

A CLINICAL STUDY OF THE MESCALINE PSYCHOSIS, WITH
SPECIAL REFERENCE TO THE MECHANISM OF THE
GENESIS OF SCHIZOPHRENIC AND OTHER
PSYCHOTIC STATES.*

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THE experimental reproduction of psychotic phenomena in the normal person is a subject which has attracted much attention in recent years from psychiatrists, and which has added remarkable and interesting facts to our clinical knowledge.

The discovery of mescaline by Lewin at the end of the last century has marked a great advance in this particular branch of clinical experiment, in that it has placed in our hands a substance which has the property of reproducing in a normal individual all those phenomena which are met with in psychotic patients, without risk to the individual.

From the time of its discovery up to the present day, numerous experiments have been performed by investigators, and the literature contains many detailed accounts of the phenomena which the drug produces. It is the purpose of the writer to set forth in this paper the results of a series of experiments performed with the drug upon himself and upon a group of normal subjects, and to effect a comparison and correlation of the psychotic phenomena studied with those which are found in the naturally-occurring psychoses such as schizophrenia, confusional insanity, and the manic-depressive and delusional states.

Since many excellent and detailed descriptions of the mescaline psychosis already exist, only a brief description of the actual psychotic phenomena will be given, and the greater part of this paper will be devoted to an analysis of the more striking mental changes produced, and a comparison of them with those of the psychoses, with finally an evaluation of the results obtained in the experiments.

Mescaline is one of the four active alkaloids found in the cactus *Anhalonium Lewinii*, which grows in Mexico and Central America. It has been used from ancient times by the Indian tribes for producing a state of pleasant intoxication accompanied by visions in their religious ceremonies. The active principle is found in the flowering tops of the plant, which are roasted and eaten for

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this purpose. It can also be prepared synthetically, and the preparation used in the experiments referred to was a synthetic preparation of pure mescaline sulphate.

Chemically, mescaline is a well-defined organic compound, 3-4-5 trimethoxy-phenyl-ethyl-amine. It is a white crystalline powder, moderately soluble in water, and with a bitter metallic taste. The doses used in the writer's experiments varied from 0.2-0.5 grm. by mouth.

The actual experiments were performed by the writer upon himself, and upon a group of normal adults of ages from twenty to thirty years.

The pharmacological properties of the drug are, briefly, that it can reproduce in the normal subject striking psychopathological phenomena without clouding of consciousness or risk of harmful effects or habit-formation. It is a true cerebral stimulant, and has no narcotic properties. The mental changes produced are of an almost exactly similar nature to those found in psychotic patients—namely, hallucinations of all senses, delusions, transformation of personality, thought-disorders, abnormalities of conduct, affect changes, and disorders of temporal and spatial perception.

Of the exact mechanism of its action, little is known. The seat of action is undoubtedly the higher centres of the brain, particularly the auditory and visual perception-centres. The action is supposed to be on the neuron and upon its synapses. Quastel states that it depresses the normal oxidation processes and glucose-metabolism of the brain, and Henderson and Gillespie have pointed out the resemblance of its effects in this respect to those of certain toxic amines found in the intestinal tract. It is destroyed in the body by a process of oxidation in the liver. It has been found to abolish the α -waves of the electro-encephalogram.

PHYSICAL SIGNS.

Before proceeding to an account of the psychotic symptoms produced, a brief account of the physical signs observed in a subject under mescaline will first be given, as these are of considerable interest.

The most striking feature in the physical appearance of the subject is the close resemblance to a patient suffering from an acute toxic confusional psychosis or acute schizophrenic episode. The lips and tongue become dry, dirty and coated with sordes; the skin is flushed at first, and later becomes dry and harsh with an earthy pallor; the conjunctivæ are injected, and the eyes appear unnaturally bright. The urine is scanty and highly coloured, and there is absolute insomnia, anorexia, and in the later stages, restlessness.

In the central nervous system the changes found are marked dilatation of the pupils and increase of all the deep reflexes, with a mild degree of tremor and inco-ordination of movement. There is no muscular weakness or rigidity. The catatonic signs will be described later under disorders of conduct. On

the sensory side there is marked dulling of the pain sense, loss or perversion of the senses of weight and thermal appreciation, and complete loss of spatial discrimination and of the sense of orientation of the body.

The drug is a powerful stimulant of the medullary centres, producing hyperpnœa, and in the later stages, Cheyne-Stokes respiration, and there is always nausea and occasionally vomiting in the early stages.

The retinal cells appear to be specially sensitive to the action of the drug, as seen by the early exaggeration and prolongation of the after-images and the early appearance of Liepmann's sign.

In the cardiovascular system there is a small rise of blood-pressure, with increased force of the heart-beat and acceleration of the heart-rate in the early stages, followed later by cardiac slowing.

The action of the drug commences within half an hour of ingestion, and lasts approximately 10 to 12 hours.

PSYCHOTIC PHENOMENA.

The various psychotic phenomena will now be described in turn and their mechanism, and similarities to those of psychotic patients indicated. It is important to realize that, unless the dose has been very large, that is, above 0.4 grm., the mental changes take place in a state of clear consciousness and without weakness of the intellectual faculties; this clearness of consciousness is all the more remarkable in view of the profound disorders of personality and thinking with which it is co-existent.

HALLUCINATION.

In the sphere of perception the hallucinations are the outstanding feature. The most common are the visual, auditory, and somatic; hallucinations of smell and taste are rare.

The visual hallucinations take the form of complex and fantastically beautiful kaleidoscopic patterns of every shape and colour, brilliantly coloured birds, dragon-like monsters, gigantic human figures in fantastic apparel, and scenes of fantastic gardens with wonderfully beautiful flowers. They are constantly changing, and their chief qualities are their wonderful beauty and variety, their stupendous and gigantic qualities, their arrangement in characteristic geometrical forms, and the fact that they are always incomplete or with parts missing. Sometimes sensible film-like scenes appear, but very often the visions consist of scenes quite indescribable in ordinary language, and bearing a close resemblance to the paintings and sculptures of the surrealist school. These last are apparently almost unrecognizable condensations and symbolizations of past mental impressions.

These hallucinations have similar characteristics to those found in the psychotic states. Thus, their content is always in line with the subject's past mental experience. They are wish-fulfilling fantasies, and in them the fantasies of childhood can at once be recognized.

Thus, to give examples, one of my subjects, a schizothymic whose principal interest in his boyhood had been the study of ancient mythologies and archæology, saw the mythical personages and monsters of his childhood fantasies; these apocalyptic types of hallucinations are found especially in toxic deliria. Another, an extrovert type, who was an air-pilot, and whose interests were chiefly mechanical, saw visions of futuristic cities with fantastic machinery and engines.

The hallucinations also blot out all normal perceptions in their neighbourhood, as pointed out by Stoddart; like those of psychotics, they are favoured by silence, solitude and self-absorption, and mitigated or abolished by simple occupation—a fact noted in several of the subjects. They represent a reversion to an archaic type of thinking, as pointed out by Hesnard.

The mechanism of their production appears to be as follows: The principal factor in their genesis is an enormous increase in the power of mental imagery and vividness of thought—a true hypertrophy of the imagination; thus, they commence as vivid fantasy, seen on the mind's eye, as it were, not as external objects are seen; at a later stage, when the process of mental dissociation is complete, the imaginalized thought becomes entirely split off from the rest of the psychic processes, and the fully-formed hallucination, appearing as a real object outside the subject, is thus produced. All the various stages between thought, vivid fantasy (pseudo-hallucination) and fully-formed hallucination can thus be seen and studied in the mescaline subject.

Their genesis is also undoubtedly favoured by the characteristic disorder of thinking, the alteration of, and turning away from, reality and the pre-occupation of the subject with the novel inner life of his psychosis.

These hallucinations are not influenced by external suggestion, thus differing from the type found in delirium tremens and allied states; the same applies to the auditory hallucinations.

It has been commonly stated by several authors that these latter are rare as compared with the visual hallucinations in mescaline psychosis. This has not been found to be the case in the writer's experience. In every case studied they were found to be relatively common. They appear to be of two types, one with an entirely novel content, apparently due to the specific action of the drug on the auditory centres; these take the form of indescribably beautiful musical sounds and of voices speaking in a strange language; the other type are really part of the disorder of thinking, and are experienced as a feeling of the subject that his thoughts have become separated from him, and are talking back to him as "voices". This last form is the most interesting, as it shows the mechanism of dissociation and projection well, and is probably

identical with that found in schizophrenia. The writer has obtained descriptions of this form from several schizophrenic patients.

The last type of hallucination, the somatic, takes the form of indescribable bodily sensations, such as, for example, that the limbs have changed size and shape independently of the rest of the body; that the subject has become gigantic and possessed of superhuman strength, or that parts of his body have been removed or substituted; a common feeling is that the whole body has been completely transformed into a lifeless rubbery substance, leading to absurd and nihilistic delusions of bodily change, such as that the patient's body has been turned into rubber, or that he has no heart or bowels—in fact, delusions of a typical schizophrenic or depressive type. A common sensation is that of tingling or “electricity”, which, combined with the other strange paræsthesias, may lead to delusions of persecution or interference—a process which will be described further under the subject of delusions.

The remarkable similarity between these experiences and the type of hallucinations experienced by psychotics will at once be noted. A further remarkable fact is the extraordinary resemblance of the visual hallucinations to the strange symbolic drawings of schizophrenic patients, and to the fantastic and garish designs in painting and weaving produced by psychotic patients in the occupation-departments of mental hospitals—a point which will be referred to again later.

Closely connected with the hallucinations is the other form of visual and auditory disturbance, namely, the extraordinary change which appears to take place in the outer world.

Taking first the visual component of this change, we find that this takes the form of a remarkable alteration in appearance of the outer world. It appears to the subject as if, as it were, a veil of unreality had been laid over everything. This feeling of unreality of the outside world must, of course, be distinguished from the feeling of unreality of self, which will be described later. The remarkable feature of this change is that objects appear more or less unchanged as regards colour and shape, and yet they are completely different—the subject is now living in a world of his own.

This phenomenon of unreality is, of course, a well-known one found in psychopathological states, especially schizophrenia.

Superimposed upon this are a number of remarkable visual illusions. Thus, at the commencement of the intoxication, objects appear to become much more vivid to the subject, and their colours to have become richer and more pronounced. Often they seem to stand out at him, as it were, as if they have some special reference for him; when this coincides with the depressive stage the effect may be extraordinarily sinister and nightmarish to the subject, and so lead to outbursts of panic and impulsive action.

Another change commonly found is that of simple patterns upon objects, appearing to become more elaborate, and finally weaving themselves into

most complex patterns of figures ; thus, for instance, a comparatively simple pattern of wavy lines on wallpaper may finally appear to evolve itself into a complex pattern of fantastic figures showing the geometrical arrangement, continuous movement, variety and majestic qualities of the true mescaline hallucination. Naturally, this gives an air of extraordinary beauty to the subject's surroundings ; though sometimes the quality of the surroundings was found to be unbearably ghostly and sinister, and the subjects complained frequently of "everything looking awful".

Another remarkable feature observed was the change in the faces of other persons. The features appeared to become intensely vivid, and all the peculiarities of their physiognomy to be greatly exaggerated ; at a later stage the faces appeared monstrously distorted, with huge eyes, enormous foreheads, and grim and menacing expressions. This illusion often leads to ideas on the part of the subject that faces are being made at him, that others are mocking him, or that he is being hypnotized or influenced in similar ways. The writer has obtained descriptions of exactly similar experiences from schizophrenic patients under sodium amytal narcosis. This phenomenon is apparently the principal exciting cause of the impulsive attacks on others which frequently occur in these conditions.

Another remarkable illusion is that of the room becoming filled with a strange and unearthly light, and of strange lights being flashed on the subject. These illusions, or hallucinations, of lights being played on the subject are frequently complaints found in the schizophrenic or delusional patient.

In the sphere of auditory perception, the most remarkable phenomenon is the strange new qualities which ordinary commonplace sounds appear to acquire. This symptom will be described now under the subject of delusions, since it appears to be an important part of the mechanism underlying their production.

DELUSIONS.

Coming now to this important subject, it is found that one of the characteristic actions of mescaline intoxication is that it is always accompanied by the presence of morbid suspiciousness and often of fully-developed delusions and ideas of reference, the mechanism of which can be shown in a remarkable way by means of the experimental mescaline psychosis. The delusionary ideas of the mescaline subject are of the same type as those found in psychotic patients, namely, ideas of grandeur, persecution, and bodily change. A description of the mechanism of these as elucidated in these experiments will now be given, and their points of similarity to those of psychotic patients pointed out.

The basic factor in the genesis of the delusions appears to be a qualitative alteration of the functions of the higher cortical receptive centres, with resulting

distortion of their functions, and consequent misinterpretation of external stimuli. The delusions are thus dependent primarily on a disorder of the central perception organs, especially the auditory centres.

Taking first the delusions of persecution, we find that one of the characteristic actions of mescaline is that of sensitization of the auditory centres. Sounds appear to be either unnaturally loud, or distorted, and to have acquired strange qualities. They appear to the subject to rush upon him in an extraordinarily purposive and deliberate way, and to have a reference for him which they would not have in the normal state. Thus, to quote actual examples, seen in the writer's experiments, the sound of a typewriter being used in the next room seemed to vibrate and reverberate through the walls and into the subject's body ; thus, the typewriter became an infernal machine persecuting him with rays of electricity ; in another case a group of people talking in the next room becomes a gang of enemies plotting against him or interfering with him. Similarly, the announcer's voice is sending messages over the wireless specially meant for him.

In the visual sphere, the strange distorted appearance of people's faces, their movements and conversation all seem to be directed against him, so that he feels as if he was being watched, spied upon or otherwise interfered with.

Similarly, the strange bodily paræsthesiæ readily produce ideas of influence, electrical interference, or bodily changes produced by the machinations of other persons.

This delusionary state may vary from morbid suspiciousness to fully-developed ideas of persecution, according to the stage of intoxication and the surroundings of the subject. It is apparent that persecutory delusions require some stimulus, in the form of an auditory or visual perception, for their production.

Grandiose delusions may arise in two ways. One is from the somatic paræsthesiæ. One of the commonest of these is a feeling of having grown extremely tall and handsome, and of being possessed of superhuman strength. Appreciation of the weights of objects is always disordered, and common objects may seem extremely heavy to the subject ; in this way he imagines, for instance, that in raising a chair he is lifting an enormous weight. The hallucinations of supernatural figures and voices similarly give rise to ideas of communion with God, and of being divinely inspired.

In these last types of delusions, the disorder of thinking and of association and lack of insight are important contributory factors in their production.

The striking similarity of the delusional states thus described to those found in schizophrenic and delusional cases will at once be observed. The phenomenon of exaggeration and distortion of ordinary sounds has been observed in paraphrenic and schizophrenic patients, from whom the writer has obtained descriptions on several occasions.

DEPERSONALIZATION.

The study of the delusions leads us to the subject of the basic and fundamental symptom of the mescaline psychosis—that of the alteration of the personality. Mescaline intoxication is indeed a true “schizophrenia” if we use the word in its literal sense of “split mind”, for the characteristic effect of mescaline is a molecular fragmentation of the entire personality, exactly similar to that found in schizophrenic patients. It is well-shown by the projection of parts of the mental content as hallucinations and delusions.

The state of depersonalization—an alteration in the personality of the subject, in which he feels that something has been taken away from his personality and something strange and foreign substituted, is characteristic. The change consists of a radical alteration of the mind and body. Thus, the subject may feel that he is being several different persons at once—a symptom sometimes found in schizophrenia. More characteristic still is the feeling that he is divided into two separate beings—one a purely intellectual and emotionless creature, the other a fantastic being of delusion and fantasy, the first being able to observe the other in an extraordinarily detached and unemotional fashion. This change, as Guttman has pointed out in his paper on the mescaline psychosis, is of great value in the extraordinary faculty for self-observation and introspection which it confers on the subject, which he does not possess in his normal state.

The feeling of unreality, both as regards the self and the external world, so often found in schizophrenics, is one of the typical features of the mescaline psychosis. One of the most common descriptions given to the writer by his subjects of their feelings was that of living in a world of one's own. “I am living in a private world,” and “Other people cannot understand me, because I am living in a different world from them”, were actual descriptions obtained in these experiments.

Precisely similar descriptions were obtained from recovered schizophrenic patients studied by the writer who were asked to give, as far as they were able, a description of their experiences during the period of their acute illness. In both cases, those of the schizophrenic and the mescaline subject, the impossibility of putting their feelings and experiences during the acute stage of the psychosis into ordinary language was a striking feature.

Even more remarkable are the self-descriptions of their mental experiences by schizophrenic patients under sodium amytal. As is well known, this drug, when administered intravenously, has the property of temporarily producing a lucid interval in a psychotic subject previously inaccessible and incoherent. Under this drug, the writer has obtained from schizophrenic patients accounts of their mental experiences which bear a remarkable resemblance to those of mescaline intoxication. For instance, the bizarre hallucinations of colour and distorted appearance of external objects and of other persons

have been described by patients given sodium amytal by the author. The resemblance to the mescaline psychosis is even closer in the case of the confusional states, especially as regards the visual hallucinations.

A further feature of the personality changes must be mentioned before leaving this subject, namely, the symptom of transformation of the personality—that is, the belief that the patient has been changed into someone else. Thus the subject of the mescaline psychosis may believe that he has become transformed into some great personage, such as a god or a legendary character, or a being from another world. This is a well-known symptom found in states such as paraphrenia and paranoia. As found in the mescaline psychosis, it appears to be due partly to the abnormal bodily feelings referred to in the discussion of delusions of grandeur. Another mechanism, observed by the writer as occurring in his own case, was a process of identification of the subject's self with the stupendous beings of the mescaline fantasies. This process, in which the subject sometimes appears to lose the power of being able to distinguish between the self and the outside world, is strikingly reminiscent of the introjection processes of childhood.

DISTURBANCES OF THOUGHT.

We now come to the subject of the peculiar disorder of thinking which is characteristic of the mescaline psychosis, and which is intimately bound up with the disorders of personality described above. As has already been stated, the drug produces no intellectual weakness or clouding of consciousness, except with very large doses, that is, of over 0.4 grm.

The characteristic symptom is a peculiar slowness and difficulty of thinking, a divorcement of the intellectual functions from the rest of the cerebration, with, simultaneously, a greatly increased output of spontaneous fantasy and imagery. Incoherence and thought-blocking are well shown, and give rise to the peculiar disorders of language presently to be described. Flight of ideas, as in the manic states, may occur as a principal feature, or in combination with blocking of thought on the intellectual side. The subject may complain of strange and foreign thoughts being put into his mind, or that each thought is simultaneously repeated as either an auditory or visual perception—the phenomenon of “double thought” so well exemplified in schizophrenic states. The feelings of passivity, of thoughts foreign to the subject being put into his mind from outside and ideas of influence are also well-known schizophrenic symptoms. Inability to hold a train of thought and follow it up to its logical conclusion, and perseveration and ideational inertia with disorders of association, are also found. A characteristic symptom is that there are several different simultaneous trains of thought running parallel in the mind of the subject. The thought-content is dominated by the subject's particular complexes, as in schizophrenic states. The peculiar scattered type of thinking

and volitional disorders are at once strongly reminiscent of schizophrenic phenomena, while the psychomotor retardation and flight of ideas bear a striking resemblance to the symptoms found in the depressive and manic psychoses respectively.

It was found that syndromes of flight of ideas, blocking of intellectual as distinguished from spontaneous fantastic thought could occur simultaneously, or alternate with one another in the same subject at different phases of the psychosis.

These disorders of the thought processes result, as would naturally be supposed, in a number of characteristic disorders of language. Thus, the psychomotor retardation was found, in the writer's cases, to lead to slowness and diminution in the flow of speech, the flight of ideas to garrulity and loquacity of hypomanic type, and the disorders of association to speech of the "word-salad" type and incoherence so commonly found in schizophrenic patients. Characteristic is a peculiar pompousness of utterance, with evident difficulty in choosing and expressing the words desired, a symptom the writer has observed frequently in many schizophrenics. Fatuous and irrelevant remarks suddenly made apropos of nothing were also commonly observed, and made the resemblance to schizophrenic language even more striking. The speech of the subject is often found to bear little or no relation to the thought-content.

Neologisms were noted in a few cases. These resulted from the subject's inability to express the indescribable mental experiences of his psychosis in ordinary language, especially the visuo-auditory synæsthesias, for which neologisms, which are usually condensations of two or more ordinary words, are invented.

MOTOR DISTURBANCES.

On the motor side characteristic syndromes are observed. The most striking are the catatonic states. The writer was able to observe in himself the catatonic state, which is a most remarkable experience. The feeling is that of a delightful laziness and disinclination for active movement, resulting partly from extreme self-absorption and preoccupation with fantasy and indifference to the outer world—two characteristic symptoms of the intoxication. There is a peculiar inability to make up one's mind to a course of action, with wavering between two alternative courses of action. The fundamental disorder appears to be a block between the higher centres which are responsible for the initiation of a train of motor activity, and the parts of the motor cortex which are responsible for the performance of voluntary movement, although no actual loss of motor power is present. It has been shown by De Jongh that mescaline produces identical catatonic signs in animals.

Alternating with this state are impulsive outbursts of meaningless motor activity, sometimes resembling those of schizophrenic patients, and in

other subjects resembling the pressure of activity of the hypomanic. Peculiar grimacing and mannerisms are also encountered ; these are usually secondary to the bizarre somatic paræsthesias. Attitudes of religious ecstasy, similar to those found in some acute schizophrenic cases, may be assumed as a result of vivid hallucinations with a religious content. Suicidal impulses, secondary to the terrifying feelings of unreality experienced in the early stages of the intoxication, and homicidal impulses, secondary to the ideas of reference and persecution, are also found. Extreme recklessness of conduct with disregard for all conventions and shamelessness are also seen, these being secondary to the thought-disorder and qualitative alteration of reality and emotional decontrol.

All these phenomena are closely dependent in their occurrence on the constitutional type of the subject, as will presently be more fully described.

The motor disorders of schizophrenic type are dependent on the condition of removal from reality, with complete indifference to the outside world, and preoccupation with internal fantasy. Thus it was found that in subjects who had passed into the state of catatonic stupor, painful stimuli, such as pricking with a pin, were often completely disregarded, although pain was still felt.

Negativism, with an attitude of hostility and stubbornness, and refusal of food with neglect of the ordinary bodily functions, were encountered in nearly all the subjects studied. The refusal of food and drink during the acute stage was partly due to the ideas that such food might be poisoned, and partly to the specific action which the drug possesses of abolishing thirst and hunger, in which its action resembles that of some of the habit-forming narcotics, such as morphine and cocaine.

INTELLECTUAL DISTURBANCES.

As regards disorders of the intellectual functions, it has already been stated that mescaline produces no intellectual weakness, unlike alcohol and other narcotic drugs. The characteristic change appears to be the peculiar divorcing of the intellectual part of the personality from the rest of the psyche, with disturbance of association, blocking of voluntary intellectual thought, and extreme distractability. These factors, combined with the morbid suspiciousness and non-co-operativeness of the subject, render any proper assessment of the state of the intellectual functions extremely difficult. It is known that the mental efficiency, as measured by psychological tests, shows a great falling-off in performance. The subject can only perform the simplest tests and remember the most elementary facts from his past store of knowledge. The time taken for the performance of any test is increased, and the number of mistakes is also greatly increased.

As regards orientation in space and time, these are not impaired unless a very large dose has been taken. If the dose has been more than 0.4 grm., true clouding of consciousness with disorientation occurs, and the clinical picture becomes that of an acute confusional psychosis.

At this point will be mentioned the characteristic disorders of temporal and spatial perception which mescaline produces.

The characteristic disorder of time-perception is that time seems much longer than it actually is, in which respect the action of the drug is similar to that of such agents as cannabis indica, morphine and cocaine. With a small dose, i.e., 0.2 grm., this lengthening of time is the only change. With the larger doses, 0.3 to 0.4 grm., at which dosage full mental dissociation occurs, extraordinary illusions of time are also experienced. Thus the subject may feel as if time were reversing upon itself, or as if he were travelling backwards and forwards alternately in time, in addition to feeling that in the course of a single afternoon he has lived through thousands of years. Extraordinary "fourth-dimensional" effects are thus produced. The mechanism of this disorder of time-sense appears to depend upon two factors. The first is the enormous speed of the fantastic thoughts, which gives the impression that the subject has got through far more thinking processes in a given space of time than he would in his normal state. The second is the curious memory-disorder which the drug produces, in which there is defective memory for the immediately past mental experiences of his psychosis.

At this point the memory-disorder must be mentioned in greater detail. The subject's comprehension of, and memory for, the actual events taking place in the outside world during the period of his intoxication is good; but upon return to normality there is almost complete amnesia for the mental experiences, with the exception of one or two of the more striking hallucinatory scenes. The auditory hallucinations are always much better remembered than the visual. This amnesia for the mental experiences of the psychosis, with a good memory for the actual events in the world of reality, was a striking finding in many schizophrenic cases observed by the writer. These disorders of memory and temporal perception are probably the basis for the disorientation found in toxic confusional cases, and of the delusions of having lived to a great age found in some schizophrenic and delusional psychotics.

The characteristic disorder of space-perception is that space is greatly extended, and infinite in extent. Thus, rooms appear as huge fantastic chambers, or endless corridors, and the walls and floor appear to have changed their shape. Macropsia and micropsia are also observed.

Under the heading of "intellectual disturbances" we may mention the question of insight. It goes without saying that the subject of mescaline psychosis is entirely lacking in insight; one of the best demonstrations of this occurs in the early stage of the drug's action, when the subject repeatedly asserts that there is nothing wrong with him, and persists in believing that no toxic

drug has been given him, although he may show simultaneously gross thought and conduct disorder, and describe marked psychopathological phenomena.

DISTURBANCES OF MOOD.

We now come to the consideration of the affective and emotional changes produced. Like other intoxicating drugs, mescaline can produce an affective change in two directions—those of euphoria and depression, depending upon the stage of the intoxication reached.

The stage of depression is found characteristically at the commencement of the psychosis, usually during the first hour after ingestion of the drug. It takes the form of an acute agitated type of depression, associated with intense anxiety and fear, and a sense of impending dissolution. There may be also ideas of unworthiness, of being irretrievably damned and lost, and of intense hopelessness. Associated with this is a terrifying feeling of unreality of self and of the outside world. Objects may take on an extraordinarily sinister and vaguely menacing appearance. These feelings are identical with those of an agitated melancholia, and can be indescribably terrible and torturing experiences. Alternatively, the depression may occur at the termination of the intoxication as a dull feeling of hopelessness, with ideas of disorder of bodily functions, and a feeling that recovery to the normal state will never occur, even though the subject has experienced the intoxication many times before and has always recovered. In fact, this form is identical with the simple depressive psychosis without agitation.

This stage is quickly succeeded by the stage of euphoria and elation. The euphoria appears to be due to the specific action of the drug on the cerebral cells, and is not secondary to the presence of pleasing and beautiful hallucinations, as it may be present without these, and often some of the most beautiful visions may coincide with the depressive stage. It varies from a delightfully happy and dreamy feeling accompanied by pleasant fantasy, to an intense ecstasy of exaltation, which is often associated with brilliant hallucinations with a religious content. It is usually coincident with the delusions of grandeur and ideas of increased physical power and ability.

The depression and elation are thus of pathological type, and of a closely similar kind to those found in psychotic subjects.

Characteristically associated with these mood-changes are marked emotional decontrol, emotional lability, and fatuousness of the type found in the schizophrenic patient. The mescaline subject also shows incongruity of affect, with complete indifference to events in the outside world, towards which he displays markedly shallow affective response. Thus, he may simply laugh fatuously at a piece of bad news ; or he may wear a mournful and depressed expression whereas he is really inwardly elated and exalted ; or he may laugh fatuously while in the depressive stage.

In the majority of the subjects studied the euphoria showed the typical features of the schizophrenic as described above. In one or two, however, who were of the cyclothymic type, the elation was of the jovial and infectious type found in the hypomanic and manic states.

A remarkable symptom observed by the writer in his own case is that of feeling both depressed and elated at the same moment. At times it is impossible to say what the prevailing affect is. On other occasions waves of elation and depression alternated rapidly and with great regularity; this was seen especially in the early stages of the psychosis.

Under the heading of "affect and emotional changes" should be mentioned the effect of the drug on the sexual functions. Guttmann has pointed out that mescaline is a powerful anaphrodisiac, and produces complete loss of sexual power and frigidity during the period of its action. This has been the writer's experience with most of his cases. In some, however, particularly of the extraverted type, there may be at the commencement of the intoxication a subjective feeling of increased sexual appetite and potency, with consequent erotic and shameless conduct.

SYNÆSTHESIA.

We must now consider one of the most remarkable and characteristic phenomena produced by the drug—namely, that of synæsthesia, that is, colour-hearing and sound-seeing, which may truly be described as a "sixth sense".

In a few normal individuals, and often in imaginative children, the close association of certain colours and shapes with certain sounds, and the production of sensory impressions in one modality by stimulation of the sense-receptors of another, is found in the normal state. In mescaline intoxication this sense is greatly heightened, and the hallucinations are found to possess equally qualities of visual and auditory perceptions. Thus, an auditory hallucination may at the same time present itself as a fantastic shape or colour, or both; in the same way a given vision may be accompanied by a corresponding auditory impression. This phenomenon appears to be a specific peculiarity of the mescaline action, and produces the most fantastic and amazingly beautiful mental experiences, which are impossible to describe in ordinary language.

In the same manner, an external stimulus in one sense may evoke a corresponding impression in another; for instance, music may be perceived by the subject as intensely beautiful rhythmically pulsating and changing colours, the musical notes appearing as patterns of exquisitely delicate spirals, scrolls and filigree work, while the visions already present pulsate and change rhythmically to the tune played. Certain notes are found to evoke corresponding shapes and colours. In the same way, looking at an object in the room may evoke a corresponding auditory sensation.

Whether this phenomenon is present in the naturally-occurring psychoses, and if so, what its significance is, is as yet not definitely known. The writer has in no case as yet been able to elicit a history of this symptom by direct questioning of a psychotic patient. It is the writer's view that it is actually the basis of the strange neologisms and expressions used by some schizophrenic patients, and of their almost complete inability to express their mental experiences in ordinary every-day language. In the case of the mescaline subject, as has been pointed out, it gives rise to ideas and concepts for which there are no equivalents known to us in our normal waking life. It is therefore, in the writer's opinion, possible, if not probable, that this process of synæsthesia is the basis of the failure of conceptual thinking found in many psychotic patients, and the almost complete inability of the physician to establish any sort of rapport with the patient, and to understand his mental processes. It is indeed this extraordinary sense of synæsthesia which, in the mescaline subject, more than any of the other phenomena, gives the subject the feeling that he is living in another world.

In connection with these bizarre and indescribable experiences a further noteworthy characteristic of the feelings of the mescaline subject must be mentioned, which is also commonly found in schizophrenic states. This can best be described as the quality of silliness. "I just felt so silly" and "I just feel funny" were typical descriptions given by the subjects. This silliness is exemplified in the hallucinations, in which mingling of the sublime with the ridiculous is one of the outstanding peculiarities, in the actual mental feelings, and in the language and conduct of the subjects. It is this feeling of silliness which often makes the subjects ashamed to talk of their experiences after the termination of their intoxication, and which is probably also one of the factors which make a psychotic patient so evasive and unwilling to talk of his experiences to the physician.

VEGETATIVE DISORDERS.

Finally, before leaving the subject of the various psychotic phenomena, the striking disorders of the vegetative centres should be pointed out.

Sleep-disorder is characteristic in mescaline psychosis; the drug appears to have a specific action in abolishing sleep; thus, the subject always suffers from intractable and absolute insomnia for many hours after the signs of intoxication have ceased. This is generally associated with restlessness and profound anorexia with refusal of food. In these respects the striking resemblance to the naturally-occurring psychoses is again evident. In the catatonic state complete neglect of the bodily functions is found, a state reminiscent once more of the catatonic types of schizophrenia.

Taking the psychosis as a whole, one striking fact should be mentioned, namely, the influence of constitutional make-up on the course and form of the

psychosis. The group of subjects studied by the writer included examples of both the intravert (schizothymic) and extrovert (cyclothymic) types of personality. It was found that the constitutional make-up in every case modified the course of the psychosis considerably.

Thus, in the schizothymic type, the symptoms most strikingly shown were vivid hallucinations, delusions and ideas of reference, and catatonic stupor with withdrawal from reality; similarly, the euphoria was of the introverted type found in schizophrenia—in other words, the clinical picture shown by the subject approximated to a schizophrenic reaction. In the cyclothymes, on the other hand, the reaction tended to resemble much more the hypomanic or manic reaction, with press of activity, flight of ideas, increase of motor activity, manic elation and joviality, and the comparative absence of hallucinations. Indeed, it appears that in this type of personality the psychosis may run its course without the production of hallucinations. In this respect, the mescaline psychosis again appears to be governed by the same conditions as determine the course of a naturally-occurring psychotic illness.

DISCUSSION.

When the nature of the mescaline psychosis is considered generally, we see illustrated in it in a remarkable manner the various mental mechanisms which are of importance in the study of mental illness.

Thus, in the first place, we have the process of turning away from reality and withdrawal inside oneself, with the creation of a fantastic dream-world of one's own to replace the discarded outer world. The subject thus finds satisfaction for all his unconscious wishes in the tremendous burst of wish-fulfilling fantasies which the action of the drug releases. He regresses to a childish mode of thought, an archaic golden age, in which all his desires are fulfilled in fantasy. His thinking processes are dominated by his complexes, which are clearly reflected in the hallucinations described. The mescaline psychosis represents a tremendous "volcanic eruption" of the subconscious, with the repressing forces in complete abeyance, in which respect it appears to bear a close relationship to dream-states.

These characteristics of withdrawal from reality, katathymic thinking and archaic regression have been emphasized as part of the essential mechanism of the schizophrenic by Henderson and Gillespie.

Having now completed a review of the principal phenomena of the mescaline psychosis, the principal points of resemblance between it and the naturally-occurring psychoses will be considered.

As Guttman has pointed out, the most striking resemblances seen are those to the schizophrenic reaction type. Thus, the extraordinary disorder of personality, the feelings of unreality and of living in another world, the delusions, hallucinations and peculiar disorders of thinking, and the motor signs

such as catatonia make this resemblance extremely striking. Likewise, the self-descriptions of schizophrenic experiences by patients obtained in different cases, and the indications given of the mental life of these patients as shown in their drawings and writings, which are found to be so strikingly reminiscent of the experimental psychosis, would further point to a similar mechanism for the underlying basis of the two conditions.

On the other hand, the type and quality of the visual experiences would appear to relate the mescaline psychosis more closely to the toxic confusional psychoses. So also would the disorders of spatial and temporal perception, and the clouding of consciousness which results from the employment of the very large doses.

The striking changes in the mood and affect produced in the same way bear close resemblances to the manic and depressive reaction types. Again the phenomena of misinterpretation of perceptions and the formation of grandiose, persecutory and somatic delusions under the influence of the drug reproduce almost exactly the clinical picture of the delusional states.

Taking the psychosis as a whole, undoubtedly the most outstanding feature is the complete transformation and alteration in the psychic life of the individual, which is the common factor in all the psychotic states.

Having pointed out these resemblances, we must now, before proceeding to draw any conclusions regarding the mechanism and nature of these changes, indicate and examine the main points of dissimilarity between the two conditions under consideration, namely, the mescaline-produced and the naturally-occurring psychosis. Furthermore, we must also consider the possible fallacies and limitations which must be borne in mind when attempting to interpret the results of the experiments described, and in applying them to the study of diseases occurring in the human subject under natural conditions. As is only to be expected, similar fallacies are found to those which apply to the study of physical disease in the human subject by means of animal experiment.

In the first place, we must bear in mind that mescaline, like any other specific poison, may produce effects which are peculiar to itself, and which are not found in any other type of psychosis, artificial or otherwise. Such effects are the vegetative symptoms, the peculiar qualities of the visual experiences, and perhaps the synæsthetic phenomena. Such effects would therefore be superimposed upon those symptoms common to all psychotic states, and so colour the clinical picture produced in a manner not found in the ordinary forms of mental illness.

Secondly, it is obvious that we cannot, for practical reasons, exactly reproduce the conditions normally found in the psychotic patient. Thus, to give an example, an acute psychosis deliberately induced by the administration of a toxic drug, to a dispassionate observer is obviously not the same thing as a chronic and insidiously developing reaction arising in an ordinary person as a result of a long period of stress and maladaptation.

Thirdly, it will have been perceived from the description of the mescaline intoxication that it is not identical in form with any of the known naturally occurring psychoses. The mescaline psychosis is a medley of all the known psychotic symptoms occurring at random in the course of an acute intoxication, the events of which are crowded together into the space of a few hours.

A fourth point which has been indicated by Guttman must also be mentioned. This worker has pointed out that in the schizophrenic psychosis the auditory hallucinations are predominant, in the confusional type the visual, so that in this respect the clinical picture produced by mescaline would approximate more nearly to the confusional state than to schizophrenia.

As against this, however, it is known that schizophrenics in the acute phase of their disorder may experience visual hallucinations. In the experience of the writer, almost all schizophrenic patients who have recovered from their acute illness are found, on questioning, to give accounts of such experiences; the same applies to such patients under amytal narcosis. Again, as has been pointed out, the drawings and other art productions of these patients are strongly reminiscent of the visual imagery of the mescaline psychosis. It should also be remembered that a large part of the mental content of the mescaline subject consists of vivid fantasy rather than true hallucination, as in the case of schizophrenic subjects; also that in some subjects it is possible for the mescaline intoxication to run its course without the presence of visual hallucinations. Another point is that with mescaline intoxication, as with many acute psychoses which occur naturally, there is often a gross degree of amnesia for the experiences of the acute stage; also, the auditory hallucinations are much more vividly remembered than the visual; so that the isolated auditory hallucinations of schizophrenics probably constitute only a very small part of the total mental content of the acute psychosis.

An interesting fact which may be mentioned at this point is the close similarity of the art-forms and symbolism of the ancient Mexicans and Central Americans, who used mescaline freely in their religious rites, to the symbolic drawings of schizophrenic patients—a point which has been mentioned by several writers on this subject. This is another fact which suggests strongly a close similarity between the thought-processes of the schizophrenic and those of the subject under mescaline.

Again, there is another fact, well known to those who have daily experience of the psychotic patient, which should be mentioned in this connection. This is that, in spite of the numerous and elaborate classifications of the different forms of mental disorder which have been produced, no hard and fast distinction between the various diseases described can be made. Few patients in actual practice conform closely to the textbook descriptions; thus, to take an example, a case may be admitted in the acute stage with all the classical signs of an acute confusional state; a few months later, when florid symptoms have abated, we may find the patient presenting all the signs of a classical mania; and later,

we may find that the picture has changed to that of a schizophrenic illness. In the same way, the signs of all the various reaction types may alternate in the mescaline subject in the course of one intoxication. This, in the writer's opinion, is a strong piece of evidence for the unity of all the various disease processes described as the psychoses, excluding, of course, the organic reaction types.

It does not seem unreasonable to suppose that, if we assume the fundamental mechanism of the natural and the artificial psychoses to be similar, the causative agent may have a selective action for the various higher centres of the brain. Thus, in confusional patients the visuo-psychic centres, and in schizophrenics the auditory, may be picked out for attack. An analogy could be drawn in the virus diseases of the nervous system, in which the specific virus always selects certain particular parts of the nervous system for its attack.

Finally, in consideration of these arguments, we should not lay too much stress on any one particular symptom or symptom-group in the psychosis under consideration, but rather consider the complete picture—the all-important transformation of the personality, of which the different symptoms are only parts.

The conclusions arrived at by the writer as the result of these experiments are as follows :

Firstly, that in mescaline we have an agent which can reproduce in the normal subject under experimental conditions all those phenomena which are found in the subject of the so-called psychogenic psychoses ; the drug is therefore of the greatest importance as a method of approach to the understanding of the nature of mental disorder.

Secondly, that the various diseases commonly known as the psychoses are all variants of the same disease process ; and that the causative agent is a toxic body, probably a toxic amine with chemical and pharmacological properties similar to those of mescaline, and having a selective action on the various higher centres of the brain. The particular centres attacked, and the nature and content of the resultant psychosis are determined by the psychophysical make-up of the individual patient and his past mental and environmental experiences.

Finally, that the correct method of approach to the problem of the understanding of the nature and treatment of the psychotic diseases lies in the spheres of biochemistry and pharmacology.

The references used in the compilation of this paper were : *Artificial Psychoses Produced by Mescaline*, by E. Guttman ; *Mescaline and Depersonalization*, by Guttman and Maclay ; and the accounts of the mescaline psychosis given in Lewin's *Phantastica*, and in W. Adams's *Drug Addiction*.

The preparation used in these experiments was a synthetic one of pure mescaline sulphate, kindly supplied specially for the purpose by Messrs. Burroughs Wellcome, of London.