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Peyotl

The peyotl is a cactus which grows in certain parts of Mexico and is used by various groups or tribes of Indians in Mexico and the United States for different purposes, including cult purposes. Its principal alkaloid, mescaline, is of some importance in psycho-pharmacology. Peyotl is not one of the drugs placed under international control by virtue of the international instruments relating to narcotic drugs. It was discussed at the twenty-first session of the League of Nations Advisory Committee on Traffic in Opium and Other Dangerous Drugs. The information in this article has been compiled from the literature published on the subject.★

Historical Background

Peyotl has been known and used in the mountainous region of northern Mexico, which seems to be its habitat, from time immemorial; it was certainly in use in the pre-Colombian epoch and was probably used by the Chichimec tribe long before the Christian era.[1] The question of why it came into use originally is obviously insoluble, but at first there seems to have been no mystery about it, for any plant with a high water content is welcome in the arid region where it grows.

Indian legends attribute a divine origin to peyotl, and several variants of the manna myth are found, as well as magical myths, some of them linking the plant to certain animals: this symbolism reappears in various aspects of the peyotl cult.

The earliest historical references to it appear in the work of Spanish writers contemporary with the conquest of Mexico.[2] At that time missionaries and administrators tried to suppress peyotl consumption, for several reasons — *social:* they regarded it as an intoxicating substance dangerous to the individual and to society; *political:* they attributed to its consumption resistance to fatigue and hunger and the courage of certain tribes which they had difficulty in subduing; *religious:* they considered the use of peyotl to be a pagan practice, especially pernicious when it survived among Christianized Indians.

During the seventeenth and eighteenth centuries, peyotl was used in a vast area streching from the (present) state of Jalisco in Mexico to the Arkansas River. A true peyotl cult cannot be said to have existed at the time, but peyotl was used for two purposes: by *individuals*, as a medicine and to induce visions leading to prophetic utterance (this is a characteristic common to most sacred herbs, wherever found); and *collectively*, to obtain the desired state of trance for ritual dances. It should be observed, however, that the Indians were not the only ones who used peyotl at that period, for other sections of the population took to it, first the whites (and the Inquisition often intervened), then the Africans imported as slaves.

In the nineteenth century, considerable movements of Indian tribes occurred on each side of the Rio Grande,[3] although their chronology and even their interconnexion cannot be exactly determined: there were migrations northwards, but also raids from north to south (the largest seem to have been by the Kiowas, who got as far as southern Mexico towards the middle of the century). The ritual use of peyotl appears to have gradually become more fully organized, cult groups thus being established. Various authors, in particular Mooney,[4] Rouhier[5] and Slotkin,[6] have tried to trace the progress of the activities which finally led to the establishment of the peyotl church at the end of the nineteenth century. They have not been completely successful, but they supply useful signposts. Broadly speaking, it may be said that the rite, moving up from Mexico, was adopted by the Mescalero-Apaches of New Mexico, who passed it on to the Comanches and Kiowas (1840). Later, it spread to the Tonkawas and Kickapoos (1860), then to the Wichitas, Cheyennes, Arapahos and Omahas and, finally, about 1910, to the Osages.

A general census of peyotl votaries has been compiled by Rouhier[7] on the basis of documentation supplied by the Bureau of Indian Affairs at Washington. What is noteworthy is, first, the small number of votaries (a few thousand) and, secondly, the wide dispersion of the cult, which — apart from four Indian tribes in Mexico — spread to some forty Indian tribes in the United States living in ten different states.

★ At the end of this article will be found a bibliography. All references given as " op. cit. " are to works listed therein.

[1] B. de Sahagun, op. cit.

[2] For the literature dealing with peyotism in the sixteenth and seventeenth centuries, see especially J. S. Slotkin: *Peyotism, 1521–1891*, op. cit.

[3] The Rio Grande del Norte, which at present forms the frontier between Texas and Mexico along most of its course.

[4] J. Mooney: op. cit., passim; the bibliography lists only one of his works (for reasons of space). A list will be found in Slotkin (see footnote 6).

[5] A Rouhier: *Le Peyotl*, op. cit.

[6] J. S. Slotkin: *Peyotism, 1521-1891*, op. cit.

[7] See footnote 5.

FIG. 1. — **Two aspects of a peyotl in flower**

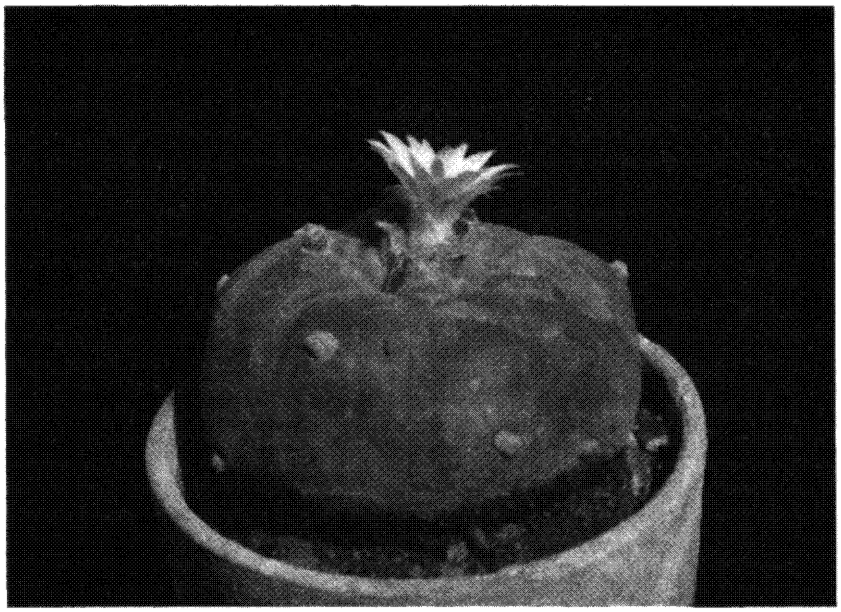


FIG. 1 *a*

FIG. **1** *b*

Photos communicated by Mr. A. Bertrand, Nogent-sur-Marne. (Copyright.)

The peyotl cult, which will be briefly studied below, was spread by Indians among Indians; the whites have never had any part in it. Incidentally, the Indians often behaved as genuine evangelists, risking the severities of the law in order to spread the cult.

It should be added that the cult was spread, not by " primitive " Indians, but, it would seem, rather by educated Indians — those re-entering the reservations — who tried to keep it alive when they returned from college or university. Since the publication of Rouhier's table the peyotl cult has been found among other tribes or groups: among the Delawares,[8] and even among negroes.[9]

* * *

The Native American Church was thus established in the United States, but to deal with it here would exceed the scope of this article and, in any case, it seems to be an ethnographical curiosity rather than an important movement. As has already been stated, attempts were made first by the Spanish colonizers and then by the Inquisition to suppress the use of peyotl, and they are still being made in certain states in the United States. Peyotl is not regarded as a narcotic drug, and its use is not prohibited by the Federal Government,[10] but it is prohibited in certain states. A Montana state law lays down that it is an offence to sell or supply peyotl in any manner whatsoever.[11] In 1926 an Indian, Big Sheep, was prosecuted and convicted under this law. (Big Sheep stated that he was a member of the Native American Church and that peyotl was used by the faithful of this church solely for ritual purposes in the adoration of God, according to the belief of the faithful, their interpretation of the Holy Bible and the dictates of their conscience.) Peyotl is also prohibited in California. In 1957, acting on information sent by the inspector at Laredo, the Californian state and district officers confiscated an express parcel containing 20 lb of peyotl.[12]

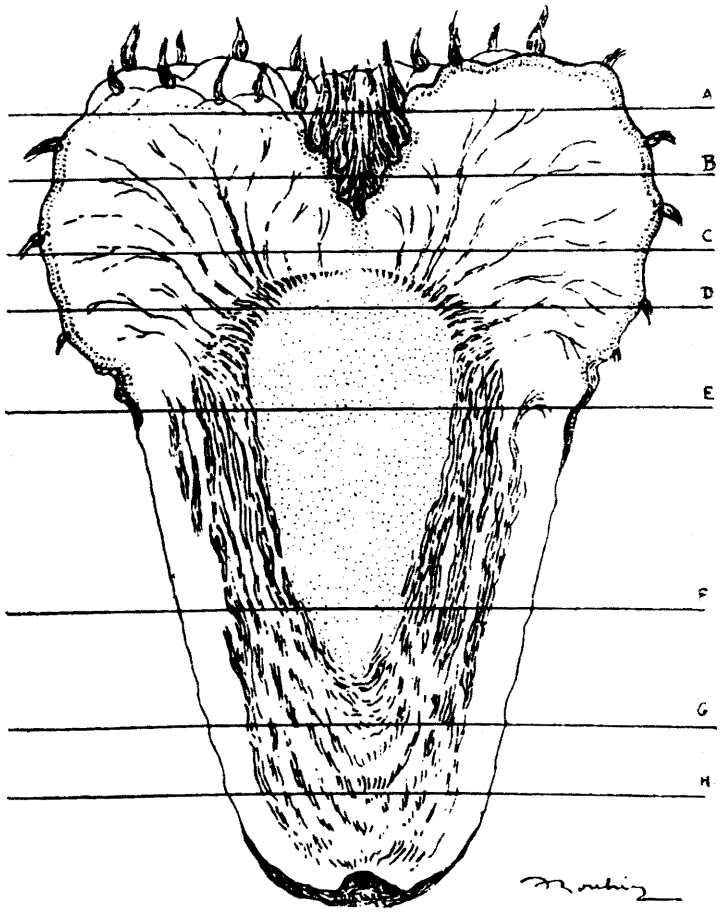
Lastly, it may be added — though it is only a trivial matter — that there was a " peyotl dispute " in the United States about 1950, and that certain ethnologists protested strongly against the idea that the use of peyotl should be prohibited, stating that the Native American Church is a legitimate religious organization with the same right to religious freedom as other churches.[13]

Description

The peyotl (*Echinocactus Williamsii Lems*) belongs to the cactus family, a sub-family of the echinocacti, genus *Echinocactus*, sub-genus *Lophophora* (this consists of only one species, the *Echinocactus Williamsii Lems*).

Rouhier (op. cit.) gives the following description of it: " The plant is small, simple or cespitose, proliferous, turbinate,

Fig. 2. — **Longitudinal section of peyotl**



A, B, C, D : spherical portion; E : collar into which the epidermis disappears; F: underground chlorophyllose stalk, part above ground where the suber begins; G, H: root.

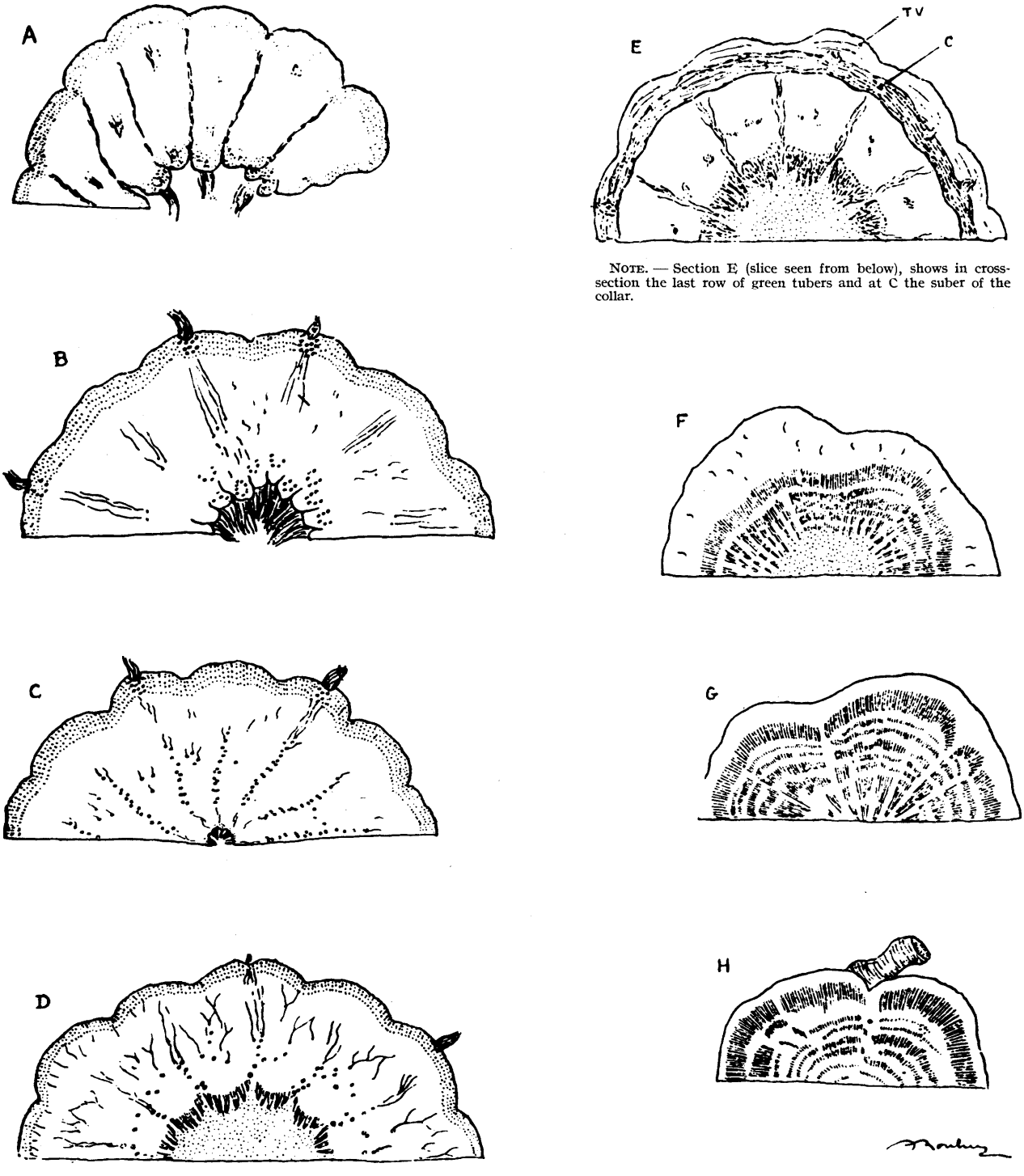
(This figure, together with figures 3, 4 and 5, is taken from the book by A. Rouhier: *Le Peyotl*, Doin, Paris, 1927.)

with a thick, napiform root. The cylindrical stalk, which has horizontal wrinkles caused by the sinking of the tubers, is suberized and greyish-fawn in colour; at the end it becomes more chlorophyllose, globular, flattened and sage-green in colour; it is divided into five to thirteen thick ribs, only slightly salient, rounded, separated from each other by well-marked longitudinal straight or sinuous grooves. These ribs are divided by shallow transverse grooves, usually at right angles to the others, into broad, flattened, relatively polyhedral tubers bearing at the top a round, inerm areola with tufts of erect long white silky hairs. As the areolae of the young tubers draw closer, the markedly umbilicate centre of the plant grows a thick pad of silky hairs from which the flowers emerge. These flowers, pink or sometimes white or yellowish, are apiculate, solitary, small, infundibuliform, with a bare glabrous ovary. The fruit is a flesh-coloured, or sometimes greenish-yellow, berry, which contains a few small dull black seeds with a granulated epidermis."

The plant rarely exceeds 15 to 20 cm in total length. Much of the plant is underground (more than half the total length). The stalk is very short, the chlorophyllose portion being broad and globular. A curious feature is that it stores water during

[8] V. Petrullo: *The Diabolic Root*, op. cit.
[9] M. G. Smith: *Ethnology: A Negro Peyotl Cult*, op. cit.
[10] See J. S. Slotkin: *Menomini Peyotism*, op. cit.
[11] See W. R. Arthur: *The Law of Drugs and Druggists*, St. Paul West Publishing Co., 1935.
[12] *Monthly Narcotics Intelligence Bulletin*, 15 September 1957 (Publication of the United States Treasury Department).
[13] *Science Newsletter*, 8 December 1951.

FIG. 3. — **Cross-sections of peyotl (made at the levels shown in figure 2)**



NOTE. — Section E (slice seen from below), shows in cross-section the last row of green tubers and at C the suber of the collar.

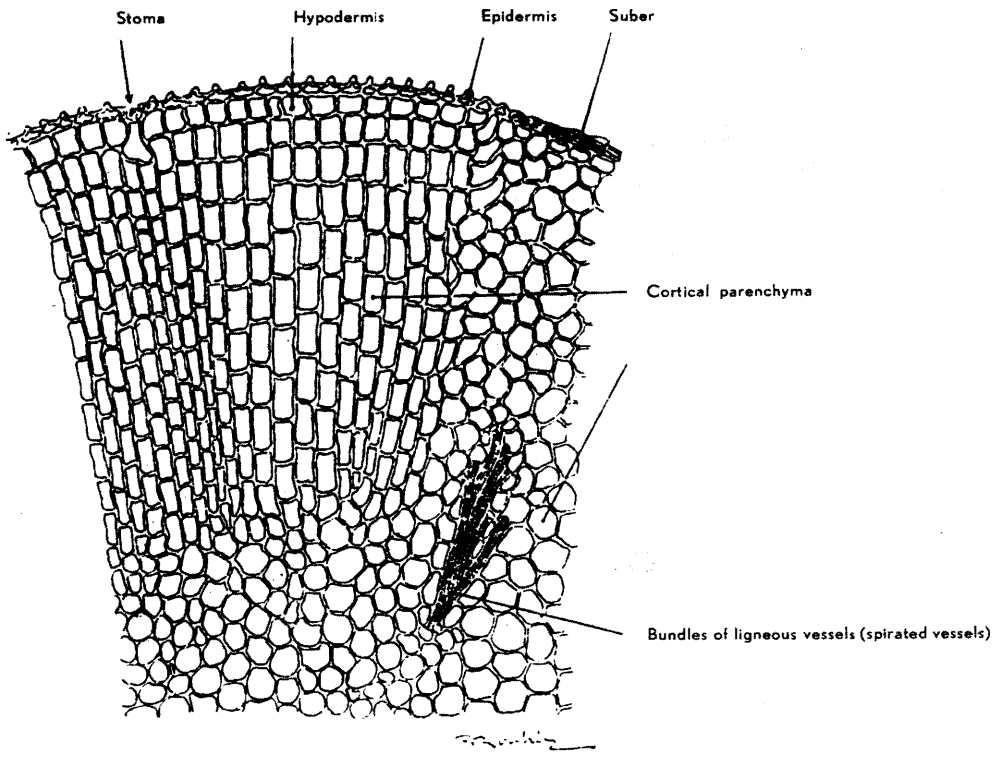
the rainy season, becoming swollen and plump, whereas drought shrivels it so much that it is hard to believe that it is the same plant. The plant flowers — in its normal habitat — after the rains — i.e., from May to July.

Figures 2 and 3 show longitudinal and cross-sections of the peyotl. The sections in figure 3 marked " A ", " B ", etc. correspond to the areas marked with the same letters in the longitudinal section in figure 2.

Figures 4 and 5 show the histological characteristics of the peyotl stalk. It should be noted that many of the cells of the cortical parenchyma " contain crystals of oxalate of lime in echini or elongated masses. They are sometimes literally stuffed with them and they appear in large numbers, especially in mature peyotls or peyotls straight from Mexico." [15]

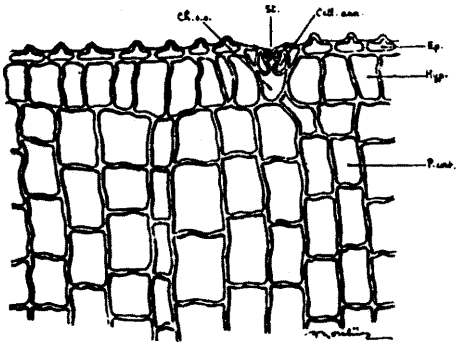
[15] A. Rouhier: *Le Peyotl*, op. cit.

FIG. 4. — **Histology of peyotl (stalk)**



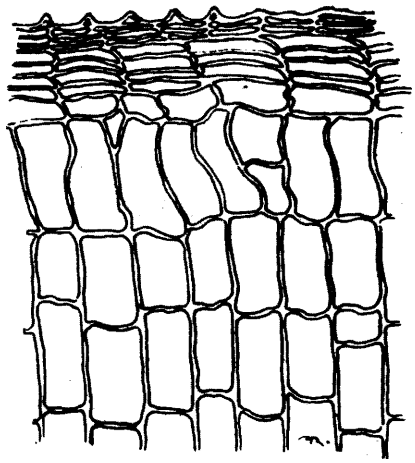
Radial section of rib of large 12-ribbed peyotl (upper chlorophyllose area of stalk).

This figure shows: the epidermis — a stoma — a sunerized area of the epidermis (top right), probably the result of a bruise — the hypodermis — the cortical parenchyma traversed by a bundle of spirated vessels leading to the periphery.



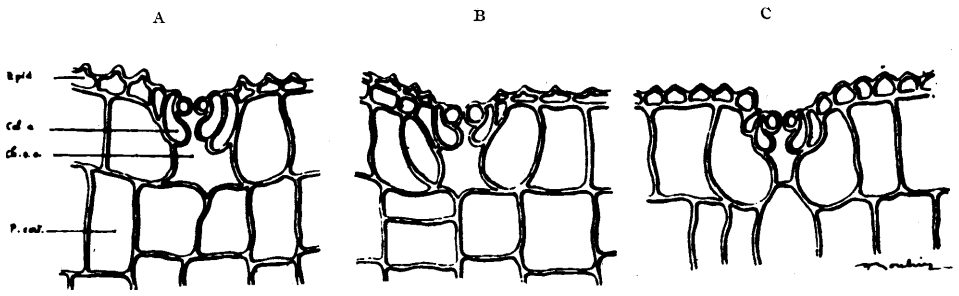
Radial section of rib of large 12-ribbed peyotl.

Cell. ann.	—	Appendent cells
St.	=	Stoma
Ch. s. s.	=	Sub-stomatic space
Ep.	=	Epidermis
Hyp.	=	Hypodermis
P. cort.	=	Cortical parenchyma



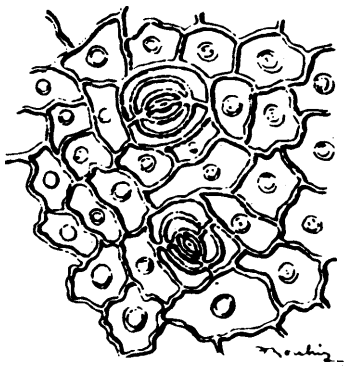
Radial section of rib of large 12-ribbed peyotl showing a portion of the epidermis in course of suberization.

FIG. 5. — **Histology of peyotl (stalk)**



Longitudinal sections of three different ribs of the same 8-ribbed peyotl showing characteristics regarded by Michaelis as specifically differentiating *Ech. Williamsii* from *Ech. Lewinii*.

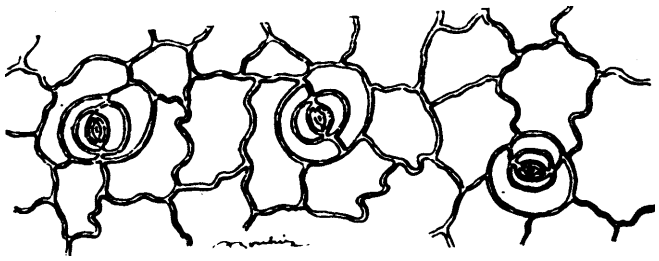
A and B show a numerical difference between the appendent cells of their stomata.
B and C show different forms of the epidermic papillose projections.



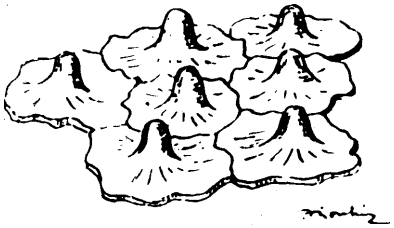
Cross-section of the epidermis of large 12-ribbed peyotl.

Above, stoma with 4 appendent cells.

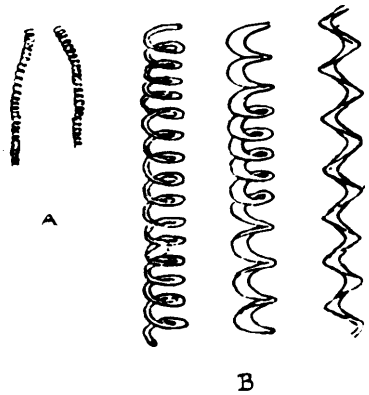
Below, stoma with 2 appendent cells.



Cross-section of the epidermis of young lateral shoot of 8-ribbed peyotl, showing the ostiola and the appendent cells of the stomata.



Epidermis of 8-ribbed peyotl seen from above (in perspective) and showing papillose projections of the cells.



A, spirated vessels slightly enlarged.
B, various aspects of the spirated vessels.

The longitudinal sections above come from the same peyotl; but there is not the same number of appendent cells of the stomata, so that this number does not constitute a characteristic differentiating *Echinocactus Williamsii Lem* from *Echinocactus Lewinii*, as has sometimes been asserted.[16]

[16] P. Michaelis: *Beiträge* ..., op. cit.

Terminology and Taxonomy

The terminological difficulties which arise in dealing with peyotl are of a twofold nature; to begin with, this term has been used throughout the ages to describe different plants or substances according to the region and, secondly, the plant is polymorphic and can thus give rise to numerous taxonomic interpretations, especially when it is borne in mind that it was studied in the nineteenth century, not as in nature, but in the form of mescal buttons — i.e., the dried slice.

The word " peyotl " appears to be of Aztec origin. It has been said to derive from various words meaning " to stir, stimulate " and so on. The most probable derivation is given by Molina [17] in his dictionary — namely, that it comes from Nahuatl " peyutl ", which means something white and silky, like a cocoon, an apt description of the fresh peyotl because of the tuft of silky hairs crowning it. But this word has always had a generic sense with different meanings. A list is given by J. S. Slotkin.[18] Moreover, there is some confusion with " mescal ", which is itself a generic term designating a cactus as well as the food and fermented beverages obtained from it. From this point of view, the confusion is worse confounded by two facts: the name " mescaline " given to the principal alkaloid of the peyotl (an attribution itself deriving from the prevailing confusion) and the name " mescal buttons ", generally given to dried slices of peyotl (perhaps because it was thought that they were intoxicating, as is the alcohol called mescal). In addition, the term " mescal bean ", which is ordinarily used for a leguminous plant (*Sophora secundiflora*), has been applied to mescal buttons.

The word " peyotl " is generally accepted throughout Mexico, though there are special terms for peyotl in the various tribal languages : " nicouri " among the Huichols of Jalisco and the Tarahumares of Chihuahua, " kamaba " among the Tepehuanes of Durango, " wokowi " among the Comanches, and so on.[19]

Lastly, two other series of names for peyotl are found: in traffickers' slang: " dry whisky ", " white mule ", and in the jargon of cactus collectors and dealers (the latter of course have every interest in putting out as many names as possible): " dumpling cactus ", " turnip cactus " and so on, referring to its shape.

Things are even more complicated taxonomically. Historically, the first scientific name was given to it by Hernández in 1638: *Peyotl zacatensis*. The name *Echinocactus Williamsii* was given to it in 1840 by Lemaire in honour of Williams, a British official resident at a place named Bahia. During the nineteenth century various writers made up other names (*Anhalonium Williamsii*, by Engelman,[20] *Ariocarpus*, by Scheidweiller, and so on). In 1894, Coulter created the genus *Lophophora* for the peyotl and called it *Lophophora Williamsii*, a name which some authors still keep.[21] Finally, in 1889, Schumann put peyotl back into the echinocactus genus and made of the *Echinocactus Williamsii* the single species of the sub-genus *Lophophora*.[22]

At the end of the nineteenth century, however, difficulties arose owing to the appearance of pseudo " new species ". These are a creation of Lewin [23] (*Anhalonium Lewinii*) and Rebut (*Anhalonium Jourdanianum*). Highly confused and complicated discussions ensued; even to summarize them would exceed the scope of this article. Not only the botanists, but also, apparently, the cactus dealers joined in, since it was to their interest that as many different species as possible should be " discovered ".

The conclusion to be drawn from the literature consulted would seem to be that the different types of peyotl belong to a single species, the confusion arising from the differences between the young peyotl, with about eight straight ribs, and the mature peyotl, with about twelve sinuous ribs; the third form, with irregular ribs, may derive from one or other of those forms, and the three forms may be found on a single root.

The designation *Echinocactus Williamsii*, which is to be found in the *Kew Index* (Vol. II, p. 813), has been adopted in this article, it being understood that the designation *Lophophora Williamsii* might also be used.

Habitat and Gathering

The peyotl grows wild on the Mexican plateau and in the southern part of Texas along the Rio Grande. It is to be found in the following Mexican states: Chihuahua, Coahuila, Nuevo Leon, Tamaulipas, Zacatecas, San Luis Potosi, Queretaro, Hidalgo and Sonora.[24] These regions are fairly high (1,800 to 2,000 metres), and have a very long dry season, with some rains in summer. The soil is in general calcareous. The peyotl grows in dry places, on cliffs or rocky slopes. These regions are very hot and the vegetation is sub-tropical.

The peyotl grows at ground level, sometimes singly, more often in clusters. It is barely visible, except when it is in flower, since it is usually more or less covered over with earth and looks like a pebble. It is very common in certain places, which often take their names from it (the village of Hicori in Sonora, Peyotan in Jalisco, etc.).

It should be added that the peyotl can be cultivated anywhere under glass or in a room, as many cactus fanciers know. It does not seem to be unduly susceptible to cold, for Rouhier [25] says that certain specimens survived during the 1914-1918 war in a greenhouse in which the temperature fell to 2° C. (A similar observation comes from the curator of the Geneva Botanical Gardens.)

* * *

[17] Molina (Fray Alonso de: *Vocabulario en lengua castellana y mexicana*, Mexico 1571).

[18] J. S. Slotkin: *Peyotism, 1521-1891*, op. cit.

[19] These terms are phonetic spellings of unwritten Indian terms and may therefore be spelled differently by different authors. The same applies to the word " peyotl " when it passes into non-Indian languages.

[20] Engelman: *Synopsis of* ..., op. cit.

[21] Coulter : *Preliminary revision* ..., op. cit.

[22] K. Schumann : *Gesamtbeschreibung der Kakteen*, op. cit.

[23] L. Lewin : *Uber Anhalonium Lewinii*, op. cit.

[24] According to a pamphlet published by the *Instituto Médico Nacional de México* (1913), quoted by A. Rouhier, *Le Peyotl*, op. cit

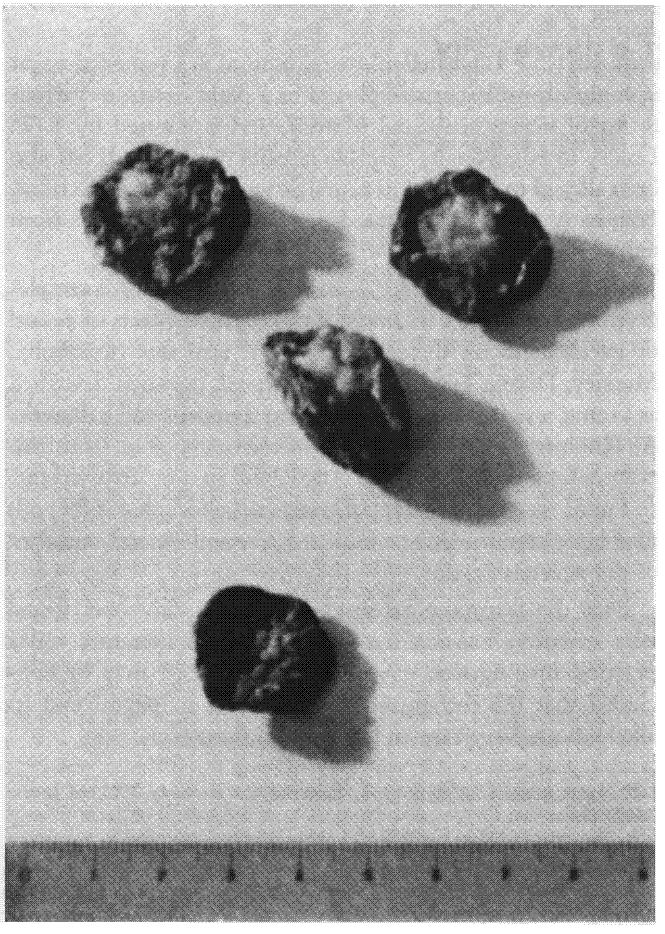
[25] A. Rouhier, *Le Peyotl*, op. cit.

Peyotl gathering may be regarded in two different ways, according to the use to be made of the plant; (1) gathering for direct consumption — i.e., by the Mexican Indians for themselves, and (2) gathering for sale. In the first case there is sometimes a religious element; the second is gathering in the ordinary sense. The whole cactus is not uprooted, but the part of the plant above ground is lopped off by machete. If this part is too large, it is cut into two slices. These slices are green and usually juicy (the peyotl is gathered after the rains if possible). They are dried in the sun, become dehydrated and assume the characteristic appearance of the mescal button, a form in which the peyotl can be kept for a very long time. It is in this form that it is supplied both to members of the cult and to those who buy it for non-religious purposes, and it is mainly in this form that it is found at druggists' and in *materia medica*. This makes fraudulent imitations easier, for it is very hard to distinguish at first sight a genuine mescal button from a dried slice of some other cactus.

In a bundle of mescal buttons (which are gathered by hand, not mechanically, and so show any number of irregularities) most of them are upper slices: single slices of small peyotls, No. 1 slices of large peyotls, together with a varying proportion of lower slices.

The upper slices vary in shape, being usually disc-like, brown or grey in colour, with the edges turned upwards.

FIG. 6. — **Mescal buttons, upper slices**



(Scale in cm) (Uncertain origin)

The diameter varies between 2 and 4 cm; thickness from 10 to 20 mm. The surface corresponding to the top of the plant has the tuft of greyish-white apicular hairs in the middle. Fragments of flowers or dried fruits may be found among them. The skin is wrinkled, the ribs salient. The areolae are visible and often still have their hairs. The under surface of the upper slice is slightly conical, with wrinkles more prominent near the centre. Not infrequently there is an orifice in the centre; this means that the section has been taken near the top and has cut across the central infundibulum.

The lower slices are similar to the upper ones, except that they are larger, have no ribs, and of course no tuft or apicular hairs. Furthermore, the epidermis is better marked and forms a kind of rim to the rest of the slice, which is very thin (1 to 3 mm). Since they are so thin, the lower slices readily lose their shape and assume even more irregular forms than the others.

The mescal button seems at first sight hard to use. It looks like a dried mushroom and swells very rapidly in boiling water, slowly in cold water. It soon softens in the mouth and can then be chewed, the flesh seeming elastic. The taste is bitter and acrid, and it leaves an unpleasant after-taste accompanied by slight burns and itching of the mucous membrane. Its smell is sharp and nauseating when it is rehydrated.

To work on the mescal button it must either be ground, if it is still fresh (it is then elastic), or be cut up or pounded in a mortar.

It is feasible, though difficult, owing to dessication, to establish the identity of a mescal button by microscopic examination; all the vessels are contracted and distorted, but the areola hairs, the spirated vessels, the parenchyma cells (see figs. 4 and 5) and the oxalate of lime crystals agglomerated in echini can be distinguished.

CHEMICAL ASPECTS

The first attempts to isolate the active principle of peyotl were made by Lewin [26] in 1888. Working on mescal buttons, he isolated a body which he called anhalonine. In 1894 Heffter [26] worked on live plants. He isolated another alkaloid which received the name of pellotine or peyotine. Shortly afterwards he isolated three alkaloids which he called A, B and C. Alkaloid A was mescaline. In 1896 Heffter completely separated mescaline, anhalonine, anhalonidine, and lophophorine. In 1899 Kayder [26] discovered another alkaloid in the mescal buttons on which he was working and named it anhalamine. The method has long been used by those desirous of studying the effects of these alkaloids. It is still used, although it is true that practically all the mescaline used throughout the world is synthetic.

In 1919, E. Späth [26] resumed the research and succeeded in synthesizing the alkaloids of the peyotl. His work is of the utmost importance, as it has shown that the peyotl alkaloids can be divided into three groups, very close to each other, but with individual structures:

[26] See bibliography for his main works on the subject.

Group 1

Mescaline: $C_{11}H_{17}NO_3$

Group 2

Anhalamine: $C_{11}H_{15}NO_3$
Anhalonidine: $C^{12}H^{17}NO_3$
Peyotine: $C_{13}H_{19}NO_3$

Group 3

Anhalonine: $C_{12}H_{15}NO_3$
Lophophorine: $C_{13}H_{17}NO_3$

The figures given in the literature for the percentage of alkaloids in the plant seem to be neither very accurate nor readily comparable. Some percentages found by Rouhier [27] may be given by way of example: weight in percentage of total alkaloids in upper slices of mescal buttons, 3.70; lower slices, 3.43; dried peyotl heads, 3.14; roots, 0.73; fresh peyotl heads (moisture content 82.5%), 0.41; fresh peyotl roots (moisture content 75.2%), 0.244.

The following conclusions emerge from the literature with regard to the aggregate alkaloids. They are all found in the mescal buttons; the alkaloid content changes with the conditions of vegetation, the time of gathering, and the nature of the soil in which the plants grow. The alkaloid content of mescal buttons diminishes with time.

* * *

The physical and chemical properties of the alkaloids of the peyotl are as follows: [28]

Mescaline. 3, 4, 5-trimethoxyphenethylamine. Molecular weight 211.25. Carbon 62.54%, hydrogen 8.11%, nitrogen 6.33%. Crystals, melting point 35-36°. Moderately soluble in water; soluble in alcohol, chloroform, benzine; almost insoluble in ether.

Anhalamine. 7, 8-dimethoxy-6-hydroxy-1, 2, 3, 4-tetrahydroisoquinoline. Molecular weight 209.24. Carbon 63.14%, hydrogen 7.25%, nitrogen 6.29%. Crystals, melting point 187-188°. Almost insoluble in cold water, cold alcohol or ether; soluble in hot water, alcohol and acetone. (Now believed to be 6, 7-dimethoxy-8-hydroxy-1, 2, 3, 4-tetrahydroisoquinoline).

Anhalonidine. 7, 8-dimethoxy-8-hydroxy-1-methyl-1, 2, 3, 4-tetrahydroisoquinoline. Molecular weight 223.24. Carbon 64.55%, hydrogen 7.68%, nitrogen 6.27%. Needles, melting point 100°. Optically inactive. Salts are dextrogyrate. Soluble in water, alcohol, chloroform; slightly in ether.

Peyotine.[29] 8-hydroxy-6, 7-dimethoxy-1, 2-dimethyl-1, 2, 3, 4-tetrahydroisoquinoline. Molecular weight 237.29. Carbon 65.80%, hydrogen 8.07%, nitrogen 5.90%, Melting point close to 111.5°. Optically inactive. Freely soluble in alcohol, ether, acetone, chloroform, benzine; sparingly soluble in cold petrol ether and cold water; more soluble in boiling water.

Anhalonine. 8-methoxy-6, 7-methylenidioxy-1-methyltetrahydroisoquinoline.[30] Molecular weight 221.25. Carbon 65.14%, hydrogen 6.83%, nitrogen 6.33%. Very soluble in alcohol, ether, chloroform, benzine, petrol ether. Freely soluble in hot water.

Lophophorine.[31] N-Methylanhalonine. Molecular weight 235.25. Carbon 66.36%, hydrogen 7.28%, nitrogen 5.95%. Soluble in ether, chloroform.

Effects and Uses of Peyotl and its Alkaloids

Mescal buttons are easily adaptable for galenical preparations such as powders, extracts, tinctures and the like. Rouhier [32] mentions the following preparations, giving the dosage and method of preparation. Powder: 1/5 tincture of peyotl; fluid extract, weight for weight of peyotl; fluid acid extract, weight for weight of peyotl; soft hydro-alcoholic extract of peyotl; soft chloroformic extract of peyotl; totum of the hydrochlorates of peyotl alkaloids; alkaloid solution for injection, weight for weight of peyotl. None of these preparations has been found in the national pharmacopoeias consulted; in fact neither peyotl nor mescaline is mentioned in them. The pharmacopoeias of more than twenty countries, including France, Mexico, the United Kingdom and the United States of America have been consulted, usually in the latest edition. The following reference is found in the *Dispensatory of the United States of America* [33] (under *anhalonium*, page 1261): " The value of mescal buttons as a remedial agent is doubtful; it has been employed to a slight extent in various forms of neurasthenia and hysteria, and is asserted by S. F. Landry to be especially valuable in cases of asthma. It has also been alleged to be useful in neuralgic and rheumatic affections. Prentiss & Morgan give the dose of the fluid extract as from ten to fifteen minims (0.6-0.9 cc)."

However, the literature contains a number of examples given by non-Indian scientists of the curative effects of peyotl or its alkaloids on themselves or their assistants (Lumholtz, Mooney, Dixon, Landry, etc.). In general, peyotl is described as a tonic, a sedative, a remedy against dyspnoea and a diuretic. A. Rouhier,[34] who has made a special study of it from this point of view, concludes: " According to our experiments and until we gain wider experience, we believe that it (peyotl) may be recommended as a tonic sedative and general stimulant of the nervous system."

Since the foregoing references were the only ones found after extensive consultation of the technical literature and a practical investigation gave no other result, it may be concluded that the recognized remedial uses of peyotl and its alkaloids are very rare and of little importance.

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[27] A. Rouhier: *Le Peyotl*, op. cit.

[28] According to the *Merck Index of Chemicals and Drugs*, 6th edition, Merck & Co. Inc., Rahway, N.J. (United States of America).

[29] Called pellotine in the *Merck Index*.

[30] Name given according to A. Rouhier (see footnote 29); not in the *Merck Index*.

[31] The *Merck Index* spells it " Lophorphorine " (probably a printer's error).

[32] Op. cit.

[33] *Dispensatory of the United States of America*, by H. C. Wood & A. Osol, 23rd edition, 1943, Lippincott Company, Philadelphia, London, Montreal.

[34] Op. cit.

FIG. 7. — **Handbill for "Peyotyl"**

PEYOTYL

LE PEYOTYL
R. D.

Le "**PEYOTYL R. D.**", produit naturel n'ayant subi aucune transformation ou altération chimique conserve, **vivantes**, toutes les propriétés merveilleuses du **Peyotl** (Lophophora Williamsii).

Cette plante est connue et utilisée depuis des siècles par les Indiens du Mexique pour ses vertus thérapeutiques, à la fois **toniques** et **sédatives** qui en font l'un des meilleurs reconstituants naturels et l'arme la plus sûre contre la douleur. C'est également un **anti-spasmodique** remarquable et le **spécifique**, par excellence, **de toutes les névroses.**

Les recherches scientifiques les plus récentes permettent d'affirmer que le PEYOTYL R. D., substance même du Peyotl, n'a aucun effet intoxicant sur l'organisme et n'est contre-indiqué en aucun cas. Il diffère fondamentalement des excitants ou des calmants ordinaires, à l'effet d'ailleurs fugace, en ce que son emploi peut être prolongé sans trouble ni accoutumance.

Le "PEYOTYL R.D." pris régulièrement ramène l'équilibre et le calme et favorise un plein épanouissement des facultés de l'individu.

■

INDICATIONS : Asthénie, Convalescences, Surmenage physique et intellectuel, Dépression nerveuse, Neurasthénie, Insomnie, Migraines, Névralgies, Douleurs abdominales et rhumatismales, Asthme, Dyspnée, Hystérie, Toux d'irritation.

■

DOSE : 2 à 4 dragées par jour avant les repas.
Contre l'insomnie : 1 ou 2 dragées avant de se coucher, à une heure d'intervalle.

PAS D'ACCOUTUMANCE

■

Le Flacon de 20 dragées : en vente au prix imposé : **14 fr. 95,** impôt

---

Une Brochure détaillée sur le Peyotl est envoyée sur simple demande

(Facsimile)

FIG. 8. — **Handbill, with testimonials for " Peyotyl "**

ATTESTATIONS De nombreuses personnes que le **PEYOTYL R. D.** a soulagées de leurs douleurs, ont bien voulu nous exprimer leur satisfaction. Voici parmi tant d'autres, quelques attestations ·

•

Paris. 8 février 1933.

Messieurs,

Sujet à de fréquents maux de tête, je suis heureux de vous faire connaître que j'ai trouvé, en prenant un cachet de Peyotyl, un soulagement beaucoup plus rapide et plus efficace qu'avec tout autre produit.

J'ai constaté, également, que les cachets pris le soir, avant de se coucher, procurent un repos parfait et un grand bien-être le lendemain.

Vous pouvez faire, de ma lettre, l'usage que bon vous semblera et, avec reconnaissance,

Je vous présente mes meilleures salutations

•

Brunoy, le 9 février 1933.

Messieurs,

Je vous fais savoir par la présente que je suis enchantée de vos cachets Peyotyl que j'ai employés pour mes maux de tête et maux de cœur et qui m'ont donné entière satisfaction.

Recevez, Messieurs, mes salutations distinguées.

•

Paris, le 12 mars 1933.

Cher Monsieur,

J'ai bien suivi le régime de Peyotyl pour la fatigue et la dépression nerveuse.

Je dois dire franchement que je me trouve beaucoup plus actif et à la fin de la journée je ne suis plus du tout fatigué.

Je trouve que les petites doses me font plus d'effet en les prenant régulièrement bien entendu.

Veuillez agréer, Cher Monsieur, mes salutations les plus distinguées.

•

Paris, le 17 mars 1933

Monsieur,

J'ai le plaisir de vous informer que la cure de Peyotyl R. D. que j'avais commencée pour mon état nerveux a complètement réussi.

Je connais à nouveau des nuits calmes, sans cauchemars et je me trouve le matin la tête reposée et claire alors que les somnifères que j'avais employés jusqu'ici me laissaient engourdie et inapte à toute activité.

Toutes mes obsessions ont disparu et je me sens pleine de confiance pour l'avenir.

Recevez, Monsieur, l'assurance de mes meilleurs sentiments.

MODE D'EMPLOI : Prendre régulièrement deux à quatre dragées par jour avant le repas. Contre l'insomnie, une ou deux dragées avant de se coucher, à une heure d'intervalle.

(Facsimile)

It may be of interest to sum up in this paragraph a case which was examined by the League of Nations Advisory Committee on Traffic in Opium and Other Dangerous Drugs in 1936. A Genevese pharmacy embarked on a large-scale advertising campaign for a product named Peyotyl, for which it claimed remarkable properties, as will be seen from figures 7 and 8, facsimiles of the original handbills. The Advisory Committee, having taken cognizance of them, asked Dr. Carrière, the Swiss member, for his opinion, and he drew the attention of the authorities of the Canton of Geneva to the matter. Subsequently, the Swiss Federal Public Health Service stated that " it would be advisable to allow Peyotyl to be supplied only on medical prescription. It has been proposed to the cantonal health authorities that they should take steps to this end. It would be better, however, for pharmacists not to wait until the cantonal ordinances come into force, but to refuse to supply the drug in question without a medical prescription ".[35]

So vanished the drug which was to " restore the individual's balance and calm and promote a full expansion of his faculties ".

Many articles examining and describing the effects of peyotl and its alkaloids have been published — for instance, Beringer, Clerc, Critchley, Dixon, Grace, Guttmann, Havelock Ellis, Heffter, Janot, Lewin, Marinesco, Mogilewa, Mooney, Paris, Perrot, Raymond-Hamet, Rouhier, Smythes & Wikler, whose works were consulted by the writers of this article.

What, as some of these authors inquire, is the relation between the effect of the alkaloids taken separately and their effect when taken together? And as with other plants with an alkaloid content, are the effects of the plant when fresh the same as when it is dried, and, again, do not those effects differ from those of the aggregate alkaloids? It would be difficult to give an accurate reply to those questions without extensive tests covering a very large number of subjects (the reactions, especially the psychological reactions, differ appreciably from one person to another) together with experiments on the fresh plant, mescal buttons, each alkaloid and the aggregate alkaloids. So far as is known, this work has not yet been undertaken. Some authors, such as Beringer, have carried out tests on a fairly large number of subjects.[36] Most of them used mescal buttons or mescaline. Far fewer authors worked on the fresh plant, and what they usually did was to observe ritual consumption rather than to undertake systematic experiments.

Luckily, it seems possible to draw a general conclusion from the literature as a whole: most authors agree that the effect of peyotl is essentially the same as that of mescaline, and the observations relating to that substance (in almost all cases synthetic mescaline) agree with those concerning fresh peyotl or mescal buttons.

* * *

The purely physiological effects of peyotl will first be examined, then the psychological effects of peyotl and mescaline together, since a separate study of each of them would cover the same ground twice over.

[35] Quoted in *Journal de pharmacie*, Brussels, 14 June 1936.

[36] Op. cit.

Peyotl (mescal buttons). Mescal buttons are usually chewed (see above) or less frequently taken in an infusion — so-called peyotl tea. The taste is bitter. The amount required to obtain an effect seems to be four buttons (about 12 g). Mooney speaks of an Indian who absorbed 90 buttons straight off, or about 225 g, equal to more than 10 g of aggregate alkaloids, which seems an enormous quantity. With most subjects an emetic effect appears after five or six buttons. After some time a certain muscular relaxation is usually noted; the subject finds it hard to co-ordinate his movements. His breathing becomes slower. Other effects noted include cardiac depression, frequent headaches and a dry skin with itching. Despite certain assertions, peyotl seems to be an anaphrodisiac. Peyotl intoxication may last from four to five hours on an average (the length obviously depends on the individual and on the amount taken). The after-effects of peyotl intoxication are slight: a certain indolence, accompanied by headache and, according to some authors (Havelock Ellis, Putt), persistence of the visual hyperaesthesia.

Mescaline. By far the most important of the peyotl alkaloids, inasmuch as it is the main agent of the effects of peyotl itself and also because of its own properties. Main effect: depression of the central nervous system; progressive paralysis, stoppage of respiration and abolition of reflexes (experiments with frogs) — effect on the muscular system: progressive paralysis — effect on the circulation: lowering of blood pressure, weakening of heartbeat. On respiration: slowing of the rhythm, leading to almost complete stoppage. It causes contractions of the intestines and of the uterus *in situ.*

Psychological Effects

A great many authors have described the psychological phenomena due to peyotl and mescaline, usually with a narration of the events as they occurred (by shorthand, dictaphone). There is therefore a fairly large mass of material, a summary of which would exceed the limits of this article. One of the best-known of these interpretations is Aldous Huxley's work, *The Doors of Perception.*[37]

The fact should be clearly borne in mind that, even though the form of the hallucination is fairly constant, its content depends primarily on the individual concerned. A subject without musical experience would very probably fail to hear the symphonies described by certain authors. Similarly, a subject having no skill in painting would not have the same kind of coloured vision as a painter, for whom colour is one of the basic elements of life. Thus, most subjects who have been asked to describe what they have seen were unable to do so, or simply resort to commonplaces (" It's marvellous "; " I see blue lines "). On the other hand, when Marinesco [37] conducted his experiment on a professional painter, the latter depicted his visions, but " the mescaline did not alter his style of painting. It was his own temperament and his own predilections which were expressed in the images depicted, although in an exaggerated form ". In other words, mescaline, contrary to many simple-minded assertions, creates nothing.

[37] Op. cit.

Bearing this in mind, one or more of the following effects are usually observed:

Visual hallucinations. Colours are at first intensified — gradually the subject shuts his eyes and entoptic phenomena appear, followed by true hallucinations with forms, shades and movements. Complete scenes are seen.

Auditory hallucinations. Fairly rare, but frequent correspondences of colour, music and form: " making the sound of a flower opening " — frequent hypersensitivity and pain at the slightest noise.

Abnormal touch, taste and smell. Paresthesias, alteration in perception of heat and cold. The subject often complains of a bad smell in the room or a bad taste in his mouth.

Disturbances in the perception of the subject's own body: feeling that he is changing shape. Inability to locate some part of the body;

Disturbances of the perception of space and time. The subject sees infinitely long corridors or decides that he cannot grasp some object because it is too far away, whereas it is actually within reach (feeling of seeing the world through the wrong end of an opera-glass). Similarly " stretching out " of time, seconds seeming to last hours.

Synesthesia. All the senses seem to follow the same rhythm, and any change in the music changes the colour of what is seen, the taste in the mouth, etc.

With regard to the emotional state, an ecstatic euphoria with laughter is usually observed, especially at the beginning of the intoxication. This state is sometimes followed by anxiety and — less frequently — depression. The subject then becomes suspicious and hostile, especially towards the person conducting the experiment.

Lastly, perhaps the most important effects of mescaline (and peyotl) are the *personality disturbances:* duality of the person — the subject observes himself as if he were two persons; loss of the sense of the ego and of reality.

Disturbances of the will: the subject speaks words and makes gestures which he simultaneously does not wish to speak or make. Lastly, *disturbances in logical thinking:* the subject cannot pursue an idea. Guttmann [38] reports that some subjects were given tests to check concentration, reasoning and judgement, and the failures were conclusive.

* * *

Habituation and Addiction

It now has to be considered whether peyotl and mescaline cause habituation and addiction. Very few of the authors consulted assert that they produce such effects. Critchley [39] is almost the only one who states definitely that they do. Some say that no opinion can be formed, but believe it is possible that habituation to mescaline may occur. Most of the authors consulted, however, including scientists, chemists, doctors and ethnologists long familiar with these substances, state roundly that they do not cause either habituation or addiction.

[38] E. Guttmann: *Artificial Psychoses* ..., op. cit.
[39] Op. cit.

Guttmann [40] states: " Experience has shown that the authors who thought that the pleasant state of intoxication produced by mescaline would speedily lead to addiction were wrong." Rouhier [40] states: " Since the use of peyotl does not produce euphoria in the strict sense of the term and does not lead to habituation, there seems to be no reason for preparations of it to be included in the group of narcotic drugs." Slotkin [40] says: " The habitual use of peyotl does not seem to produce tolerance or accrued dependence." The same opinion was also expressed by the group of scientists who, in a statement made to the journal *Science* (13 November 1951) affirmed that peyotl was not a narcotic drug. They included Dr. Weston, La Barre, Duke University; Dr. D. P. McAllester, Wesleyan University, Dr. O. C. Stewart, Colorado University and Prof. S. Tax, Chicago University. However, Dr. Ellenberger, a psychiatrist who has taught at the University of Topeka (Kansas) and who knew a group of Indian members of the Native American Church very well, has stated in a note to the Division of Narcotic Drugs that he personally knew an Indian who had become a " peyotl addict ". Nevertheless, such habituation seems to be purely psychological.

* * *

Quasi-medical Use

As was pointed out above, there are practically no therapeutic uses of peyotl and its alkaloids in modern medicine.

With regard to the Mexican Indians and, at a later date, the Indians in the United States who believe in the mystical virtue of peyotl, it is hard to decide whether they began by experimenting with its therapeutic uses and then went on to worship it, or whether, conversely, it is because they believe in its mystical virtue that they use it as a remedy, in accordance with a well-known tendency of primitive mentalities: sickness, they believe, has no physical cause, but is a manifestation of the wrath or malignity of the spirits or the divinity. Hence, any distinction between the use of peyotl as a remedy and its part in a cult is artificial.

The best way to draw such a distinction is perhaps first to consider the *use of peyotl by individuals* for their personal ends and then its collective use.

The Indians use peyotl individually for all kinds of purposes: first, as a stimulant to allay the sensation of hunger and fatigue; secondly, as a remedy for the most varied ailments and accidents — to counteract the effects of snake-bite; macerated in alcohol, against rheumatism (massage); directly or in a decoction to cure headache, haemorrhages and fevers; as a cure for tuberculosis. Thirdly, they use it as an amulet for protection against accidents or as a drug to induce prophetic visions; lastly, sometimes simply as an intoxicant, exactly like alcohol elsewhere.

Cult Uses

Collective uses are of two kinds: first, as an accessory in certain tribal rites, when peyotl is a means of attaining a state of trance, for example; and secondly, symbolically in the ornaments used in feasts and ceremonies. It then forms part of the propitiatory rites for rain. These rites, which are very complicated and were formerly widespread among certain Mexican Indian tribes, are gradually dying out. A study of them would exceed the limits of this article. Very accurate and remarkably illustrated descriptions (including the music to accompany the hymns) will be found in Lumholtz [41] (especially for the Huichols) and A. Rouhier.[42]

The last use of peyotl to be considered is that of the Native American Church, not as an accessory, but as an integral part of the cult.

There has often been a tendency to slander this cult by describing it as a succession of orgies, etc., the more so as it is little known and seems strange. Actually, the peyotl cult represents a survival of certain traditions of the Indian tribes. It was established by an Indian *élite*, the leaders of the rest of the flock. The " peyotists " really seem to be seeking in the cult a sort of reaffirmation of their " Indian-ness ". The rites, and even the beliefs, vary from tribe to tribe, but the essential features of this religion may be summed up in a few principles. A very full description of them is given in the monograph by J. S. Slotkin.[43] According to this author, these principles are: (*a*) there is a great spirit who has created the universe and controls the destinies of everything in it, including man; the great spirit has placed part of his supernatural power (*mana*) in peyotl, which he has given to the Indians to help them in their present precarious situation; (*b*) by eating the peyotl under the prescribed ritual conditions the believer absorbs part of the power of the great spirit. The requirements are physical and spiritual purification. The rite is composed of prayers and hymns, the mescal buttons and peyotl tea being distributed to the faithful, who take as much as they wish; (*c*) the power absorbed with the peyotl has spiritual effects. The believers spend a night of watching and prayer and await the divine revelation. The coloured visions are not regarded by the believers as important. The idea is, essentially, to forget the outside world in order to concentrate on the contemplation of the divinity.

Research on the Possible Use of Mescaline in Psychiatry

A final aspect of the matter should be briefly mentioned. This is a use of mescaline which is at present in the experimental stage, but might assume importance in psychiatry and neurology. The bibliography to this article shows the very large number of books dealing with mescaline published in recent years. The aim of most of these is, for the time being, to clear up various obscurities in the action of mescaline. Even a succinct digest of the various directions taken by this research would exceed the scope of this article. Among recent works the following are of special interest: Fischer, Denber, Merlis & Hunter, Hoffe, Osmond & Smythies, Wikler, Hoch, Stockings,[44] etc.

[40] Op. cit.

[41] *Opera citata.*

[42] A. Rouhier : *Le Peyotl*, op. cit.

[43] J. S. Slotkin : *Menomini Peyotism*, op. cit.

[44] *Opera citata.*

Interest in mescaline, as in other similar substances, has been aroused by the effects described above: everything happens as if the substance *created* psychoses and changed the very essence of personality (schizophrenia, paranoiac reactions). By administering a substance of known composition, states met with among mental patients are induced artificially. The first point of interest is to study these states with variations obtained at will by changing the doses, the surrounding conditions and so on, and by auto-observation by the psychiatrist. It is also possible that a similar effect is produced on the patient through some unknown mechanism. Thus, whereas the first research workers to experiment with mescaline were mainly concerned with its effect on the senses, especially the sense of sight, they are now interested in its effect on the personality itself.[45]

[45] See in this connexion the report of the Study Group of the World Health Organization on Ataractic and Hallucinogenic Drugs in Psychiatry. (WHO/AHP/14, 21 April 1958.)