emergent factors that are primarily related to rapid social change. Evans describes three "drive-defense constellations" representing adaptational modes characteristic of the contemporary adolescent's effort to deal with stage-specific maturational tasks: (i) Protective regression of ego function, as manifested in the adolescent's tenuous, idealized, and narcissistic way of relating to external objects; (ii) rebellion, which is interpreted as the externalization of the adolescent's ambivalent emancipatory strivings; and (iii) dislocation, a clinical term for alienation.

The transition through adolescence is fraught with a "sense of crisis," according to King, which is more likely to occur at times of rapid social change when transition points and the rites of passage of the adolescent receive less attention and less social endorsement, and the lines of demarcation between the child and the adult roles are less clear. King further asserts that in an affluent society, as in a family setting which overindulges the child's wishes, this crisis may lead to the fantasy of omnipotence served by what Murray has described as "narcissistic entitlement," the feeling that things are owed a person without his doing anything to earn them. Narcissism, however, may take another form in crisis, ". . . that of destructive rebellion, or the form of withdrawal, or regression to the real or fantasied gratifications of earlier phases of development, including the belief in magical solutions to problems.

Drugs provide one avenue to withdrawal, and represent one way of responding to crisis. The danger lies in abrogating the task of maturing in a rapidly changing society for which there is no blueprint providing safe guidelines into the future." Other sources of difficulties for the adolescent brought about by rapid social change include, according to Settlage, "the sparsity of suitable models for identification in bridging the gap from childhood to adulthood," and the "lack of consensus and conviction regarding values on the part of the society that tends to deprive parents of convictions and support in their child-rearing practices and also tends to deprive children of the benefit of relatively clear-cut limits and guidelines for their impulses and behavior."

Considerable interest has been focused on the syndrome of adolescent "alienation" as a major factor associated with both the phenomena of youth unrest and drug-taking behavior. Halleck describes alienation from a psychiatric viewpoint as a "syndrome which represents a psychological arrest in growth and maturity," reflecting Blos's view of the alienated older adolescent as one who "has settled down in a transitory stage of adolescence." For Halleck, alienation constitutes a distinct personality pattern disturbance and a specific clinical syndrome which results from the adolescent's failure to resolve childhood conflicts and prepare himself for the complexities and frustrations of the student role. Halleck describes the alienated student's family setting as being characterized by an "image of loving permissiveness"

in which love "was more talked out than provided," by an "identification of the parents with their child in an attempt to impose role responsibilities upon him which more appropriately belonged to them," and by paratactical communication or "double binds." In this family setting, the adolescent learns to adopt a pseudo-mature pose in which he is just rebellious enough and just conforming enough to please his parents. When he leaves home and begins life at the university, where there are no restraints to serve his need for structure and guidance, he reacts to his new freedom with strong guilt feelings which eventually lead to a peculiar kind of apathy and withdrawal. Referring to the "middle-class, white, alienated, generation-gap-minded, drug-taking, uncommitted older adolescent," Bios emphasizes the "enormous dependency on a caretaking tension-reducing environment, which represents a displacement from the family." Bios describes the alienated adolescent's tribal affiliations as "sham independence" in a "self-built ghetto."

He further asserts that "Adolescent phase-specific regression, finding no adequate societal support or rescue, leads to the formation of adolescent groups, which contain flagrant ego inadequacies or put them to self-protective and adaptive use." The adaptive element of this activity is further supported by the reparative nature of self-medication in drug-taking behavior, which may be viewed as the alienated youth's attempt to "treat himself" in order to relieve his symptoms of depression and anxiety.

Several authors have emphasized the presence of depression in the alienated drug user.'"' Unwin has pointed out the striking clinical similarities between the "alienated syndrome" and the "amotivational syndrome" described in heavy marijuana users, both of which, in his view, appear to be characterized by a "masked nuclear depression." The dynamics of this depression, according to Unwin, are "a function of the ego-ideal and a feeling of shame, rather than a function of superego and a feeling of guilt with which depressive reactions are traditionally associated." Nicholi has also described this depression as being "related not to object loss but to the disparity between the ideal self as a uniquely gifted intellectual achiever and the real self as one of thousands of students struggling in a competitive and threatening environment." Similarly, Settlage, in his discussion of alienated youth, notes "a rather grim and unrelenting attempt to measure up to the excessive high standards of one's ego ideal in order to maintain self-esteem," and feels that "if the gap between personal standards and performance is too great . . . the results can be a depressive picture of varying degrees of severity," which may eventually lead to experimentation with drugs and to "an increasing disengagement from truly meaningful relationships with people, with an accompanying rationalization of the activity as a means of discovering the self and the true meaning of life." Goodman also associates the use of drugs with "the urgent wish for an escape from conflict and anxiety into a sense of omnipotence and omniscience by way of a magic potion."

Adler views the contemporary hippie subculture as representing a "crisis of values" which has resulted in the emergence of a specific personality configuration: the "antinomian personality" of the hippie. According to Adler, the "antinomian" fears diffusion and depersonalization, seeks out "haptic irritations" to overcome boredom and insensibility, and plays at throwing away what is lost to maintain the illusion of self-determination and freedom. His life style, including his introspective LSD "trips," represent his attempts to demonstrate a capacity to control self and objects and to reinstate both self- and object-constancy. Boredom has been mentioned by others as playing an important role in drug use, especially in the late adolescent. Grinspoon assumes that boredom may reflect a maladaptive control of unacceptable sexual and aggressive impulses, which are unsuccessfully sublimated. However, this special ennui may also be related to an increased need for self-stimulation, a low motivational level, or masked depression.

Other writers have attempted to relate the use of drugs to needs for interpersonal closeness, a wish for fusion with others, and fantasied introjection of strength, or to an "ambivalent loneliness" in which drugs fulfill the need for an episodic establishment of intimacy. To Grinspoon, drug use may also represent "identification with, or modeling after, a generation that has legitimized the taking of drugs," a viewpoint that has been elaborated by many others. Grinspoon further asserts that "to some extent, at least, young people are acting out some of the repressed unconscious wishes of their

parents" for antisocial behavior and sexual promiscuity, symbolized or fantasized in the taking of marijuana.

In concluding the discussion of the determinants of drug use, it is important to emphasize the following points: (1) The ubiquitous phenomenon of drug use among adolescents, although symptomatic of the strains associated with the vicissitudes of the developmental process, is not specific of these strains. (2) The preferential use of the so-called psychotomimetic or mind-altering drugs by the contemporary youth may be viewed as an age-contingent phenomenon only within the presently existing sociocultural and ideological contexts. Future preferential patterns of drug use for any age group should be expected to undergo changes dependent upon the evolving culture and ideology of a society. (3) The pervasive use of drugs in our modern society represents one example of the emergence of phenomena of a new order, the increasing magnitude of which is not merely the result of increased population. These phenomena constitute the expression of the complex interaction and reverberation of processes characteristic of large-scale systems. Among them, the processes of rapid and wide dissemination ("mega-processes"), developed by recent technological advances—telecommunication, mass information media, and mass transportation—not only facilitate the massive and distal spreading of localized, episodic, or sporadic phenomena that were previously controlled by small-scale systems, but also account for the information overload that is

continuously and instantly impinging upon large masses of people, with far-reaching consequences on man's personality, behavior, culture, and society. Any serious consideration of the social control of drug use must take into account these points.

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