

MESCAL: A STUDY OF A DIVINE PLANT.

BY HAVELOCK ELLIS.

I.

MESCAL (*Anhalonium Lewinii*) belongs to the group of plants which in various parts of the world have been intimately connected with religion and have received the honors due to divine beings. This group may indeed be said to be large, but mescal—on account of the special appeal to the supernatural which its peculiar properties make—belongs to the innermost circle of such plants. It is or has been venerated by the Indians of many tribes over a very large region in Northern, Central and Eastern Mexico, in New Mexico, in Texas and in Indian Territory, each tribe having its own name for the plant—mescal, hikori, peyote, kamaba, etc.* Botanically it is a cactus, belonging to the special and little known group of the Melocactæ; there are in the group some six or seven *Anhalonia*; they all grow in inaccessible spots on high and rocky peaks, and have only in recent years become known to science. The plant most nearly allied to the *Anhalonium Lewinii* is the *A. Williamsii*, from which is obtained the alkaloid pellotin, lately found of therapeutic value as a hypnotic. Mescal buttons (as from their shape the dried tops of *A. Lewinii* are locally known) are somewhat brittle discs some two or three centimeters in diameter and partially covered by a hairy cushion. Lewin and Henning in 1885 first described this cactus and made experiments on animals with it, from which Lewin concluded that it is 'intensely poisonous,' resembling strychnine in its action, and by its lethal action standing apart from all other *Cactæ*. This opinion probably rendered investigators of mescal cautious, and little further progress was made in our knowledge until 1894, when Mr. John Mooney, agent among the Indians, who had read a paper on this subject before the Washington Anthropological Society three years earlier, brought to the United States Bureau of Ethnology a large supply of mescal buttons which were entrusted to Professor Prentiss and Dr. Morgan, of Columbian University for physiological investigation.

* I retain the name mescal by which the plant first became known. It has, however, the disadvantage of being identical with the name of an intoxicating drink, prepared from one or more species of *Agave*, with which it has no connection whatever.

II.

At this point it may be interesting to consider briefly the sacred rites with which the Indians have surrounded the mescal plant. These rites have been vaguely known for a very long time and were referred to by early travelers, like Hernandez and Sahagun. Father Ortega, on account of its hallucinatory properties, named it *Raiz diabolica*, devil's root.

The first reliable account of its use in modern times was given by Mr. Mooney from his experience of the Kiowa Indians on the Kiowa Reservation in Indian Territory. The religious ceremonies of these Indians usually take place on Saturday night; the men, having obtained a supply of the drug which is brought by traders from Mexico, seat themselves in a circle round a large camp fire within the tent. After prayer, the leader hands each man four buttons. One of these, freed from the tuft of hairs, is put into the mouth, thoroughly softened, ejected into the palm of the hand, rolled into a bolus and swallowed. Ten or twelve buttons are thus taken at intervals between sundown and 3 A.M., with the accompaniment of occasional prayers and rites. Throughout the ceremony the camp-fire is kept burning brightly and attendants maintain a continual beating of drums. The Indians sit quietly throughout, from sundown to noon of the next day, and as the effect wears off they get up and go about their work, without experiencing depression or unpleasant after-effects. On the day following they abstain, from ritual reasons, from using salt with their food. These and similar rites have become the chief religion of the tribes of the southern plain, to such an extent that the Christian missionaries, unable to grapple with the mescal cult by spiritual weapons, fell back on the secular arm and induced the government authorities at Washington to prohibit mescal under severe penalties. Nevertheless its use still persists.

Although the propaganda of the mescal cult among the Indians of the United States has thus been highly successful, it is fairly clear that much of its primitive religious significance has here been lost. We may understand how this is when we know that the Kiowa Indians are immigrants from the south; they come from the Rio Grande, and it is from the Rio Grande that they still obtain their mescal. Mexico is the chief home alike of the mescal plant and of the mescal rites in their primitive purity. It is to Mexico that we have to turn to realize their primitive significance.

As used by the Indians of the Nayarit Sierra in the province of Jalisco, mescal (or peyote, as it is here commonly called) has been described by Diguët.* Mescal is regarded by these Indians as a food of

* Léon Diguët, *Nouvelles archives des missions scientifiques*, Vol. IX., 1899, pp. 621-625.

even higher order than maize, for while maize is merely the food of the body, mescal is the food of the soul. It is indeed the supreme food, and on that account is offered to the gods. Like maize, mescal has tutelary deities and a special goddess. Its psychic manifestations are considered a supernatural grace bringing man into relation with the gods; while in moderation it enables men to face the greatest fatigues and to bear hunger and thirst for five days, that is during the fast prescribed by the laws of Majakuagy. It is said that when Majakuagy was engaged in preaching his doctrines he and his disciples had to flee from persecution. In the course of his flight he broke his food vessels near San Luis Potosi, and the gods in mercy changed the fragments into mescal. The Indians only gather it in October, just before the dry season; it is said that it is only at this time that it contains its active properties. The third maize feast, which takes place at the beginning of October, is regarded as a prelude to the mescal festival and dances. An expedition is organized to the spot near San Luis Potosi, where the prophet's utensils were transformed into mescal, to gather the sacred plant. This expedition takes a month; those who lead it march in front, reciting or chanting prayers; the others follow with the pack-animals to carry the harvest. A few days before reaching the holy spot the members of the expedition practise a rigorous fast. They also perform a sort of public penance with expiation. As they return, there is great rejoicing in all the villages through which they pass, and mescal is offered on the altars and fragments given to every person met. Sufficient is reserved for the great festivals, and the rest is sold to those who took no part in the expedition.

The Huichol Indians, who occupy part of the territory covered by Diguët's investigations, have been carefully investigated as regards their religious symbolism by Dr. Lumholtz, who touches on the mescal (or, as it is here called, hikuli) cult.* He states that the expedition to obtain the plant goes to a place near the mining town of Real Catorce in October, but that the great festival only takes place in January. Abstinence from sexual intercourse is part of the cult, and it is noted that the use of the plant temporarily removes all sexual desire. The balance of the body is said to be maintained better than usual, and under its influence men walk fearlessly on the edge of precipices, and endure hunger, thirst and fatigue to an incredible extent. Lumholtz states that the festival is connected with the god of fire. We may account for this by the luminous nature of the visions caused by mescal and by the influence of a blazing fire in stimulating those visions.

The same author, in the course of an account of 'Tarahumari Dances and Plant-Worship' † has described the cult of mescal among

* Carl Lumholtz, *Memoirs of the American Museum of Natural History*, Vol. III., Anthropology, II., 1900.

† *Scribner's Magazine*, Oct., 1894.

an allied Indian tribe who call it hikori and worship it as a god. This account furnishes a few supplementary details to Diguët's narrative of the expedition. We are told that as the Indians approach the plants they display every sign of veneration, uncovering their heads. Before gathering them they cense themselves with copal incense. They dig out the cactus with great care, so as not to hurt it, and women and boys are not allowed to approach the god. The plants are kept in jars in caves, and offerings of food and drink made to them. Even Chiutian Indians regard hikori as coequal with their own divinity and make the sign of the cross in its presence. At all important festivals hikori is made into a drink and consumed by the medicine men, and certain selected Indians partake of it, singing invocations to hikori to grant a 'beautiful intoxication.' A rasping noise is made with sticks, while men and women dance, the sexes separately, a picturesque and fantastic dance, the women in white petticoats and tunics, before those who are under the influence of the god.

III.

We have now to consider what are those special virtues which have caused this insignificant little cactus, hidden away among almost inaccessible rocks, to be surrounded by so splendid a halo of veneration.

The first really scientific attempt to ascertain the nature of the peculiar effects of this drug on the human organism was made by Professor Prentiss and Dr. Morgan in their investigation, already mentioned,* of the mescal buttons obtained by Mr. Mooney among the Kiowa Indians. These observers administered the drug, in what I should consider extremely large doses (in one case as many as seven buttons), to several subjects whose symptoms were noted and their color visions briefly described. These investigators made no observations on themselves. In the following year, however, Dr. Weir Mitchell, attracted by their account of the effect of the drug, obtained some of the extract from them and made an experiment on himself, taking a large dose. Dr. Weir Mitchell describes himself as a good subject for visions, and his vivid and elaborate account of his experiences, as read before the American Neurological Society,† furnished the first really full and instructive description of the artificial paradise of mescal. In the early part of the next year, having been greatly interested by Dr. Weir Mitchell's experience, and thinking that this drug might help to throw light on various matters which I was trying to account for, I succeeded in obtaining a supply of mescal buttons in England and experimented on myself. As these observations, the first made outside America on the psychic effects of mescal, covered the same ground as Dr. Weir Mitchell's, while at the same time revealing new classes of

* *Therapeutic Gazette*, September 16, 1895.

† Reprinted in the *British Medical Journal*, December 5, 1896.

phenomena which had not been noted by previous observers, it may be worth while to record them in full, as fairly typical of those vision-producing properties which procured for this plant its divine honors.*

The experiment took place on Good Friday, 1897, when I was entirely alone in quiet chambers in the Temple, the most peaceful spot in central London. I made a double infusion or decoction of three mescal buttons (a single infusion is inert) and drank this, in three doses, at intervals of an hour, beginning at 2:30 P.M., two hours after a light lunch. I had not touched alcohol or smoked during the day. The following notes are reproduced, with trifling omissions, exactly as written, during the course of the experiment.

"The most noteworthy, almost immediate, result of the first dose was that a headache which for some hours had shown a tendency to aggravation was somewhat relieved. At 3 began to feel drowsy. At 3:30 took another third of the infusion. My headache was speedily still further lightened, and I now felt a certain consciousness of energy and intellectual power. No color or other visual phenomena appeared, however, even when eyes were closed for several minutes. No obvious increase of knee-jerk, though I seemed to be conscious of a certain heightening of muscular irritability as when one has been without sleep for an unusual time. Some gastric discomfort now made itself felt, but was relieved (at 4 o'clock) by eating a few biscuits. At this time, for the first time, there was a distinct lowering of pulse by some 6 or 8 beats. At 4:30 took the remaining portion of the infusion. At this period, except for a very slight frontal headache and a faint sensation of nausea, no abnormal phenomena had yet appeared, and I was feeling on the whole better than before I began the experiment. At 5 I felt slightly faint, so that it was difficult to concentrate my attention while reading and I lay down on a couch; the pulse was still lower (48) but no visual phenomena could be detected. At 5:45 while lying down reading I noticed (what Weir Mitchell noticed) that a pale violet shadow floated over the page around the point on which my eyes were fixed. Some little time earlier I had noticed that objects not in the direct line of vision, such as my hand holding the book, frequently tended to become obtrusive, and as it were heightened in color, monstrous and enlarged. At 6 the prevailing feeling was one of slight faintness with some muscular unsteadiness; there was no marked discomfort (except slight nausea); the headache had almost gone. No

* I published a somewhat briefer account of this experiment in 'Mescal: a New Artificial Paradise,' *Contemporary Review*, January, 1898. This paper also contains the interesting results of an experiment on an artist friend; further remarks were published in 'A Note on Mescal Intoxication,' *Lancet*, June 5, 1897. These papers attracted the attention of Dr. Walter Dixon, who made many experiments on himself and has published the results in an interesting article in the *Journal of Physiology*, September, 1899.

further visual phenomena except that it seemed that on closing the eyes after-images were marked and persistent. It may also be said that for some time previously, although no color visions came, the play of light and shade always seen with closed eyes seemed more marked than usual, and *suggested* pictures which were not really seen.

"6:15. I should take more buttons in solid form, but refrain from doing so in consequence of the faintness which makes me disinclined to do more than make these notes. Also the thought of taking more of the drug and the sight of the glass produces a feeling of nausea. The blue-black color of the ink as I write seems unusually brilliant and the shadows on my left on the verge of the visual field seem unusually violet.

"6:40. Pulse now, lying down, is about 60. When lying with eyes closed I am more conscious than before of visions on the curtain of the eyelid; but they are vague and confused, the whole of the field seeming crowded with them, and even when definite images are seen they are not recognizable, but are of the same character as the images produced by the kaleidoscope—symmetrical groupings of spiked objects. Violet shadows are still conspicuous, and now also I see what some little time earlier I seemed faintly to see—occasional distinct green shadows on the outskirts of the visual field, while a green-toned newspaper lying on the floor, whenever I glanced at it, always seems unusually green.

"7:00. It is now dark, and chancing to glance out at the window for a moment and then close my eyes I was surprised at the astonishingly bright vision of light left in my eyes, a positive after-image. All objects seen not in the direct line of vision have a tendency to look startlingly large and prominent.

"Before 7:30, when lying with closed eyes, the visions had become much distincter, but still quite indescribable, mostly a vast field of golden jewels studded with red and green stones and ever changing and full of delight. And moreover all the air round me seemed at one moment to be flushed with vague perfume—producing with the visions a delicious effect. All feelings of discomfort have now quite vanished, except only a slight feeling of faintness showing itself by tremors in hands, etc.

"8.00. The chief character of the visions is their indescribability; sometimes, however, they are like clusters of jewels—some bright and sparkling, others with a dull rich brilliance. Again they resemble a vast collection of the glistening, iridescent, fibrous wings of gorgeous insects. But the main impression is that they are constantly approaching and constantly eluding the semblance of known things. The human face is the only known form that is sometimes momentarily caught, or perhaps merely suggested.

"8:30. [*Written with pencil.*] Pulse now much higher (72 in

sitting position). Muscular incoordination is so considerable that it is very difficult to use a pen, but still easy to write with a pencil.

"I find that it is easily possible to see the visions when lying down in a dark room with open eyes. (Weir Mitchell could not do this.) Sometimes the vision seems to be of a vast hollow vessel into the polished interior of which one gazes while the hue rapidly changes on its mother-of-pearl surface. The objects seen are very often extremely definite; the remarkable point is that they are always novel. There has been all along apparent hyperæsthesia to all sensory impressions.

"9:10. I had to break off as I cannot write for long at a time. The visions continue as brilliantly as ever: I think I see them better in a room lighted by fire than in a dark room. I have seen thick glorious fields of jewels which spring into forms like flowers beneath my view and then seem to turn into gorgeous butterfly-like forms. When I speak my voice seems strange to me and certainly sounds hoarse.

"As I write (by electric light) vague thin color washes seem to lie on the paper, especially a golden yellow, and even the pencil seems to make somewhat golden-tinged marks. My hands seen in indirect vision seem strange, bronzed, scaled, flushed with red. Except for slight nausea I am feeling well, my head perfectly well, though when watching the visions I once noticed slight right frontal pain. The chief inconvenience is decidedly the motor incoordination. It involves inability to fix attention long; but otherwise intellect is perfectly clear.

"9:40. [*Written with pen.*] I am now going to bed. Visions continue; I feel well, except for slight nausea when I move and the motor weakness. [*What follows was written on the next morning.*] Before going to bed I drank some hot water with a little wine in it, but took nothing to eat. On undressing I was struck by the red, scaly, bronzed or pigmented appearance of my feet, hands and limbs when I was not directly looking at them. After going to bed the nausea entirely disappeared, not to reappear, and except for thoracic oppression and occasional sighing there was no discomfort. But there was not the slightest drowsiness. I think, however, that the visions might easily have blended into dream visions but that I was kept awake by a certain consciousness of faintness and by auditory hyperæsthesia. I was keenly receptive—as I had been all along—to sounds, and whenever I seemed about to fall asleep I was startled either by the exaggerated reverberation in my head of some distant street sound or else by the mental image (not hallucination) of a loud sound. At a later stage there was some ringing in the ear. There were also some slight twitchings of the larger muscles of the limbs. Before going to bed I had ascertained that there was marked exaggeration of the knee-jerk, and the pupils were dilated. I felt hot; the skin was dry, the kidneys active.

"Meanwhile the visions continued with but little diminution of

brilliancy, and the same perpetual novelty. Some new kind of effect was perpetually appearing in the field of vision; sometimes there was swift movement, sometimes dull somber richness of color, sometimes glitter and sparkle, once a startling rush of flashes that seemed to approach me. Usually there was a combination of rich dark color with jewel-like spots of brilliant color. Every conceivable color and tint seemed to appear at one time or another (Weir Mitchell never saw blue). Sometimes the different varieties of one color, as of red, would spring up in turn—scarlet, crimson, pink, etc. But, in spite of the immense profusion of objects, there was always a certain parsimony and esthetic value in the colors presented. They were always associated with form, and seldom appeared in large masses of color; if they did the color was of very delicate tone. I was struck not only by the brilliancy, delicacy and variety of the colors, but by the great variety and loveliness of texture which they presented—fibrous, waxen, polished, dull, glowing, veined, semi-transparent, etc. The glowing (jewel-like) and the fibrous (insect-wing) textures were perhaps the most prevalent. Although the effects were novel, they often vaguely recalled known objects—exquisite porcelain, elaborate sweetmeats, Maori architecture, Moorish windows. But in all these cases the objects grew and changed beneath my gaze without any reference to the characteristics of those real things of which they vaguely reminded me. I tried to influence their course but with very little success. It seemed that colors could to some extent be called forth but I could not evoke the simplest image by an act of will.

“On the whole, if I had to describe the visions in one word, I should say that they were living arabesques. There was generally a certain incomplete tendency to symmetry, the effect being somewhat as if the underlying mechanism consisted of a large number of polished facets acting as mirrors. It constantly happened that the same image was repeated over a large part of the field, though this holds good mainly of the forms, for in the colors there would still remain all sorts of delicious varieties. Thus at a moment when uniformly jewelled flowers seemed to be springing up and extending all over the field of vision, the flowers still showed every variety of delicate tone and tint.

“Unlike Weir Mitchell, who could not see the visions with open eyes even in the darkest room, I could see them in the dark with almost equal facility when my eyes were open, though they were not of equal brilliancy. After observing them in the dark for some hours, I became a little tired of them and turned on the gas. I then found that I was able to study a new aspect of these visual phenomena. The gas jet (a common flickering burner) seemed to burn with great brilliancy, sending out waves of light which expanded and contracted enormously. I was even more impressed by the shadows which were in

all directions heightened by flushes of red, green and especially violet. The whole place became vivid and beautiful and the tone and texture of the whitewashed but not very white ceiling was immensely improved. The difference between the room as I saw it then and the appearance it usually presents was the difference one may often observe between the picture of a room and the actual room. The shadows I saw were the shadows that the artist put in, and that are not visible in the actual object under ordinary conditions of casual inspection. At the same time shadows chased each other across the walls, never becoming actual visions.

"I wished to ascertain how the subdued and steady electric light could influence the phenomena, and passed into the next room. Here the rich shadows which were evidently largely due to the stimulus of the flickering light were not obtrusive. But I observed that whatever I gazed at seem to show a tendency to wave or pulsate. If I looked at the matting on the floor it showed a singular richness of texture, thick and felted, with a tendency to rise in little waves. These effects were apparently due to the play of heightened shadows on the outskirts of the visual field. In the same way a closed door seemed to be ajar, from the heightening of the shadows in the interspaces.

"I returned to bed still experiencing the same phenomena though in a less degree, and now for the first time there was a tendency for human figures to appear, fantastic and Chinese in character. There were vague hallucinations of smell, sometimes distinct recurrence of the freshly prepared mescal infusion; these olfactory impressions were pleasurable, I think because they involved deep inspirations, and thus relieved the respiratory oppression.

"At 3:30 A.M. I felt that the phenomena were diminishing and was able to settle down to sleep. When I awoke two hours later, after a peaceful and dreamless sleep, there was a slight headache and the visions were still present with closed eyes, though they were now in somber colors, brown and black. I slept again for an hour or so and rose at the usual time feeling by no means tired, and with an excellent appetite; except for a slight headache which passed off in the course of the morning, I felt none the worse but rather the better for my experiment. The only after-effect was a slightly hyperæsthetic vision for colored objects (as at the beginning of the experiment), lasting for a day or so, and more especially noticeable as regards blue, so that a familiar notice-board in the Strand with dark-blue background was much more conspicuous and intensely blue than usual."

IV.

The experiment just described may be regarded as fairly typical of the effects of mescal in an ordinarily healthy subject, so far as my

observations extend. There are, however, very wide individual variations in the effects of the drug, as have been made clear by subsequent experiments which I have made on other persons. It may, therefore, be of interest to present another experiment for the sake of comparison. In this case the subject was not under my own immediate observation; I should not myself, indeed, have given him mescal at all, knowing that in such a case the experience would certainly not be altogether pleasant. The subject was an art-student, 26 years of age and 6 feet in height, a Highlander on the father's side, and a Lowlander on the mother's, presenting the type of the red-haired, beak-nosed Highlander. Though never ill, he is never in good condition, muscles flabby, skin clammy, pulse liable to be weak and intermittent, without reserve of mental or physical energy. He had severe rheumatism ten years previously. He is lazy and drinks and smokes to excess. He gives the impression of a man of splendid physical race, who has somehow not reached the perfection of his type. Altogether, so far as mescal is concerned, I should regard him as an unlikely subject for what the Indian would call a 'beautiful intoxication.' But the experiment which I give in the words of the very good observer who conducted it is not on that account the less interesting.

"The first dose was administered, after a fair meal, at 4:30 P.M. No nausea was at any time experienced. Pulse 96.

"5:00 P.M. The pulse was 86.

"5:30 P.M. The pulse was 62, flaccid and compressible, with a perceptible second beat, and rather intermittent. The subject had been lying in the veranda of the bungalow since 4:30 P.M. The second dose was now given.

"5:45 P.M. The pulse was 60, and remained at 60, except during exertion, for the next twenty hours. The pulsations were now occurring in a strongly staccato fashion. There was no perceptible second beat, and the pulse was not so compressible.

"6:00 P.M. The pulse was no longer staccato, but distinctly intermittent. It was, however, stronger, and but little affected by holding the wrist above the head.

"6:30 P.M. The third dose was given at 6:30, and the subject came indoors, and was wrapped up in a chair facing the open door, and looking out to sea. A deep sudden breath now caused a marked acceleration in the heart's action, and rising from a lying to a sitting posture sent up the pulse from 60 to 80, for a space of ten seconds or so.

"6:45 P.M. A feeling, neither pleasant nor unpleasant, of general lassitude and indifference, and a slight sensation of rigidity in the backs of the fingers when extended. The same feeling was present in a less degree all over the body, giving the subject the impression that the motor nerves were becoming partially paralyzed. Otherwise the subject was perfectly comfortable, though somewhat weak and lethargic.

"7:00 P.M. The pulse was alarmingly intermittent. There was often a pause of two seconds between beats. However, the subject was quite unaware of the fact, and perfectly comfortable.

"8:00 P.M. The subject complained of difficulty in breathing, as though a tight bandage were tied over the left side. The pulse was now almost, and sometimes quite, imperceptible. The arms became weak; in a few minutes they became absolutely paralyzed. The subject began to be a little scared. However, in about ten minutes the loss of power passed away, and he became perfectly comfortable, though disinclined to move a finger.

"8:45 P.M. The sea suddenly turned purple and tilted up to the eaves of the veranda, and instantly regained its normal aspect. The victim was not particularly excited at this sight; indeed, throughout the experiment I was struck by the very matter-of-fact way in which he received the various visions, I myself being far more keenly interested in them. The legs now became partially paralyzed for a few minutes. There was no other symptom whatever till 8:45 P.M., when very indefinite stationary spots of purple and blue-green were seen on the beach at a distance of fifteen or twenty feet. They gradually assumed the shape of rather conventionalized thistle-heads, some purple and some emerald. For a moment the shingle beach appeared to be turning into a bed of flowers, but they quickly faded away. When I went out and struck a match before the bungalow the flowers suddenly reappeared. Whenever a match was struck they became more vivid. It was now twilight and when the flowers appeared the beach became brighter.

"I now lit the lamp and placed it by the subject. The thistles had faded away. Suddenly the sea—which was gray—turned green, and became covered with symmetrically arranged spots of violet, which rotated on their axes and passed off to the right. There were three bathing-machines half way down the shingle, and the spots passed behind them.

"I now turned down the lamp. The shingle instantly became a bed of blue flowers; some unknown little plant which produced a short spire of blue blossoms, and a few green blades. I asked the subject to direct me to one spire which was higher than the others, and trod on it, when it disappeared. I turned up the lamp; the flowers disappeared.

"The subject now saw a large cutter about half a mile from shore, which sailed rapidly along and passed behind the bathing machines. He made a sketch of it as it approached, to give me the relative proportions of the cutter and the machines, and then described it as close in. As a matter of fact there was a small cutter about a mile off shore, and about one tenth the size of his sketch.

"9:25 P.M. On the beach, where the flowers had been seen before,

a head like the Cheshire Cat appeared. It was vague, except for the smile. Presently it developed a body and legs, and became a lynx, with no feet, and eyes like glowing opals. It danced gravely round in a circle. Having inquired as to its exact position, I went out and kicked it. It vanished.

"The subject now saw, in the wake of the moon, which was now shining brightly, a boat containing two men fishing, with a light. I could see the men only with the telescope. Handing the subject the telescope, he said that he saw the boat three times as large without the glass. He now came out and leaned on the rail of the veranda. A cloud over the moon appeared to him an oared galley, five times the diameter of the moon. The oars were moving at the rate of 30 strokes to the minute.

"10:15 P.M. The galley having disappeared, the subject sat down inside the door again. A creature with a pointed nose and sharp ears popped its head constantly round the corner of the door. As the pulse was again imperceptible I administered a pint of strong coffee.

"10:45 P.M. A beautiful miniature Eastern city appeared, on the beach about twelve feet away. It was lit, apparently, by the sun; there were walls, citadels, mosques, minarets, houses, etc., all white, interspersed with green foliage. It was very compact, standing high above the walls, and about six feet in diameter. After some five or ten minutes an enormous tortoise, with a Greek key pattern in metal round the periphery of the carapace, walked against the city and right through it when it disappeared, and the tortoise with it.

"Shortly afterwards a vast horde of little black woolly animals, rather like black guinea-pigs with astrachan coats and glow-worms for eyes, poured up over the pebble ridge from the sea, and disported themselves over the beach, which was quite covered with them. After pouring up for a minute or two they vanished into thin air. Their motion was like that of a swarm of maggots discovered in turning over a dead animal. This was the last vision. The subject expressed a desire for a very large meal, ate a small one, went to bed, immediately slept a dreamless sleep, and was for two days very languid and weak, with a feeble and depressed pulse, and occasional palpitation. He will on no account try the experiment again.

"The most remarkable feature of the visions was that they all had 'a local habitation and a name.' They all appeared out of doors, most of them on the ground at a distance of twelve feet or so; they did not move when the head or eyes were turned, but kept exactly in their place. The visions were seen with either eye indifferently; with the eyes closed nothing was seen. Mechanical pressure on the eye-balls had no effect. At one period of the experiment the muscles of the eyes became relaxed, so that the subject saw near objects slightly doubled."

V.

It may be seen from the two experiments which I have described in some fullness that, in general character, the physical and psychic manifestations of mescal somewhat recall those produced by haschisch, the most famous and typical of the 'artificial Paradises' which man has found for himself. No other drug, indeed, can be said to approach so nearly to haschisch in its effects. They are alike in the variability of their effects on different individuals and in the difficulty of obtaining a reliable preparation.* They both slow the heart, tending in some cases to produce intermittence, and both affect the respiration. They both produce muscular weakness and incoordination, exaggerate the knee-jerk and dilate the pupils. They both, moreover, possess the same vision-producing properties. I cannot speak from personal experience on this point, but one of my subjects, a poet who has paid much attention to the methods of generating visions, assures me that in his experience the virtues of the two drugs are about equal and that he has no preference for haschisch over mescal.

While there are thus marked and fundamental resemblances between mescal and haschisch, there also appear to be numerous points of difference. On the whole it may be said that mescal has a more restricted, a less generalized action than haschisch. In some of the early accounts of haschisch, which may now almost be said to be classic, great stress was laid on its exuberant motor manifestations, the uncontrollable antics, and the loss of all sense of time. These manifestations are much less conspicuous, and often do not appear at all, in the later accounts of haschisch, so that they are evidently not essential.

Under mescal, so far as I have been able to observe, they seldom appear. Mescal may at one stage produce a sense of well-being, vigor and intellectual lucidity, but there is no actual motor exhilaration, or loss of self-control, usually no mental failure at any point, except that when the influence is strongest attention may be impaired, so that one realizes when under mescal how much attention is a matter of muscular coordination. The action of mescal on the motor system is to depress, so that there is a tendency to tremulousness of the muscles which feel weak, and it seems to the subject that he must exert more than usual care

* Haschisch is said to vary in accordance with season, as well as with the district in which the hemp is obtained. The Indians believe that mescal is only active at one season of the year. I found one supply that reached me to be almost or quite inert, and it is possible that it was gathered out of season.

† The resemblances between haschisch and mescal come out most clearly in the latest and most reliable investigations, see, e. g., W. E. Dixon, 'The Pharmacology of Cannabis Indica,' *British Medical Journal*, November 11, 1899, and E. B. Delabarre, 'Report on the Effects of Cannabis Indica,' *Psychological Review*, March, 1899. The latter is only a brief summary, but Professor Delabarre informs me that he hopes to publish a full account of his investigations.

to prevent himself from staggering and more than usual energy to perform even the simplest action. This may affect space-relations and one of my subjects found that in lifting a cup to his lips the distance traversed seemed very much more than usual; the same subject found that his ideas of time seemed to be disturbed, but on testing him with the watch his estimates were found to be fairly accurate.

The positive and active manifestations of mescal are always mainly if not entirely on the sensory side, and the motor weakness and sense of lassitude which is often present only throw the subject of mescal intoxication more absolutely at the mercy of the waves of unfamiliar sensory impetus which strike him from every side. Every sense is affected: apart from the various visionary influences, sounds become unfamiliar and abnormally acute, the sense of smell is stimulated or olfactory hallucinations may occur, the simplest food seems to possess an added relish, while there are vague skin sensations, and to the sense of touch the body seems as unfamiliar as everything else has become. I have elsewhere remarked, in illustration of the peculiar effects of this drug, that mescal seems to introduce us into the world in which Wordsworth lived or sought to live. The 'trailing clouds of glory,' the tendency to invest the very simplest things with an atmosphere of beauty, a 'light that never was on sea or land,' the new vision of even 'the simplest flower that blows,' all the special traits of Wordsworth's peculiar poetic vision correspond as exactly as possible to the actual and effortless experiences of the subject of mescal.

It should be added that a sense of well-being is not an essential part of these sensory manifestations. In this respect mescal is entirely unlike those drugs of which alcohol is the supreme type. Under the influence of a moderate dose of alcohol the specific senses are not obviously affected at all, but there is a vague and massive consciousness of emotional well-being, a sense of satisfaction tending to a conviction that 'all's well with the world.' Alcohol has a dulling influence on sensory activity and on the intellectual centers; and it may indeed be said that for the brain-worker whatever value the moderate use of alcohol may possess chiefly lies in the fact that after brain-work is over it helps to soothe undue brain-activity. Mescal, on the other hand, is not mainly emotional in its effects but mainly sensory and it leaves the intellect almost unimpaired even in large doses. It is true that at one stage of mescal intoxication, and more especially in quite healthy persons, there is a feeling of well-being, and even of beatitude, accompanied by an illusory sense of quite unusual intellectual activity; but there is no stage of maudlin emotionality; on the whole there is a condition of fairly unimpaired and alert intellect, untiringly absorbed in the contemplation of the strange world of new sensory phenomena into which the subject has been introduced.

These phenomena are above all visual, and the intellectual character of mesal intoxication as compared with perhaps any other intoxication, seems connected with the fact that it is the most intellectual of the senses that is chiefly involved. The visual effects of mesal may be of very various character, largely depending on the idiosyncrasy of the subject as well as on the degree of the intoxication. They vary from an exaggeration of the normal phenomena, producing a heightened play of light and shade and color, to visions seen on the curtain of the eyelid with closed eyes and with open eyes in the dark, up to actual localized hallucinations seen in broad daylight. It seems reasonable to suppose that the cerebral centers of vision are affected under mesal, and the occipital headache which occasionally follows supports such an assumption; a merely peripheral stimulation could scarcely suffice to account for such an ergy of vision. But at the same time I am convinced that the conditions produced in the eye itself are important factors in the production of the phenomena. Not only must we suppose that the retina, like all the sensory apparatus, has become hyperæsthetic, but the pupils are dilated, so widely dilated in one of my subjects that there was extreme photophobia. It is probably not without significance that in the other chief vision-producing drugs, such as haschisch and belladonna, the pupils are also dilated. It is evident that light can penetrate into the chamber of the eye with much more ease than usual. The Kiowa Indians sit round a fire during the nights on which the mesal rites are performed and I have found that the flicker of fire-light acting through the closed eyelids furnishes a very favorable condition for seeing the visions to advantage.

There is another characteristic of a large number of these visions (as indeed of many visions otherwise produced) which, it would seem, we must explain through peculiarities of the eye. I refer to what I have termed their kaleidoscopic character, the tendency to symmetrical grouping in the visual field of objects similar in shape, and harmonious, though not necessarily similar, in color, so that a kind of vision is produced such as we might attribute to an animal with faceted eyes. We might account for such a phenomenon by means of that irregular astigmatism, found more or less in normal eyes, which has been attributed to the fact that the crystalline lens is composed of many sections connected by radial sutures, or, more plausibly, with Shelford Bidwell, who has made some interesting experiments on this point, to the light passing through the coarse-meshed tissues of the eyes.* With perhaps still greater probability we might adopt the suggestion of Zehender† who in dealing with subjective visual perceptions would explain the strikingly regular polygonal figures which arise under various con-

* Shelford Bidwell, 'Multiple Vision,' *Nature*, April 13, 1899.

† *Klinische Monatsblatt für Augenheilkunde*, November, 1895.

ditions to the movements and displacements of retinal pigment grains in course of chemical decomposition.

There is another visual phenomenon caused by mescal, to which my attention was particularly attracted, since it appears to have been little noticed by previous observers, and which is of considerable interest because it may be brought into line with various phenomena which occur without the intervention of drugs. I refer to the play of shadowy color, and more especially the violet halos which are seen to play around and over objects and constitute, in my own case at all events, the earliest group of color phenomena seen under mescal. I have already described my impressions of this effect, and one of my subjects who saw the same phenomenon, describes it as 'a violet fringe, surrounding objects and tending to become flower-like.' It has been observed by many when passing over snow-covered regions, and especially by Alpine climbers, that moving objects, and more especially their own hands or garments, show a violet border.* Then we have the tendency to color vision (erythropsia or perhaps more strictly, or more usually, violet vision) to which the eye becomes liable after surgical removal of the crystalline lens. Once more there are the colors produced by the much discussed colorless 'spectrum top.' It seems to me that all these phenomena, and others that could be named, must be regarded as more or less allied. The first explanation offered for the earliest of them to be noted was that they are due to over-stimulation and exhaustion of the eye. Later inquirers have sought after a more precise mechanism for the phenomenon. Thus Dobrowolski in 1887, dealing with the erythropsia often occurring after removal of the lens, argues that a necessary condition is the dilatation of pupil produced by atropine, and that the color vision is really of the nature of a negative after-image of the rays that strike the eye. Fuchs, in 1896, who has dealt in an interesting manner with the erythropsia experienced on climbing snow-covered mountains (regarded by him as strictly a purple vision) finds that Dobrowolski's explanation is inadequate, and, while contenting himself with the theory of stimulation and fatigue for some of the phenomena, believes that the real explanation is to be found in a temporary visibility of the visual purple of the retina. Whatever the value of this explanation may be as applied to the whole group of phenomena, Fuchs more than any one helped to bring color-visions of this kind from the sphere of the pathological into the sphere of the normal. More recently still, Shelford Bidwell in 1897, when making some simple but ingenious experiments with the object of discovering the mechanism of the spectrum top, found that when a dark patch is

* This phenomenon was discussed in *Nature*, during May, 1897, some of those who described it assuming without question that it was an objective phenomenon.

suddenly formed upon a bright ground the patch appears to be momentarily surrounded by a blue border, and he accounts for this by the theory of a sympathetic affection of the red nerve fiber; when the light is suddenly cut off from a patch in a bright field, there occurs an insensitive reaction in the red fibers just outside the darkened patch, in virtue of which they cease for a short time to respond to the luminous stimulus, in sympathy with those inside the patch. The green and violet fibers, by continuing to respond uninterruptedly, give rise to the sensation of a blue border. Where highly competent experts fail to agree it would be rash to state any definite conclusions. It is difficult, however, not to believe that, whatever the precise retinal process may be, over-stimulation and fatigue certainly have very much to do in calling it into action. Associated with the violet halo, as we have found, there is a tendency under mescal, especially by the aid of a bright flickering light, for shadows generally to be variously colored, more especially (as in erythropsia and allied conditions) towards the outskirts of the visual field. Any one who will sit for a few minutes with his eyes directed on a sheet of white paper illuminated by bright sunlight will soon begin to see on a small scale a faint reproduction of the colored shadows seen under the influence of mescal. Here clearly we have a fatigue phenomenon due to over-stimulation by bright light, and precisely analogous to the after-images produced by looking at any excessively bright object. Under mescal we have a similar effect produced, not through the stimulation of unusually bright light, but by the unusually hyperæsthetic condition of the visual apparatus, due in part to the dilatation of the pupil and in part to the effect of mescal on the retina.

There is one other effect of this fascinating drug to which attention may finally be called. It has been pointed out that under mescal all the peripheral sense organs become highly irritable or hyperæsthetic. Not only is this so, but they are brought in a quite unusual degree into sympathy with each other. I found that casual stimulation of the skin at once heightened the brilliancy of the visions, or produced an impression of sound. One of my subjects, an artist, had a curious sensation of tasting colors, and another found that music had a delightful influence over the visual effects. This, and the fact that the Indians keep up a continual beating of drums during the time they are under mescal, led me to plan a further experiment on myself with mescal. I arranged that when the stream of visions was in full force a friend should play to me on the piano various pieces of a more or less progressive character which were unknown to me, at all events by name. I found that these pieces, more especially those which were somewhat uniform and monotonous, not only distinctly stimulated the visions, but influenced their character; and in about half the tests there was a

real resemblance, sometimes in a striking manner, between the prevailing nature of the visions and the name of the piece. This was especially the case as regards Schumann's music. It would be worth while to carry out further experiments along this line, and on a variety of people, preferably non-musical people. It may be added that under some circumstances music itself evokes a train of visual imagery. Heine has somewhere described in detail the imagery called up when listening to Berlioz's music, and in 'Florentine Nights' he describes, in the person of his hero, the elaborate imagery evoked on hearing Paganini play, and remarks: "You know my second sight, my gift of seeing at each tone a figure equivalent to the sound, and so Paganini with each stroke of his bow brought visible forms and situations before my eyes; he told me in melodious hieroglyphics all kinds of brilliant tales; he, as it were, made a magic lantern play its colored antics before me, he himself being the chief actor." It would seem that in Heine's case music produced actual visual imagery, as under the influence of mescal. In this connection I may recall an account of visual imagery, as seen at a concert, recorded by Dr. Robert MacDougall.*

One is tempted to ask by what process we should conceive to ourselves that the action of mescal works on the organism. I think it is not impossible to hazard such an explanation, provided that we avoid the risks attending undue precision in our explanations. We are justified, it seems to me, in supposing that mescal effects its peculiar actions by producing a kind of violent but temporary neurasthenia and cerebrasthenia. In other words, it rapidly overstimulates and exhausts the nervous and cerebral apparatus, more especially on the sensory side. It is true that such an explanation might be said to apply to the action of many drugs, including all those that are commonly called stimulants. The day has gone by when it could be supposed that a stimulant put anything into the system. It acts not by putting energy into the system but by taking it out, and so rapidly producing a state of fatigue. The careful experiments of Féré with the ergograph have lately shown that all sorts of sensory stimulants, acting on various senses and not necessarily involving the use of drugs, produce an immediate increase in the output of muscular work, but that no sensory stimulant of any kind will enable us to do a total amount of work equal to that we can achieve without stimulants, because the sudden rise of output is more than compensated by the subsequent fall. So that by the use of stimulants, so far as output of work is concerned, we not only draw on our capital,

* 'Music Imagery,' *Psychological Review*, September, 1898. The cases in which some definite appearance is regularly associated with the sound of each instrument belong to an allied though different class; a case of this kind is recorded in *Nature*, March 6, 1890. Here, we approach the best known group of 'secondary sensations.'

we actually dissipate and waste it. But the results of this kind of fatigue do not usually produce any condition comparable with neurasthenia; they do not, for instance, produce visions. In neurasthenic states there is, however, a tendency to visionary effects—colored vision, intolerance of light, photopsiae, persistence of retinal impressions, etc.—and, moreover, in all temporary conditions of nervous fatigue in otherwise fairly healthy people the same tendency to abnormal color effects with open eyes, and vague visions with closed eyes, is apt to show itself. I find that some persons, when very tired, see shadows as unusually violet, while kaleidoscopic visions and processions of figures and faces are also seen with closed eyes after fatiguing days. I have myself noted effects faintly recalling those produced by mescal after periods of unusual brain activity. On the border-land between sleeping and waking color-visions are also sometimes seen, and Mrs. Christine Ladd Franklin has stated that in falling asleep over a book she sees colored shadows, especially violet, floating over the page. It is noteworthy, further, that in various conditions of abnormal color-vision fatigue increases the brilliancy of the colors. The same tendency rules the association between music and visions. Heine was a somewhat neurotic subject who constantly complained of very severe headaches, and Mr. MacDougall, in describing the physical conditions under which he finds that visual imagery is liable to occur, describes a state approaching that produced by mescal: "In the earlier stages of fatigue, before the final condition has been approached, a period of cerebral excitement occurs, often accompanied by slight frontal headache, in which my mental imagery becomes more varied and concrete than normal. I feel an unusual brilliancy and fertility of suggestion; my mental scenery becomes less schematic and algebraic; comparisons and illustrations suggest themselves on every hand; thought proceeds by object images." It may be pointed out that neurasthenia is widely regarded as a condition of depression with irritability of the higher cerebral centers. Binswanger, indeed, in his book on the pathology of neurasthenia, considers the parallel between fatigue and neurasthenia as so close that he is inclined to regard the latter as nothing else than a prolonged condition of over-fatigue. In mescal intoxication we may be said to have a neurasthenia which is very limited, but is very sudden and swift. The sensorial apparatus is allowed to run violently down, and in healthy persons the accompanying acute metabolic activity produces the pleasurable feelings which usually accompany nervous activity. It is perhaps due to the swiftness of this process, and also to the good physical condition of the subject, that no unpleasant after-effects are usually experienced. I have noticed that the pleasant or unpleasant effects and after-effects of mescal may be quite accurately foretold from a knowledge of the subject's general health, and that the better his general

condition the less likely is he to experience any unpleasant results from taking mescal.

It was inevitable that an attempt should be made to drag mescal into the already overcrowded field of therapeutical agents. Curiously enough, the first affection which it was used to treat was neurasthenia, and the results were said to be good, but nothing further has been heard of it. In various quarters it has been suggested for use in insanity, and at Carmarthen Asylum Dr. Goodall, as he informs me, has made many trials with it, on melancholic and stuporose patients, pushing the drug eventually in large doses, but beyond dilatation of pupils and rapidity of heart action, the results were nil. I have myself never felt hopeful about mescal as a therapeutic agent, and though it is possible that of the various alkaloids obtained from it some may be found useful, it is not easy to see in what diseased conditions the crude drug itself is indicated. The fact that its best results are obtained in perfectly healthy individuals would alone counter-indicate its use as a remedial agent, and at present there seems no excuse whatever for thrusting it into the pharmacopœia.

The chief interest of mescal is for the physiologist and the psychologist.* It may be added that for every healthy person a single experience, at all events, of what mescal has to teach would be an educational advantage of no little value. As one of my subjects, who strongly feels this educational value of mescal though he has no wish to repeat the experience, remarks: "The connection between the normal condition of my body and my intelligence had broken—my body had become in a measure a stranger to my reason—so that on reasserting itself it seemed, with reference to my reason which had remained perfectly sane and alert, for a moment sufficiently unfamiliar for me to become conscious of its individual and peculiar character. It was as if I had unexpectedly attained an objective knowledge of my own personality." Thus it is that the Indians who raised this remarkable plant to divine rank, and dedicated to it a cult, have in some measure been justified, and even in civilization there remains some place for the rites of mescal.

* 'What an excellent use for a medical congress,' Mr. Francis Galton writes to me, 'to put one half of the members under mescal, and to make the other half observe them.'