Summary

Hallucinations and delusions are defined and their relations to each other discussed.

An account is given of hallucinations in the sane and of elementary hallucinations.

In surveying the aetiology and psychopathology of hallucinations emphasis is laid on the importance of differentiating between the acute hallucinations arising in a confused state and the subacute or chronic hallucinations arising when consciousness is clear.

Comparison is made between visual and auditory hallucinations: an illustrative case shows the importance of sensory elements.

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NEUROLOGICAL ASPECT OF VISUAL AND AUDITORY HALLUCINATIONS*

BY

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The neurologist encounters clinical states of hallucinosis—either episodic or habitual—in a variety of pathological circumstances. One can briefly divide the aetiological factors into lesions which are focal and those which are diffuse. On the one hand there are the circumscribed lesions as represented by tumours and less often by vascular disease and injury. Perhaps, too, we should include here those cases of epilepsy and of migraine where hallucinations are conspicuous. Among the diffuse cerebral causes of hallucinations we may mention a number of toxic-infective states, such as delirium (associated with general infections, high fever, exhaustion, starvation, thirst), various drug intoxications, hypoglycaemia, etc. Outside this workaday grouping will lie a number of other neurological states where the genesis of the special sense phenomena is obscure. Here belong the interesting examples of hallucinations associated with narcolepsy (as well as with the manifestations of sleep in normal subjects), and various of the organic psychoses, as instanced by chronic epidemic encephalitis and by dementia paralytica.

Lastly, there are the so-called "hallucinations of the sane," which will include a diversity of phenomena. The neurologist is perhaps intruding into other provinces when he evinces interest in such obscure though important matters as veridical and telepathic dreams and hallucinations, phantasms of the dying and of the dead, collective or mass hallucinosis. He will be concerned, although

perhaps remotely, with those subjective states which lie on the borderland of hallucination—such as, for example, the questions of hyperacute mental images, eidetic images, synaesthetic associations, "thought forms," "number forms"—especially as they concern those deprived of sight or hearing.

Cerebral Tumour

Hallucinations are not uncommon symptoms in patients with cerebral tumour, whether as preludes to epileptiform incidents or as isolated events. The nature of the hallucinations; their special sense quality; their size, projection in space, degree of complexity, vividness, constancy, are all aspects which merit attention in case-taking, for these are factors which may at times have localizing significance. In very broad terms it may be said that the postero-inferior third of the cerebral hemisphere seems to be of the greatest significance when tumoral hallucinations are concerned—that is to say, the regions closely associated with the end-stations of the special sense pathways. Clinically we may therefore say that hallucinations are likely to be of importance in the diagnosis of lesions of the temporal or occipital parts of the brain.

It is not necessary to enter into details with regard to such a banal subject as the nature and frequency of hallucinations in cases of tumour involving this lobe or that. One may perhaps be content to recall that the hallucinations vary in degrees of complexity or crudity, though usually constant for the individual. With occipital tumours the hallucinations are generally visual in type, coloured, but otherwise relatively simple or formal. Flashes of light, balls of fire, stars, spots, zigzags, are fairly characteristic. They are usually projected into the contralateral visual field, which more often than not is a blind one.

When the tumour is situated more anteriorly the visual hallucinations may be far more complex, and may be associated with auditory phenomena. Thus in the case of a temporo-occipital growth recorded by I. M. Allen the patient said: "I see gold stars falling in front of me . . . then I see sort of wings flapping. Also I hear a sort of 'ha-ha'-ing in the ears; and sometimes a voice, a strange voice like nothing earthly, saying, 'Why have you not told me before? Why did you not tell me long ago?' Sometimes I see an old woman with a hood coming towards me. Then I feel a strange heavy sinking sensation in the pit of the stomach. Then I lose myself."

Visual hallucinations may also occur with temporal lobe tumours, possibly—as Cushing has thought—from damage to the optic radiations. Horrax noted visual hallucinations of a more or less definite and complex nature in twelve out of seventy-two cases of temporal lobe neoplasm and of a less defined character in another five.

Auditory hallucinations may also occur with temporal tumours, and may comprise crude akasmic noises such as buzzing, roaring sounds, bells ringing, and the like. Elaborate sounds—for example, voices or music—occur rarely, and then usually in connexion with uncinate epileptic attacks. Kolodny noted an aura of "horrible noises" once only in his series of thirty-eight temporal tumours. In Cushing's clinic, auditory hallucinations occurred four times among ninety-nine temporal lobe tumours and, it is interesting to note, six times among ninety-nine frontal lobe tumours.

It would be irrelevant to discuss the complicated psychosensory phenomena which may accompany discharging lesions of the uncinate lobe, and which are familiar under the term "dreamy states." The special sense involvement

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usually takes the forms of olfactory or olfacto-gustatory hallucinations; occasionally, however, visual and auditory components enter. Foster Kennedy has described visions of men and women dressed in eighteenth century court dress, of a beckoning woman dressed in blue, of roomfuls of negroes, as auræ of temporal or temporo-sphenoidal tumours. Dr. Symonds records that a patient of his used to see and hear an on-coming railway train which, as it approached, sounded louder and louder. Just as it was about to crash into the victim consciousness was lost. Still more elaborate poly- or inter-sensorial hallucinations have been recorded. Perhaps one of the most interesting patients in this connexion is the one of Ferrier's, who said she experienced before losing consciousness "a smell like that of green thunder."

In tumoral cases we also encounter auræ of sudden loss of vision or of hearing, where the explanation may lie in a negative visual or auditory hallucination. Stransky's symptom of *thought-echo*, *reading-echo*, or *Gedankenhören* belongs as a rule to the domain of psychiatric medicine, though it has been known to occur in patients with temporal lesions (Sanz; Klein). It may show itself as an auditory hallucination whereby the patient hears his own thoughts spoken aloud into his ear.

Among the more unusual visuo-hallucinatory phenomena which may accompany occipital lobe lesions we recall the *optical allæsthesia* of Herrmann and Pötzl. This symptom, which may also occur in cases of migraine, entails the illusory projection of real objects from one quadrant of the visual field into the diagonally opposite quadrant, in a hallucinatory fashion. This phenomenon, which has been termed the "fata morgana of the visual sphere," is well exemplified by the following case:

The patient frequently saw his nurses, attendants, visitors, etc., who were actually by his bedside, inverted and appearing as though they were walking on the ceiling. This illusory state chiefly supervened towards night-time. Other disorders included spatial disorientation with regard to his body image, a right-sided paracentral scotoma, diplopia, and nystagmus. At necropsy a suppurating injury of the left occipital pole and cerebellar hemisphere was found.

It would be unwise to lean too heavily upon the occurrence and nature of hallucinations in localizing intracranial lesions. They may at times lead to errors in topographical diagnosis unless it is borne in mind that false localizing symptoms of a hallucinatory nature may be occasionally provoked (1) by compression of cerebral arteries against the edge of the tentorium, or (2) by simple internal hydrocephalus. Thus we may meet cases of hallucinosis in sub-tentorial as well as frontal lesions. We are reminded that in a personal account of the symptoms of a cerebellar haemangioblastoma made by the Hungarian novelist Karinthy, hallucinatory noises like "trams rattling in the street" occurred very early.

In a separate category belong those uncommon cases of "*peduncular hallucinosis*" described by Lhermitte. This syndrome comprises as a rule mild confusion and persistent visual hallucinations. These last are often of the Lilliputian variety, originally described by Leroy in toxic and senile states, and may consist in the appearance of little people or animals, often brightly coloured and in quick movement. The corresponding affect is usually one of interest, pleasure, and amusement, rather than distress or alarm. Although the original cases were associated with vascular lesions in the mesencephalon, the syndrome is more often seen in cases of pituitary or juxta-pituitary tumours. It is perhaps significant how often blindness coexists.

Epilepsy

Hallucinations may occur as auditory, visual, or combined sensory auræ in cases of essential epilepsy. Visual auræ were found in 6.7 per cent. (Lennox and Cobb) and 15.9 per cent. (Gowers), compared with auditory warnings which occurred in 1.7 per cent. (Lennox and Cobb) and 6.2 per cent. (Gowers). There are far-going analogies with the conditions seen in tumour cases, though clinical evidence and eventual post-mortem verification may completely exclude gross macroscopic disease of any part of the cerebral cortex. The physician at the bedside, however, will be wise if he regards with suspicion every case of epilepsy where the aura is one of a visual or auditory hallucination and never dismisses the possibility of an intracranial growth.

Some neurologists consider that minor differences may occur between the characters of the auræ in "idiopathic" and "symptomatic" cases. Crude, simple, and unpleasing hallucinations of sight and hearing (as also of taste and smell) are thought to be more suggestive of tumour than are the complex formed hallucinations. According to Gowers, visual auræ in epileptics often comprise coloured photisms, which have the following order of frequency: red, blue, green, yellow, purple. This arrangement of colours corresponds roughly with the scale of luminosity.

There is also some connexion between cases of epilepsy with special sense auræ and the ability to precipitate a seizure at will by artificially reproducing the hallucination. There are a number of such instances of *reflex epilepsy* on record, a personal case of which, published elsewhere, may be quoted here:

A woman of 40 was subject for many years to epileptic fits. Frequently an attack would be heralded by an aura of weird and unearthly music. Usually of a displeasing type, once or twice the music had been agreeable, though unreal. At times fits could be induced by extraneous factors, such as a sharp pinprick or, characteristically, by loud noises.

Holmes has also stated that soldiers with occipital injuries, and who were subject to focal epilepsy, used to develop an increased number of fits after their eyes had been strained in a cinema. Elsewhere I have mentioned the case of an epileptic boy whose fits were preceded by a visual aura. On several occasions an attack had been adduced by visual stimuli reminiscent of the aura (arc light, fireworks, sunlight through railings).

Hallucinations in Migraine

The characteristic teichopsia of a migrainous attack, with its scintillating, polychrome, zigzag, or fortification figures, is of course a phenomenon of hallucinatory character. Judgment as to frequency of this depends entirely upon a personal viewpoint as to what exactly constitutes an attack of migraine. For myself I would regard teichopsia as a relatively infrequent symptom. More elaborate visual phenomena are excessively rare. Optical allæsthesia, to which reference has already been made, can also precede attacks of migraine; and, indeed, we owe the original description of this visuo-psychic aberration to the autobiographical record of Dr. Beyer's migrainous attack. Some writers, notably C. Singer and R. H. Elliot, have chosen to ascribe the fantastic illustrations in the writings of the mystical Abbess Hildegard of Bingen to the operation of a severe migraine.

Auditory hallucinations do not ordinarily occur in migraine, and the presence of a pulsatile tinnitus during

an attack should at once arouse the suspicion of an underlying vascular anomaly of the brain—for example, angioma.

Hallucinations in Infective States

In pyrexial states, especially in alcoholic subjects, delirium is a common development with its attendant confusion, disorientation, and hallucinosis. It is perhaps less well known that in milder febrile illnesses, where the sensorium can in no way be regarded as clouded, isolated hallucinations of sight or of hearing may occur. These may be so clear, and so in conformity with the environment, as to arouse considerable credulity on the per-
 ceipient's part. There is no background of confusion, and there is nothing bizarre or incongruous about the hallucinations. It seems more as though the slightly raised temperature produced a state of sensorial hyperaesthesia, rendering minor special sense stimuli perceptible though incorrectly interpreted.

Hallucinations in Organic Psychoses

Commonest among the psychoses which fall within the notice of the neurologist is general paralysis. Hallucinations, though not actually a frequent symptom, do nevertheless occur in a certain number of cases. There is a good deal of evidence to suggest that malarial therapy actually increases the tendency towards hallucinosis. Thus Zoltan v. Papp, in 1934, recorded them in 19.29 per cent. of his series of 428 cases of general paralysis of the insane, most of which had received fever therapy. W. Pires also noticed the development of hallucinations after malaria, and he regarded this not as a bad prognostic feature but as an indication of partial arrest though insufficient treatment.

In chronic epidemic encephalitis hallucinations are not rare. They may occur as recurrent manifestations in association with crises of respiratory dysrhythmia or of oculogyric spasm. More often they appear as an hypnagogic occurrence, linked up with one of the various post-encephalitic disorders of sleep (narcolepsy, hypersomnia, inverted sleep rhythm). According to K. Leonhard, there is a resemblance to the delirium of alcoholism in that the hallucinations may often be induced voluntarily or be suggested to the patient by fixating the visual or auditory attention.

Narcolepsy

It is not generally known that hallucinations are common symptoms in narcoleptics. Elsewhere I have described the various disturbances of nocturnal sleep which are characteristic of this disorder. The most striking of these disturbances is seen in hallucinations appearing when the victim awakes. Thus Brock's patient passed into a condition of *Wachanfall*, so that on coming round from a sleep attack he would be unable to move for a period of five to fifteen minutes ("waking paralysis"). During this state he would imagine he saw and heard around him various members of his family. Moyer's patient saw grotesque creatures approaching him with the onset of each sleep attack. Fischer described a narcoleptic patient who was subject to tactile and auditory hallucinations, both during the day and when in bed. One of Daniel's patients was liable to visual hallucinations while driving his car.

Hallucinations complicating what is probably hypnagogic cataplexy in narcoleptic subjects are exemplified by various case reports in the literature. Lhermitte wrote of this feature under the term "onirisme narcoleptique." The

patient recorded by Serejski and Frumkin often saw round his bed women who tried to choke him. Other comparable cases have been mentioned by Nemlicher, by Alajouanine and Baruk, and also by Rosenthal. Daniel described three such patients:

(1) Shortly after retiring his legs and arms and then face felt helpless; a ghost-like figure would now appear. (2) Attacks of powerlessness on dropping off to sleep, associated with a spectral snake which he could see and feel coiling around the neck; or a bright-coloured parrot would be seen and heard abusing him. (3) Attacks of hypnagogic powerlessness coupled with hallucinations of people entering the room by way of the window. Various other complex hallucinations of a haptic nature also occurred.

One of my narcoleptic patients, who was able to give minute details of his predormital symptoms, said: "I seem to be aware that people are in the room. I seem to hear them moving about. I hear their voices; they usually make commonplace and not unexpected remarks, such as comments upon the untidiness of the room, etc. I can usually refer the voice to a particular person—for example, to my brother, or to my housekeeper, who is actually thousands of miles away."

Such predormital hallucinations are of course comparable with the more common hypnagogic feelings in narcoleptics of motor paralysis and psychical unrest, with illusions of people moving about the room although nothing abnormal is actually seen or heard. These hallucinatory states are perhaps also allied to the frequent occurrence in narcoleptics of very vivid and realistic dreams.

We must also recall that vesperal hallucinations are by no means uncommon occurrences in persons who are not narcoleptics, and who are apparently in perfect physical and mental health. These "*hypnagogic hallucinations*," as they are called, have been the subject of a good deal of attention, not only on the part of medical psychologists but also of laymen interested in the occult and the bizarre.* Francis Galton mentioned this phenomenon quite briefly in his account of "visionaries," and he referred to five eminent newspaper editors known to him as subjects of predormital or crepuscular hallucinosis. The problem is ably dealt with in Lhermitte's monograph on sleep. All sense organs can be involved, but chiefly those of hearing and of sight. In the former case, isolated words, snatches of a sentence, notes or even phrases of music, may obtrude upon the drowsy subject's consciousness. They differ from the impulsive thoughts of psychoneurotics in that the sounds are hallucinations and not images: they are not necessarily reiterative; and they cause no feeling of annoyance or alarm. Visual hypnagogic hallucinations are more common than auditory, and are usually elaborate. At times they consist in some intricate coloured pattern—stylized, geometric, crystalline. More often there appear visions of flowers, animals, objects, human beings, either in active movement or in repose. According to Delage these phantasms may be projected into the direction of the fixating gaze and may shift with the movements of the eyes; here we have evidence of a peripheral factor in the production of the hallucination. The visions usually appear abruptly, and

* This subject has often been ventilated in the lay press under such titles as "Faces in the Dark," "Visions," etc. Those interested may refer to the *St. James's Gazette*, February 10, 1882, and to the correspondence columns of *John o' London's Weekly*, November 22, December 6, 20, and 27, 1930. Various writings on psychical research dealing with phantasms, and hallucinations in general, also refer to this problem briefly. (Vide *Proc. Soc. Psych. Res.*, 1, 102, and 3, 171; F. Podmore, *Apparitions and Thought Transference*, 1894; E. Gurney, F. W. H. Myers, and F. Podmore, *Phantasms of the Living*, 1886—two vols.)

are independent of any volitional or affective factors. Indeed, a willed effort to modify the visions usually results in nothing but their disappearance, acting in the same way as an interrupting auditory stimulus. As a rule the feeling-tone is one of interest or curiosity, though in young children there may be intense alarm.

Hallucinations in Drug Intoxications

There are a large number of substances, differing widely in chemical composition, which are capable of producing states of hallucinosis. We must of course distinguish between the effects of a single large dose of a deliriant drug—where the psychosis will resemble a febrile delirium—and the states of chronic intoxication, where consciousness remains intact and delusional ideas and illusory phenomena are associated. Although there is a certain uniformity about the symptoms of the acute deliria, the chronic drug psychoses differ a good deal one from the other. Mixed drug addictions are of course extremely common and render the resulting psychosis difficult to analyse.

According to Kraepelin's classical work there are certain features common to all cases of acute drug hallucinosis: (1) rapid, even abrupt onset; (2) dulled consciousness, associated with lively hallucinations, chiefly visual and auditory; (3) mild disorientation; (4) occasional delusional ideas, which are only exceptionally acted upon; (5) a feeling-tone sometimes of indifference, but more often of anxiety or alarm; (6) zoopsia, or hallucinations of animals; ideas of numerous small objects—threads, flock, dust; tactile micro-hallucinations, comprising feelings of being sprayed, stabbed, electrocuted, or woven in; (7) visual hallucinations which come and go, and change in form, in a kaleidoscopic fashion; (8) a general mood which is chiefly one of anxiety, less commonly elation—sometimes there is an impulsive restlessness; (9) such physical manifestations as loss of weight, unsteadiness, ataxia, defective speech, sweating; (10) not rarely, local or general fits; (11) exaggeration of the tendon reflexes, the pupils being sluggish in reaction and abnormal in size; (12) frequent fever and tachycardia, associated with albuminuria; (13) a short duration, usually less than fourteen days, the outcome being generally favourable.

Kraepelin differentiates between hallucinations and delirium; he draws many clinical points of distinction, chief among them being the clouding of consciousness in the delirious states. The same author considers that the exogenous poison in question is not directly responsible for the symptoms, but that "metatoxic" by-products are the immediate factors. He discusses the view that alcohol may be at the bottom of every drug intoxication; certainly alcohol appears to increase susceptibility to all other poisons. He also believes that there is no real distinction between the withdrawal psychosis and the drug psychosis—in the case of many toxic substances, at any rate.

The chemical substances which may be directly or indirectly responsible for the production of visual or auditory hallucinations are very diverse. Kraepelin discussed such well-known poisons as alcohol, chloroform, benzene, paraldehyde, chloral; carbon disulphide; morphine, cocaine; phanodorm, veronal, belladonna, salicylic acid, adalin. We may perhaps consider quite briefly a few other well-known deliriants—namely, the bromides, cannabis indica, mescal, ayahuasca, yagé, and agaric.

Bromide intoxication has been recognized as a not uncommon occurrence only within the past seven or eight years. Certainly it may be responsible for the develop-

ment of various bodily and mental symptoms in patients who have been under prolonged treatment with nerve sedatives. Confusion, or even stupor, may develop. There may be mental excitement with confabulation, or at times depression. Tremor of the limbs, dysarthria, diplopia, sluggishness of the reflexes, are among the neurological features. Hallucinations, especially of hearing and of sight, very commonly occur. As in so many of these drug intoxications, the visual hallucinations often comprise Lilliputian phantasmagoria, with swarms of little animals or people, grotesque and many-coloured, in constant movement and transformation.

Cannabis indica, an excellent account of the effects of which has lately been given by P. B. Wilkinson, produces a feeling of hilarious intoxication, often followed by depersonalization and vivid hallucinations. These vary in complexity, but are frequently grotesque and kaleidoscopic. Both Gautier and Baudelaire have described in powerful language the elaborate visual, auditory, and tactile hallucinations, with illusory distortions and hypersensitivity, often accompanied by the most intricate synaesthetic phenomena. According to Gautier:

"My hearing was enormously increased; I heard the noise of colours. Green, red, blue, and yellow sounds reached me quite distinctly in waves. A glass knocked over, the creaking of an armchair, a whispered word, vibrated and re-echoed in me like a peal of thunder; my own voice seemed to me so loud that I dared not speak for fear of knocking the walls down or making myself explode like a bomb. More than five hundred clocks sang the time to me in silvery flute-like voices. Everything I touched gave forth the note of a lyre or an Aeolian harp. I was swimming in a sea of sound in which certain motifs from *Lucia* or the *Barber of Seville* floated like islands of light. Sounds, scents, and lights came to me through innumerable pipes, thin as hairs, in which I could hear magnetic currents whistling. As far as I could determine, that state lasted about three hundred years. When the attack was over I saw that it had lasted a quarter of an hour." His visual hallucinations included the flight of a myriad butterflies whose wings he could hear; hideous and protean fabulous monsters. In another place Gautier writes: "... a complete transposition of my sense of taste. The water I drank seemed to me to possess the flavour of the most exquisite wine, the meat changed in my mouth into raspberries, and vice versa. I could not distinguish a cutlet from a peach. My neighbours began to look a little strange... their noses grew into proboscides; their mouths opened like a bell. Their faces took on supernatural tints... A dull warmth ran through my limbs... Hallucination, that strange host, had installed itself with me." Later: "A red light passed under my eyelids, a countless number of candles lit themselves and I felt myself bathed in a pale luke-warm light... everything was bigger, richer, more splendid. Reality served only as a focus for the magnificence of the hallucination... I heard the rustling of materials, the creaking of shoes, voices which whispered, murmured, and lisped; bursts of stifled laughter, noises of the legs of the table or armchairs. The china was being rattled; doors were opened and shut... suddenly a mysterious figure appeared. How had he gained admission? I do not know. His appearance did not alarm me; his nose was hooked like the beak of a bird, his green eyes were encircled with three brown rings and he wiped them constantly with his enormous handkerchief; a high white starched cravat into the knot of which had been passed a visiting-card... choked his thin gullet, and threw into pink folds the skin of his neck; a black coat with square tails, from which hung a bunch of charms, imprisoned his convex body like a pouter pigeon. As for his legs, I could swear they were made of mandragora roots, bifurcated, black, wrinkled, full of knots and warts which looked as though they had been pulled up quite recently, for particles of earth still adhered to their filaments. These limbs wriggled and

twisted with an amazing agility, and when the little torso which they supported confronted me this strange being burst into sobs, and wiped his eyes upon each sleeve in turn."

Mescal is of course well known as the most powerful excitant of visual hallucinations, and the literature of the past decade contains a great deal of information on the subject. The effects are not unlike those of cannabis indica, though differing in the rarity of auditory hallucinations. I may perhaps be permitted to quote from an earlier paper of mine in which I described the hallucinations produced by personal experimentation, in association with a colleague:

"On the horizon, a setting sun, lighting up the landscape with a dark red glow. The radiations from the sun are a beautiful combination of red and black. In the foreground are several dark figures which might be camel riders or trees. . . . A thing like an aeroplane with a long yellow body and blue wings. Almost at once it changes so that it is obvious that the centre is really a broad pathway leading up to a high palace. The sides of the path are light blue and consist of shrubs. The pathway itself is most beautiful . . . steps are visible at the end of the path. Now the sides are changing into a gorgeous flower-bed, the predominant colours in which are white and red . . . the whole effect is most beautiful . . . the picture is now rapidly changing and has now become a bowl of heather mixed with tiger-lilies." Later still: ". . . yellow specks dotted upon a black background . . . they are becoming larger and more numerous, and are forming a pattern. Red is now the most prominent colour: the arrangement is like a carpet, consisting in concentric rectangles, dark red, salmon pink, blue, golden, and so on. Larger white specks dart rapidly in from the periphery on to the carpet, like bright silver coins pouring into the centre—or like white streaks of lightning. Everything is now moving; the carpet design is breaking up and gives place to a mass of bright spangles dancing rapidly all over the picture."

As Klüver has pointed out, in the hallucinations certain form-constants tend to appear over and over again. The visions are always multi-coloured and luminous. They are frequently changing but often incomplete. Almost always are they described as beautiful (*kalopsia*). The emotions provoked are those of interest, amusement, and delight. Depersonalization and disorientation are characteristic. Illusory changes in the appearance of surrounding objects are often conspicuous. The faculties of other special senses may be perverted or, more often, enhanced. This is illustrated in D. H. Lawrence's description:

"So distinctly she heard the yapping of tiny dogs, the shuffle of far-off feet, the murmur of voices, so keenly she detected the smell of smoke and flowers and evening falling, so vividly she saw the one bright star infinitely remote stirring above the sunset, that she felt as if all her senses were diffused on the air, that she could distinguish the sound of evening flowers unfolding and the actual crystal sound of the heavens as the vast belts of the world atmosphere slid past one another, and as if the moisture ascending and the moisture descending in the air resounded like some harp in the cosmos."

In studying the effects of cannabis indica and of mescal we are reminded of de Quincey's autobiographical account of the dreams which attended his opium intoxication. One knows that it is rare for that drug alone to produce so vivid a delirium, and it is a moot point whether one is recording realistic mental images or actual hallucinations. Thus as we turn the pages of de Quincey we find:

"Often I used to see a crowd of ladies, and perhaps a festival of dances. . . . This pageant would suddenly dissolve; and at a clapping of hands would be heard the heart-shaking sound of *Consul romanus*; and immediately came 'sweeping by' in gorgeous paludaments, Paullus or Marius, girt round by a company of centurions, with the crimson

tunic hoisted on a spear. . . . To my architecture succeeded dreams of lakes and silvery expanses of water; . . . the water gradually changed their character—from translucent lakes, shining like mirrors, they became seas and oceans." Later in his diary we read: "*May, 1818*: . . . every night . . . I have been transported into Asiatic scenery . . . under the connecting feeling of tropical heat and vertical sunlights, I brought together all creatures, birds, beasts, reptiles, all trees and plants, usages and appearances, that are found in tropical regions, and assembled them together in China or Hindostan. From kindred feelings, I soon brought Egypt and her gods under the same law. I was stared at, hooted at, grinned at, chattered at, by monkeys, by paroquets, by cockatoos. I ran into pagodas, and was fixed for centuries at the summit, or in secret rooms; I was the idol; I was the priest; I was worshipped; I was sacrificed. I fled from the wrath of Brama through all the forests of Asia; Vishnu hated me; Seeva lay in wait for me. I came suddenly upon Isis and Osiris; I had done a deed, they said, which the ibis and the crocodile trembled at. Thousands of years I lived and was buried in stone coffins, with mummies and sphinxes, in narrow chambers at the heart of eternal pyramids. I was kissed, with cancerous kisses, by crocodiles, and was laid, confounded with all unutterable abortions, amongst reeds and Nilotic mud."*

Ayahuasca (*Banisteria caapi*) is a little-known drug, being a plant sacred to the dwellers of the Brazilian forests. We have been reminded within recent years of this drug through the employment of "harmine" in states of Parkinsonism, this alkaloid being chemically identical with the active principle of ayahuasca. The clinical effects of the drug are demonstrated in the descriptions in the religious orgies. A preliminary stage of excitement and erotism is followed by vertigo and simple visual hallucinations. Then appears delirious excitement in which the victim rushes here and there uttering piercing cries. Formed hallucinations of vision now occur—"beautiful landscapes, cities, towers, animals . . . shining circles of light, many-coloured butterflies" (Critchley).

Yagé is a climbing plant of similar geographical distribution. It is not yet employed in orthodox medicine, but locally it is used as an intoxicant, and also as a remedy for beriberi. Here, too, visual hallucinations are conspicuous. "Blue splashes before the eyes," succeeded by malaise, vertigo, euphoria, and confusion, are in turn followed by vivid and extraordinary visions. According to Bayon, "I saw an enormous green serpent in threatening attitude, then thickets, rivers, cascades, birds, savage beasts, immense swamps. . . . I was changed into a giant, my head was above the highest buildings and I looked down upon the crowd of pygmies. Then little men and women came and danced about in the dark. . . . I was being chased by a little figure with an enormous head." Of chief interest, however, is the alleged metagnomogenic or clairvoyant virtues of the plant, which lead the devotees to take it on important occasions, as, for example, when they wish to learn the whereabouts of their enemy, the location of ambushes, the approach of strangers, propitious hunting areas, or the most suitable partner in marriage. To test the thaumaturgic action of this drug a Portuguese soldier, Colonel Morales, was persuaded to experiment on himself. After taking sixteen drops he dreamed that his father was dead and his sister ill. This proved to be actually the case. Other instances are recorded of veridical dreams or hallucinations due to the influence of this drug (Critchley).

* We are reminded also of the Journal of Jean Cocteau and his fantastic designs, inspired under the influence of opium, by the recollection of some sleeping dream or waking hallucination. We also recall Gautier's *Pipe d'Opium*, wherein he describes the fantastic dreams induced by this drug. Farrère's *Fumée d'Opium* probably belongs more to the realm of the imagination, but is none the less of interest to medical readers.

Mushroom poisoning, or "mycetism," is another occasional cause of hallucinations (Critchley). For years a variety of mushroom called the *Agaricus muscarius* has been taken by the inhabitants of Siberia as an intoxicant. The effects of this "fly-agaric inebriety," as it is called, appear within an hour or two. Twitching or trembling of the limbs is followed by a sense of exhilaration, leading to a condition of delirious excitement. During this stage auditory and visual hallucinations develop, while enlargement of the pupils produces macropsia. The subject in his frenzy may rush round until he collapses into a state of exhaustion coloured by strangely pleasurable fantasies. Lewin believes that the fury of the old-time Berserkers may have been due to agaric intoxication. The Siberians have discovered that the urine of a person inebriated by agaric also possesses intoxicating properties. As soon as the reveller finds that his drunkenness is passing off he drinks his own urine or that of another.

Summary

A description is given of hallucinations occurring in the course of various neurological disorders.

Hallucinoses associated with narcolepsy is also considered, and reference is made to the occurrence of hypnagogic hallucinations in "normal" persons.

Drug intoxications are then dealt with, distinction being made between acute delirium after poisoning from a single massive dose and states of chronic intoxication.

Kraepelin's views regarding the clinical characteristics of drug deliria are given. Finally the phenomena associated with intoxication with mescal, cannabis indica, bromides, agaric, yagé, and ayahuasca are briefly described.

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Gonococcal Carriers.—The types of "carrier" are described. The author regards as the true carrier one who harbours the organism in recoverable form, who can infect others with clinical gonorrhoea, and yet at no time has symptoms and signs of the disease. Such cases are rare but perhaps occur more often than is generally thought. In such cases the organism can be found for a limited period only, and before it can be regarded as a gonococcus it must show the usual cultural characteristics, including the characteristic sugar fermentation reaction.—Carrier Problem in Gonorrhoea. W. Burger.—*Arch. Derm. Syph., Wien.* March, 1939, **178**, 562.

PUERPERAL SEPSIS AND HAEMOLYTIC STREPTOCOCCI

BY

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In 1932 the results of a study of 4,655 deaths directly attributed to childbirth in this country showed that 38 per cent. were due to puerperal sepsis. Almost half (46 per cent.) of these deaths from sepsis followed normal deliveries. In other words, infection following normal labour caused 18 per cent. of all deaths in this series. It was estimated that not less than 85 per cent. of these fatal infections following normal labour were due to haemolytic streptococci. These organisms were also responsible for a somewhat less but variable percentage of infections following instrumental or difficult labour. In view of this evidence the importance of the study of haemolytic streptococci needs no emphasis for those interested in the reduction of maternal mortality.

As a result of recent research it has become possible to differentiate between various types of haemolytic streptococci. By means of a precipitin test, Lancefield (1933) divided haemolytic streptococci into several groups designated at first A, B, C, D, and E, further groups being added later. Strains from various human infections were found almost invariably to belong to Group A; Lancefield and Hare (1935) showed later that almost all the infecting strains in a series of cases of severe puerperal sepsis belonged to Group A. They found also that Group A streptococci were extremely rare in the genital tract of women with afebrile puerperia or with minor puerperal infections.

In organizing our attack on puerperal sepsis as a contributory factor in maternal mortality, emphasis has to be laid upon two facts: (1) Since almost half of the deaths from sepsis follow normal labour, it is clear that more must be done than can be effected by improving ante-natal treatment or by increasing the amount of dexterity or judgment exercised in operative obstetrics. (2) Since evidence is accumulating that the upper respiratory tract of the patient herself (or more often that of her contacts) is the most probable source of puerperal infection with haemolytic streptococci, attention must be directed to possible methods of preventing the transfer of organisms from these sites to the genital tract immediately before, during, and after childbirth. The following report of an investigation in a consecutive series of 120 students examined during the last two years contributes data on the incidence of Group A haemolytic streptococci in women of college age.

In 1936 it was decided to take a swab from the throats of all medical students before they began their work in the maternity wards of the obstetrical and gynaecological unit of the Royal Free Hospital, London. In each case the throat swab was taken about three weeks before the student was due to come into residence in the hospital for her two and a half months' training. If a growth of streptococci was found, McLeod's test was carried out to see if it showed soluble haemolysin, and, if it did, the Lancefield group to which the haemolytic streptococci belonged was ascertained by the precipitin reaction.

Incidence of Haemolytic Streptococci

In 22.5 per cent. of cases a growth of haemolytic streptococci was obtained. This carrier rate of haemolytic