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ANHALONIUM LEWINII
(MESCAL BUTTONS).

A STUDY OF THE DRUG, WITH ESPECIAL REFERENCE TO
ITS PHYSIOLOGICAL ACTION UPON MAN, WITH
REPORT OF EXPERIMENTS.

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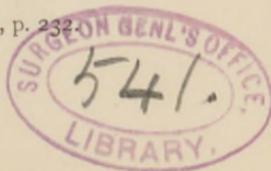
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THE attention of the medical world was first directed to the Anhalonium Lewinii by Lewin and Henning,* who, in 1888, published the results of their observations upon the drug. Since that time Lewin has made the drug the subject of further study. But, besides this and some discussion as to the place in botanical classification which the Anhalonium Lewinii should occupy, little attention has been given to the drug by investigators, owing, in all probability, to the difficulty with which specimens are obtained.

In the autumn of 1894 the United States Bureau of Ethnology received, through Mr. James Mooney, agent among the Indians, an abundant supply of the mescal buttons. The investigation of its physiological effects having been intrusted to the present writers, we have embodied the results of our observations in this paper.

* THERAPEUTIC GAZETTE, 1888, p. 232.



The *Anhalonium Lewinii* being a drug with which few are familiar, a brief description of it may not be out of place. Without entering into a minute botanical description,* it may be said that the plant from which the buttons are derived belongs to the natural order of *Cactææ* (cacti), of which order there are many species, the *Anhalonium Lewinii* being the one about which least is known at the present time. It inhabits the valley of the Rio Grande in Mexico, growing in barren and even rocky soil, and often in places which can be reached with difficulty by those who gather it. It reaches a height of about one-half inch above the surface of the ground. The body (Fig. I., 1, is comparatively thick, and is surmounted by a top, which is composed mainly of the blunt leaves of the plant. In the centre of this top is a tuft, about one-half to one inch in diameter, composed of yellowish-white filaments or hairs. These *tops*, when dried, constitute the mescal buttons, the commercial form of *Anhalonium Lewinii*.

The mescal buttons (Fig. II.) are of a brown color, circular, about one to one and a half inches in diameter, and about one-fourth of an inch in thickness. The edge curls upward, giving to the under surface, *a*, a convex appearance. In the centre of the upper surface, *b*, is a tuft composed of the yellowish-white hairs before mentioned, and matted down so as just about to reach the level of the upturned edge.

The button is somewhat brittle and hard, and can be pulverized in a mortar with difficulty. In the mouth, however, under the

* See Henning, THERAPEUTIC GAZETTE, 1888.

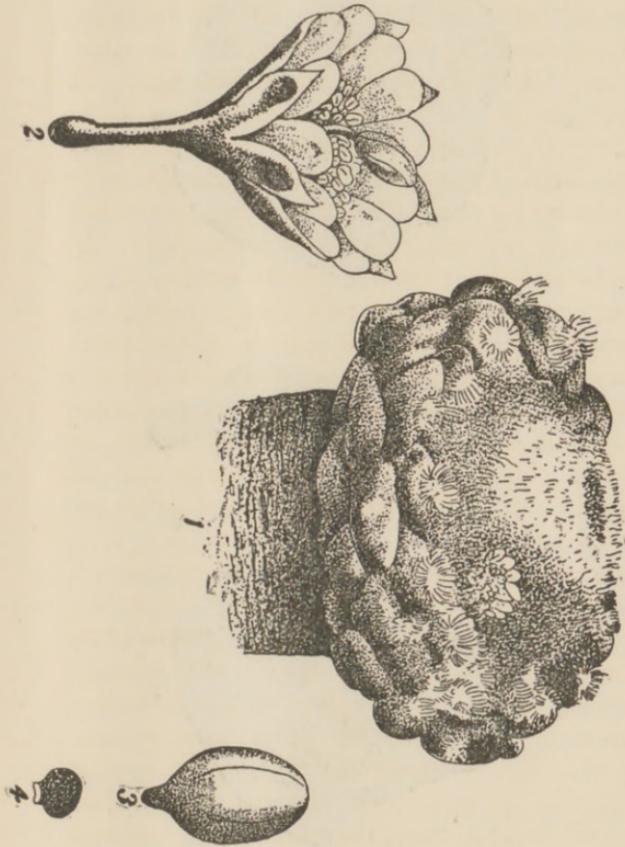


FIG. I.



FIG. II.



action of the saliva, it swells, and rapidly becomes soft, the consistency which it acquires giving somewhat the sensation imparted by slippery elm. The taste is decidedly disagreeable and nauseous, and very bitter, with a persistent after-taste. A marked sensation of stinging or tingling is produced in the fauces, which remains for a considerable time after the drug has been swallowed. The powdered drug is odorless when dry, but acquires a nauseous odor upon being moistened.

The chemical constituents of Anhalonium Lewinii, so far as known at the present time, are most interesting.* In 1888, Dr. Lewin† obtained from the drug an alkaloidal substance which he tentatively named anhalonin. This substance is a brown, syrupy liquid, having an intensely alkaline reaction. It was found to be slightly soluble in water, but readily soluble with the aid of an acid. When sulphuric acid was used as a solvent, the crystallized sulphate of an alkaloid separated in the form of colorless, needle-shaped crystals.

Heffter,‡ by careful analysis of this syrupy substance, obtained three alkaloids. The first, probably the same one crystallized out by Lewin (*ante*), and more properly called anhalonin, formed brilliant, colorless, needle-shaped crystals. To this Lewin has ascribed the formula $C_{12}H_{15}NO_3$.

* For the following account of our present knowledge of the chemistry of Anhalonium Lewinii I am indebted to Mr. E. E. Ewell, Bureau of Chemistry, United States Department of Agriculture.

† *Archiv für Experimentelle Pathologie und Pharmakologie*, 1888, xxiv. 401.

‡ Dr. A. Heffter, *Archiv für Experimentelle Pathologie und Pharmakologie*, Band xxxiv., Heft I u. 2.

The second formed non-lustrous, white rhombic tables.

The third was an amorphous and very poisonous alkaloid left behind in the mother liquor.

The chemical analysis now being made in the laboratory of the United States Department of Agriculture by Mr. E. E. Ewell, under the direction of Dr. H. W. Wiley, promises, when completed, to throw great light upon the chemistry of the mescal. This investigation likewise indicates the presence of at least three alkaloids. Besides these, at least two resinous bodies are also present, as well as a wax-like body, which latter is insoluble in cold alcohol, but is soluble in hot alcohol, petroleum ether, chloroform, etc.

The resinous bodies are dark brown in color and very thick, and have the taste and odor of the moistened mescal.

Which of these constituents is the true active principle of the drug cannot be stated until the chemical analysis is complete, and experiments have been carefully made with each of the constituents found, to determine its individual action and identity. It is the opinion at the Agricultural Department that the activity of the drug is due mainly to the resinous bodies and not so much to the alkaloidal constituents.

A marked peculiarity of the mescal is that about one-half of its ash is potassium chloride,—a proportion greater than that found in any other plant.

Physiological Action.—In connection with the physiological action of the mescal, its use by the Indians is of great interest. The Kiowa Indians formerly for generations occupied the valley of the Rio Grande, and became

addicted to the use of the mescal buttons, which, as already stated, are native in that region, and they adopted its use as a regular part of their religious ceremonies. Later on they migrated from the Rio Grande, and finally took up their abode on the Kiowa Reservation in Indian Territory, which they now occupy. They have continued the use of the mescal button in their ceremonies, however, the demand being supplied by traders, who obtain it from the valley of the Rio Grande. Complaint being made to the government authorities at Washington by missionaries and others, the buying and selling of the drug was rendered unlawful. Nevertheless, the use of the mescal has persisted among the Kiowas to the present time.

The religious ceremonies mentioned usually take place on Saturday night. The male Indians, having obtained their supply of the buttons, seat themselves in a circle around a large camp-fire, which is kept burning brightly. A button, after having been freed from the tuft of hairs, is put into the mouth, and, after it is thoroughly softened, it is ejected into the palm of the hand, rolled into a bolus, and then swallowed. In this way ten or twelve of the buttons, as a rule, are taken at intervals between sundown and 3 A.M. Throughout the ceremony there is no dancing or singing, but the camp-fire is kept burning brightly, and a continual beating upon drums is kept up by attendants. The Indians sit quietly in a state of reverie, the intoxication of the drug showing itself in the visions of color and other manifestations, which will be described later. They sit in this manner from sundown to noon of the

next day. As the effect wears off, they get up and go about their work, it is claimed, without the slightest depression or unpleasant after-effect. Upon the day following the ceremony they carefully abstain from the use of common salt with their food; this, it seems, for a religious reason, and not because of any incompatibility of salt with the drug or its effects. This description of the manner in which the mescal buttons are used by the Indians was given to the writers by Mr. Mooney, who has several times partaken of the drug with them.

It will be noticed in the following experiments that only three to seven of the buttons were necessary to produce a marked effect, whereas the Indians take ten or twelve at one ceremony. This difference in susceptibility is undoubtedly due to the tolerance for the drug which has arisen in the Indian as a result both of his own habitual use and of the hereditary influence received by him from his progenitors.

Experiment 1.—Chemist; age, twenty-seven; height, five feet five inches; weight, one hundred and twenty-three pounds.

This experiment is of value only as showing the remarkable effect of the drug upon the brain, especially the centres of vision. No record of the effect upon the bodily functions was taken.

About four and a half buttons were taken, weighing, in all, between fourteen and fifteen grammes. Between 9 and 11 P.M. three buttons were slowly chewed and swallowed. A slight nausea was noticed after the second button had been swallowed, which increased in intensity until midnight and then gradually disappeared. The following account is from

the report of the subject of the experiment, taken partly from notes made by himself at the time :

“ At eleven o'clock I retired to my room to prepare for bed. Before doing so, however, I noticed that on closing my eyes I could see all sorts of designs in brilliant and ever-changing colors. These visions were so pleasing that I at once decided to continue the experiment, and I placed the fourth and a part of the fifth button in my mouth. Then followed a train of delightful visions such as no human being ever enjoyed under normal conditions. My mind was perfectly clear and active ; the power to concentrate my thoughts upon any desired subject was only slightly lessened ; seated at my desk, I could write of my sensations and experiences ; stretched out upon the bed, with closed eyes, an ever-changing panorama of infinite beauty and grandeur, of infinite variety of color and form, hurried before me. By concentrating my thoughts upon various subjects successively, the nature of the visions could be determined and considerable control exercised over the time that they remained in view. Perhaps the most pleasing of all the visions of the night were brought to view by my voluntarily thinking intently of the production of Kiralfy's 'America,' as given two years ago. Indeed, during the passage of this and many other visions before my enraptured mental gaze, my pleasure so far passed the more ordinary realms of delight as to bring me to that high ecstatic state in which our exclamations of enjoyment become involuntary. I truly thought that I had experienced great pleasure upon many previous occasions, but the

experience of this night was one quite unique in this regard in the history of a lifetime. The tendency of every feature of the experience to prove a source of pleasure was quite remarkable. Efforts to fix the attention upon some subject which should give rise to unpleasant visions resulted in the appearance of myriads of horrible crawling monsters and seas of grewsome forms of human face and body which would cause the ordinarily sensitive human being to shudder. But under the influence of the mescal it merely added another item to the list of the inexpressible delights of my remarkable night's experience."

Besides the visions mentioned, the loss of conception of time and space was a marked feature of the experiment.

About 4 A.M. the effects of the drug began to pass off, and had entirely disappeared by evening. During the day slight depression was experienced with inability to sleep until 9 P.M.

Careful chemical examination of the urine passed during the experiment disclosed the presence of a considerable quantity of at least one of the alkaloids of the drug.

Experiment 2.—Reporter; age, twenty-four; height, five feet eleven inches; weight, one hundred and fifty-eight pounds. In preparation for this experiment the buttons were ground to a coarse powder, and were administered in wafer-paper, the subject having previously found it impossible to chew and swallow them after the manner of the Indians without emesis.

At the beginning of the experiment the pulse was found to be 108 and the other bodily

functions normal. The height of the pulse was due to the unfortunate fact that he had taken a glass of whiskey with his supper, a short time before.

Between 11.30 P.M. and 2.30 A.M. seven buttons were taken at regular intervals. Observations taken at hourly intervals showed that the condition of the skin, respiration, and temperature remained normal throughout the experiment. The pupil began to dilate at 1.30 A.M. and remained dilated until the evening of the following day. The pulse-rate gradually fell from 108 at 11.30 P.M. to 71 at 2.30 A.M., and then rose to 81 at 3 A.M., and continued at this rate and of good quality throughout the experiment. A sedative effect upon the muscular system became apparent at 2.30 A.M., the subject feeling decidedly lazy and perfectly contented.

At 3 A.M. began the period of intoxication and full effects of the drug. During this time, which lasted until about 7 A.M., he reclined lazily in his chair, disinclined to make the slightest movement. His eyelids drooped, and he scarcely moved his lips and jaw in articulating. His pupils were dilated. There was no exhilaration, but a tendency to reverie. He noticed a fine tremor of the extremities and a rumbling in the ears. He lost conception of time, the intervals between his words and sentences seeming inordinately long.

Besides these constant symptoms, which persisted during the experiment, another set came on in paroxysms or periods, which would last a varying length of time,—from one to five or six minutes or more. The intervals between these periods also varied in length very much.

During each paroxysm of this sort he had visions of ever-changing and gorgeously colored objects, forms, and designs in motion. "The first sensations that followed my taking the drug came upon thoughtlessly closing my eyes. Instantly there sprang into the field of view a host of little tubes of shining light, down which green and red balls the size of peas were constantly rolling. The tubes of light bent themselves into the shape of letters, but they would spell nothing, and, slowly curving themselves into grotesque shapes, began to revolve rapidly, the green and red balls going in the opposite direction with even greater velocity. All the field of view between these silent wheels was filled in with a shifting mass of green. The colors were wonderful. They were the colors of the spectrum intensified as though bathed in the fiercest sunlight. No words can give an idea of their intensity or of their ceaseless, persistent motion. The figures constantly changed in form and color, but always remained a series of fantastic curves, revolving rapidly back and forth upon their own axis. The forms changed through rich arabesques, Syrian carpet patterns, and plain geometric figures, and with each new form came a new flush of color, every shade appearing, from pure white to deepest purple. When the eyes opened and the light was turned up, the visions faded like stars going out in daylight, and the room, tables, chairs, and all surroundings came back into real existence and within reach of the hands."

During these paroxysms he also experienced difficulty in enunciation, and was frequently at loss for a word with which to express his thoughts. He also seemed to have a double

personality,—to be outside of himself looking at himself. At such times, also, a marked symptom was a feeling of great distrust and resentment which he exhibited towards those who were making the experiment with him. He realized his "mental inferiority," and firmly believed that we were secretly laughing at his condition. He believed that we intended to kill him, and for this reason he refused to take the eighth button at 3.30 A.M. He has since stated that the drug made him perfectly "insane" in this particular, and that he would have attempted violence had it not seemed to him too much trouble in his lazy and depressed condition. Between the paroxysms he had no such feeling, and apologized for the feeling which he realized he could not help.

At about 7 A.M. the paroxysms and all symptoms began to diminish in intensity, and had entirely disappeared at 7 P.M. During the day he was troubled with some disturbance of vision, occipital headache, sense of dual personality, and tendency to recurrence of the visions and "lapses of mind;" but he managed to do a day's work.

Experiment 3.—Subject same as in the last experiment. Between 11 P.M. and 1.30 A.M. three and a half buttons were taken in wafer-paper.

Observations at regular intervals showed that the condition of the skin, respiration, and temperature remained normal throughout the experiment. The pulse-rate declined from 82 at 8 A.M. to 72 at 2.30 P.M., and then rose gradually to 78 at 3.30 P.M., and continued at this rate, with slight variations, throughout the experiment. The pupil began to dilate at 2.10

P.M., and remained dilated until about noon of the following day. Marked sedative and quieting effect upon the muscular system appeared at 2 P.M., preceded by a period of "nervousness." The same disinclination to muscular effort was noted as in the last experiment, though not so marked; also the fine tremor of the extremities. In this, as well as in the last experiment, a feeling of discomfort and fulness in the stomach followed the ingestion of the drug.

At 4 P.M. a faint color display appeared upon closing the eyes. This effect gradually deepened into visions, differing from those already described only in the fact that they were much less intense. They could be seen at intervals, upon closing the eyes, until about noon of the day following, passing off with the other effects of the drug. No disagreeable symptoms appeared, as in the last experiment,—no dual personality, resentment, difficulty in thought and enunciation, etc. He was able to work with extraordinary facility and ease before the effect of the drug passed off, and regards it, in the dose given, as a remarkable brain stimulant. No after-effects were noticed.

Experiment 4.—Student; age, twenty-six; height, six feet two and a half inches; weight, one hundred and fifty-eight pounds. Between 6 and 10.30 P.M. three and a half buttons were slowly chewed and swallowed. The pulse-rate fell from 90 at 6 P.M. to 80 at 7 P.M., 72 at 8 P.M., 68 at 9 P.M., 63 at 10 P.M., and then rose to 72 at 11 P.M., 80 at 12 M., and remained at 80, with slight variations, throughout the experiment. The pupil became dilated after the third button, and remained dilated until

evening of the following day. A fine tremor of the extremities was noted at 11 P.M. A feeling of perfect comfort and satisfaction appeared after the second button at 9 P.M. This feeling was accompanied by disinclination to make any muscular effort, and the effect deepened into a most marked depression of the muscular system at about 11 P.M., which became the most prominent feature of the experiment. He became unable to walk without assistance, and could with difficulty maintain himself in the sitting posture. All of his voluntary muscles took part in this depression, and were limp and flaccid. He did not move his lips in talking, and at times was unable to speak above a whisper. Like the subject of Experiment II., he "lapsed away" into paroxysms, at which times the depression was greater and the visions and all other symptoms more intense. In the intervals between them he was more nearly himself. These paroxysms could be precipitated at any time by turning the light low.

His condition began to improve at 3 A.M., though the depression did not entirely disappear until 1 P.M. of the following day.

The pulse during the period of depression was of good quality, and remained at 80, except after exertion.

The respiration during the paroxysms was more shallow and rapid than normal, and interrupted occasionally by a very deep breath, at which he expressed the greatest satisfaction.

Loss of conception of time was a marked feature of the experiment. All objects also seemed small and removed to a great distance,

so that he needed assistance to bring a glass of water to his lips.

Visions appeared upon closing his eyes at about the time of commencement of the depression, and lasted until about 3 A.M., when they began to diminish in intensity, and finally disappeared at 1 P.M. on the following day. The visions were not brilliant displays of color, but the appearance in rapid succession of variously colored familiar objects, like barrels, pumps, etc., and he expressed no admiration for them. The visions were subject to suggestion. Upon being asked if he did not see this or that object, it immediately appeared before his imagination. Thus, having suggested a Sunday-school, he described accurately the scholars, the movements of the leader, the song they were singing, and even sang the song with them before us. He fully realized that the vision was an effect of the drug and not a reality.

His intellect was fairly clear, there being only slight slowness and confusion of thought at times. He had a sense of mental inferiority, and also felt that he was sinking all the time, and that his life was leaving him, and expressed anxiety as to his condition. His sense of smell was so far blunted that he could not recognize cinnamon-water, or tell whether or not tincture of asafœtida was a perfume. He could not recognize cinnamon-water by the sense of taste, but thought it different from pure water in some way. During the experiment there was frequent urination, accompanied by a burning sensation in the urethra. Sleep was found impossible during the day following.

Throughout the experiment he complained

of an aching sensation in the occipital region and eyes. This ache and "tired feeling" persisted in the occipital region for three days, being so severe on the second day that he could not attend to his work.

Experiment 5.—Clerk; age, twenty-one; height, five feet ten inches; weight, one hundred and forty-eight pounds. At the commencement of the experiment the subject's condition was found normal, with the exception of the pulse, which was 96, the rapidity being in all probability due to excitement. Between 6 and 10.30 P.M. three and a half buttons were slowly chewed and swallowed.

The respiration and temperature were unaffected by the drug. The pulse rate gradually declined from 96 at 6 P.M. to 66 at 9 P.M., and then rose gradually to 78 at 11 P.M., and continued at that rate throughout the experiment. The pupils became dilated after the second button, and remained dilated until the evening of the following day. A fine tremor of the extremities was noted, as in the last experiment. The sedative and quieting effect of the drug appeared after the second button, the subject reclining lazily in his chair, perfectly contented, and unwilling to make any muscular effort. The effect upon the brain showed itself in this case not in the production of visions,—only a few visions of color being seen,—but in a remarkable mental exhilaration and stimulation, which lasted until 9 A.M. He was perfectly happy and experienced a sense of superiority and well-being. He wrote continuously an account of his sensations, but experienced difficulty in writing down his thoughts, so fast did they follow one another.

He lost all conception of time. There was frequent urination, accompanied by a burning sensation in the urethra. Some anæsthesia of the surface of the body was noted. Sleep was found impossible during the following day.

The last two experiments present a remarkable contrast in the susceptibility of the two persons to the effects of the drug, both taking the same amount, at the same time, and under the same conditions.

Experiment 6.—Chemist; age, twenty-nine; height, five feet ten and a half inches; weight, one hundred and fifty-five pounds. Between 10 A.M. and 1 P.M. four buttons were taken, weighing, in all, 11.52 grammes. At the commencement of the experiment the subject's condition was found normal; pulse, 90. The respiration and temperature remained normal.

The pulse-rate declined from 90 at 10 A.M. to 80 at 11 A.M., 68 at 11.30 A.M., 60 at 12 M., and remained at 60 until 3.30 P.M., when it rose to 65, 70 at 4 P.M., and continued at this rate. At 12.15 P.M. dilatation of the pupil was noted, which continued throughout the experiment. A sedative effect upon the muscular system became apparent at 11 A.M., after the second button. This lasted until the active effect of the drug passed off, and was a pleasant feature, and at no time approached actual depression. Slight uneasiness in the stomach was present a part of the time. Visions appeared upon closing the eyes at 1.30 P.M., in the form of tapestry designs in black and white. From this time until 3 A.M. on the following morning, whenever the eyes were closed, a panorama of beautifully colored objects, designs, scenes, dances, marches, etc.,

passed constantly before his imagination. The visions were at times under the control of the will. The effect of music upon them was noted, and it was found to have no effect, except so far as the regular marking of the time was concerned. He preferred drumming to regular time upon a table to the music of a piano. The effect of this was to make the men, women, and objects dance, or otherwise keep perfect time to the drumming, and greatly intensified the pleasant effect of the drug. It will be remembered that a constant beating upon drums is a regular part of the taking of the mescal buttons by the Indians.

His reason and will were absolutely unaffected.

Partial anæsthesia of the surface of the body was noted at 4 P.M. All objects seemed removed to a distance, though this was less marked than in any of the preceding experiments.

The effects of the drug wore off gradually, commencing at 5 P.M., although visions could be seen until 3 A.M., and sleep was found impossible until 5 A.M. No depression was experienced the next day.

The quantity of the urine and its constituents were not altered by the drug.

The production of visions is the most interesting of the physiological effects of the Anhalonium Lewinii, as shown by these experiments. The visions ranged from ill-defined flashes of color to most beautiful figures, forms, landscapes, dances,—in fact, there seemed to be absolutely no limit to the variety of visions which the drug could pro-

duce. They could in but few cases be seen with the eyes open, but upon closing them an ever-changing panorama appeared. The predominating feature of the visions was the color effects, although the figures, forms, etc., were in themselves sources of pleasure and admiration. Drumming, or otherwise marking regular time, enhanced the beauty and variety of the objects seen. In two cases the visions were under the control of the will, and in one case they were subject to the suggestion of others. The amount of pleasure derived from the drug seemed to vary inversely with the amount of muscular depression present. The effect of the drug in the production of visions is in all probability due to the stimulation of the centres of vision in the brain. The persistent ache and feeling of exhaustion in the occipital region, which was present for several days after Experiment 4, is of interest in this connection.

In some cases no effect whatever was produced upon the reason or will of the individual. In others there was some slowness of thought and loss of power of expression, and in Experiment 2 a marked delusion. Compared with other intoxicants, however, the effect upon the mind is extremely slight.

Dilatation of the pupil was well marked in every case, and persisted for from twelve to twenty-four hours after the drug was taken. The dilatation was accompanied by a slight loss of the power of accommodation and consequent disturbance of vision.

More or less depression of the muscular system existed in every case, and this was the first effect noticed after the drug was taken. It

ranged from a feeling of lazy contentment to marked muscular depression. Susceptibility to this effect varied widely. Whether the sedative action is caused by depression of the nerve-centres, peripheral nerves, or their nerve-endings, or of the muscular fibres themselves, we are at present unable to state; but from concomitant nervous effects we are inclined to the belief that it is due to depression of the nervous system and not of the muscular fibres themselves.

Partial anæsthesia of the skin was present in three of the cases, appearing when the effects of the drug began to wear off.

The heart action is at first rendered more slow and somewhat weaker in quality. This is followed by a rise to the normal in quality and rapidity, which continues during the period of greatest activity of the drug. In the cases in which the muscular depression was greatest, slight, if any, depression of the heart was present.

The respiration was unaffected in all cases except one. In this it seemed to partake slightly of the general muscular depression.

Upon the stomach the drug produced an effect which varied from a feeling of uneasiness and fulness at intervals to nausea and vomiting.

Inability to sleep for at least twelve hours after the effects of the drug commenced to pass off was a marked effect.

Loss of the sense of time existed in all cases.

No constant effect upon the bowels, skin, temperature, and the amount of secretion of the various glands of the body was found.

The only record of the taking of Anhalonium Lewinii for experimental purposes which we have been able to find is that of Briggs.* He took "a third of a specimen," and the symptoms produced were the following: in fifteen minutes the pulse rose from 60 to 70. In thirty minutes there was fulness of the head, pulse 90, respiration 26. The sense of fulness increased, and was followed by a headache and swimming in the head. Suddenly the pulse shot up to 160, and the respiration increased so that he could with difficulty get sufficient breath to keep himself alive. He thought he was about to die, and became unconscious. In six to eight hours his pulse and respiration went down again to the normal. Great depression existed for twelve hours.

The symptoms produced in this experiment are so widely different from those which we have obtained from administration of the drug that we cannot believe that the drug taken by Briggs was the same one which we have now under consideration.

Lewin,† in experiments upon animals, found that in them the drug produced an acute muscular spasm of varying intensity, with increased reflexes, its action in this particular much resembling strychnine or brucine. No such effect was present, however, in our experiments upon man. Whether or not it would be produced by much larger doses is, of course, a matter of conjecture. In some animals, also, a quickened respiration was noted, which effect was

* Lewin, *Archiv für Experimentelle Pathologie und Pharmakologie*, Band xxxiv., Heft 5 u. 6.

† *Archiv für Experimentelle Pathologie und Pharmakologie*, Band xxxiv., Heft 5 u. 6.

present in our experiments only in one case, and in the presence of great general muscular depression. In animals, also, the heart remained unaffected, whereas, in man, we found a primary slowing of the heart action. In both animals and man more or less tendency to nausea and vomiting existed in most cases.

The physiological action of *Anhalonium Lewinii* upon man cannot be said to be identical with that of any other known drug. Its effects resemble those of certain drugs in some of the symptoms produced, but differ widely from them in others. *Cannabis indica* produces visions, with dilated pupils, and with slight effect upon the circulation. In these particulars its action is similar to *Anhalonium Lewinii*. But *cannabis indica* is an hypnotic, and the delirium and hallucinations are in most cases followed by sleep. *Anhalonium Lewinii*, on the other hand, tends to produce wakefulness in every case. The Indians do not sleep for twenty-four hours after the commencement of their ceremony, and in our experiments sleep was found to be impossible for about the same length of time.

In this tendency to produce wakefulness it resembles cocaine. The visions produced by *cannabis indica* "are generally of a gay character, producing much merriment, accompanied by a great inclination to muscular movement."* The visions of *Anhalonium Lewinii* provoked wonder and admiration, but no merriment, and there was present disinclination to make any muscular effort. Other marked differences

* Brunton, "Pharmacology, Therapeutics, and Materia Medica," p. 1026.

exist, which will become evident to any one comparing the action of the two drugs.

Of the other drugs to whose action Anhalonium Lewinii may seem to bear a faint resemblance,—cocaine, belladonna, strychnine,—the difference in action present is so great as to render it very improbable that any of them are active principles of the drug. Whether one or more of these substances or their alkaloids do not exist in the Anhalonium Lewinii cannot be stated until the chemical analysis is complete and experiments have been conducted to determine the identity of the principles isolated.

In conclusion, we would say that Anhalonium Lewinii (mescal buttons) must not be confounded with the intoxicating drink, “mescal,” used by the Mexicans and others. This drink is the fermented juice of one or more of the species of *Agave*.

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