The same symptoms are produced in certain lesions of the spinal marrow or cerebrum. Westphal rendered guinea-pigs epileptic by blows on their heads. Hitzig, Eulenburg, and Landois by irritating the motor cortical centers of animals by mechanical and chemical agents, and by electricity, brought on attacks of epilepsy. Points have been localized in the cerebro-spinal axis whose excitation produces epilepsy, and Albertoni and Koloman-Balogh have given precise directions in this regard. Roberts Bartholow has gone even farther, and in a patient, the surface of whose brain was denuded to some extent, he has produced epileptiform convulsions by applying electricity to the exposed cortica, substance.(*a*) Clinical observation strikingly confirms these experimental facts, and the annals of medicine contain a vast number of cases where wounds and irritations of nerves have determined epilepsy, and where it has sufficed to remove the vicious cicatrix, or the foreign body embedded in the tissues, in order to obtain a permanent cure. In other instances the epilepsy has resulted from injuries or compressions of the cerebral substance, by spiculæ of bone, by abscess, by tumors ; the removal of the bony splinters or the disappearance of the tumors has brought about complete cure.

It is in cases of this kind that the application of the trepan in the treatment of symptomatic epilepsy gives good results. Extolled by the ancients in an empirical fashion, the trepan has of late years found its legitimate place, a place, in fact, of such importance that we have seen in America an eminent surgeon perform this operation for the cure of epilepsy twenty-three times in five years, and obtain seven complete recoveries. Echeverria, in his interesting statistics, gives the results of one hundred and forty-five cases, ninety-three of which were permanently cured by the trepan.

In the same group we place anti-syphilitic medication, for oftentimes the

larvæ of insects in the frontal sinuses may determine the development of the neurosis, (sympathetic or reflex epilepsy). It is the same with alterations or strange affections of the different viscera, of the stomach, of the intestine, the liver, the kidneys, the genito-urinary organs. Gastro intestinal epilepsies are equally admitted.

Some authorities have related cases of attacks occurring especially in plethoric individuals as a sequel of indigestion, where improper articles of food have been indulged in or where there has been departure from the ordinary habits of diet. The presence of worms in the intestine and obstinate constipation, have often induced convulsions in persons predisposed. Moreover, in females slight lesions of the neck of the womb or displacements of that organ are sometimes sufficient to determine epilepsy. Menstruation has a manifest influence on the development and march of epilepsy. It is, in fact, generally at the period of the establishment of the menses or at the epoch of the menopause that the disease first appears. In fine there is a multitude of other causes which are operative in persons predisposed ; the perception of certain odors, the sight of certain objects, sometimes the disappearance of certain rashes, etc.

(*a*) Brown-Séquard : Researches on Epilepsy, its Artificial Production in Animals, and its Etiology, Nature, and Treatment in Man, Boston, 1857; Pietro Albertoni –Influence of the Cerebrum in the Production of Epilepsy, Milan, 1876 ; Roberts Bartholow : Experimental Investigation into the Functions of the Human Brain, American Journal Medical Society, April, 1874 ; Westphal: Berliner klinische Wochenschrift, Nos. 24 and 39, 1871 ; Vulpian: Epilepsy in the Guinea-pig after section of the Sciatic Nerve.

relation which exists between this neurosis and syphilis is explained by the presence of gummata, or bony tumors compressing the brain and spine, and it is quite clear, as Fournier and Dreschfeld have shown, that in cases of this sort the specific is the proper treatment for the neurosis. In this same category we must place epileptiform convulsions due to the presence of worms in the intestines, and which disappear with the expulsion of the offending cause. In this group, too, we must place those cases of epilepsy connected with troubles of the genital functions, for the relief of which Marshall Hall proposed castration.

It was formerly maintained that epilepsy results from a chronic inflammation of the brain and spinal cord; a variety of epilepsy was even described under the name of plethoric epilepsy. Morgagni, Fothergill, and others defended this doctrine of the constant inflammatory origin of epilepsy, hence their antiphlogistic treatment, which consisted in blood-letting and the most powerful derivatives, such as cauteries, blisters, and setons. This kind of treatment is now a thing of the past; it gave no certain results of any value, and was based on a hypothesis which the recent anatomo-pathological researches on essential epilepsy have not confirmed.

We know that since the labors of Schroeder-Van der Kolk and Echeverria,[1] the post-mortem disclosures in deaths from epilepsy have generally been alterations of the medulla oblongata, characterized by an intercellular albuminous exudation and capillary ectases. It may, however, be reasonably affirmed that these lesions are the consequence rather than the cause of attacks of epilepsy.[2]

[1] These are the statistics of Echeverria :

Recoveries,	93
Ameliorations,	18
No change at all,	5
Aggravation,	1
Deaths,	28

Mason Warren, in 10 cases of trephining, reports 3 cures, 2 ameliorations, and 5 deaths. (*a*)

[2] The necroscopic examination of epilepsy very often gives results quite negative, with nothing to explain the phenomena during life; at other times, however, there are found alterations of recent date, or of long standing, to which the disease may be attributed. Leaving one side lesions of the members or of certain viscera which provoke sympathetic or reflex epilepsy (wounds of the sensory nerves, affections of the stomach, of the intestines, of the genital organs, etc.), we will recall the principal alterations described by writers. On the part of the cranium, thickening, deformity, whether by depressed fracture, the presence of foreign bodies, or of bony tumors; vices of conformation, cranial asymetry, an arrested development of the face; in fine, fronto-facial asymetry. According to Laségue, who has devoted much study to this question, the asymetry which is observed in epileptics seems to respond to two types: either the face has undergone movements of rotation in a direction opposite the frontal region, or else it is drawn in the same direction. In the first case, to the right frontal prominence corresponds a left molar prominence; in the other case, the prominences are on the same side. The first form is the most common. The lesions of

(*a*) Trephining for epilepsy (Boston Med. and Surg. Journal, 1872—Echeverria on trephining in hysteria from traumatism of the cranium (Arch. de Med. de Paris, 1878, t. 11, p. 529.652), Mason Warren, Boston Med. and Surg. Journal, 1867).

Nevertheless, the rachidian bulb has a predominant part in epilepsy, and it is by modifications of its functions that we best explain the convulsive paroxysms.

The first phase of the attack, that which corresponds to the initial outcry, to the loss of consciousness, and to the tetanic contraction of all the muscles of the economy, would seem to result from an excitation of the medulla oblongata, sufficient to cause sudden anæmia of the cerebrum and of the bulb itself. Next comes the asphyxia, consequence of this tetanic state, and the passive congestion of the cerebro-spinal axis which it produces. Next in order is a period of reaction, in which the accumulation of venous blood in the encephalon and spinal cord determines clonic convulsions everywhere, the respiration is stertorous, the face is blue, the attack terminates with exhaustion of the nervous centres implicated. In these phenomena the medulla oblongata is principally concerned, and the therapeutic indication is plain; every medicament which tends to diminish the excitability of the medulla oblongata, and the cerebral anæmia which results from it, is applicable to the treatment of epilepsy. But before beginning the consideration of the physiological treatment of epilepsy, I will say a few words about the empirical treatment.

Certain simple herbs have enjoyed a great repute in the treatment of epilepsy, and the common people have accorded heroic curative virtues to a number of indigenous plants which deserve a brief mention here, as their anti-epileptic properties have been endorsed by certain physicians.

Galium verum and galium mollugo ("white cheese rennet," "yellow ladies' bedstraw," are the familiar names) are reputed as having quite special virtues in the treatment of epilepsy, and we are frequently referred to the observations of Jourdan and Miergues, fils. I believe that even now certain religious communities in France treat this disease with the expressed juice or an infusion of this plant.

Valerian is also an ingredient of a great many anti-epileptic preparations, and its employment in this disease is supported by a respectable number of eminent names. I will pass rapidly by hyoscyamus, vaunted by Storck and Hufeland; daffodill, employed with success by Dufrenois, Vieillchèse, Delonchamps; bitter orange leaves, counselled by Larcher; peony, extolled by Portal, to devote a moment's consideration to belladonna, which, before the introduction into therapeutics of the bromides, was one of the medicaments the most depended on in the treatment of epilepsy, supported, as it was, by the authority and experience of Trousseau. Belladonna is given in the form of pills, each containing one-sixth of a grain of the powder and one-sixth of a grain of the extract; dose, one pill morning and evening the first month, and every succeeding month you increase the dose by one pill a day, till you arrive at the enormous dose of twenty pills night and morning.

All these medicaments, belladonna included, are to-day completely abandoned; they have had to yield their place to more active and more certain medicines, and I have only mentioned them here because they belong to the history of the therapeutics of epilepsy. By the side of these vegetable substances we must place the mineral remedies which have been prescribed for the falling sickness; these are especially certain metals, such as silver, copper, and zinc.[1]

the encephalon are: for the meninges, a thickening of the dura mater, ossification of the falx cerebri, of the tentorium cerebelli, fungous growths, abscesses, adhesions of the thickened pia mater to the encephalon, tumors, cysts of the choroid plexus, the lesions of meningo encephalitis. The brain substance presents: congestion or pallor, softening or induration of the white and gray matter, atrophy or incomplete development of the cerebral lobes, tumors of divers natures, tubercles, cancers, cysts, hypertrophy of the pituitary gland, asymetry or inequality of weight of the cerebral hemispheres, lessened weight of the cerebellum, sclerous induration and atrophy of one or both of the cornua Ammonis, or softening of these cornua. These lesions, regarded immediately after death, may be considered as being of relatively ancient date. Among the recent lesions, or those seeming to be such, and judged to be consecutive to the attacks themselves, are found, if death has occurred during or immediately after an attack, certain phenomena of asphyxia, ecchymoses under the scalp, sub-pleural ecchymoses, congestion of the lungs, of the liver, of the spleen, of the kidneys, injection, with ecchymotic patches of the pia mater, etc. The cerebral hyperæmia so frequent is seated preferably at the level of the medulla oblongata, in the gray substance of the pons, and this hyperæmia entails divers changes of texture (ramollissement, or induration, hypertrophy, etc.).

The congestion, with enormous vascular dilatation, and the ramollissement are often found at the point of origin of nerves which have been concerned in convulsions (the hypoglossal, pneumogastric); likewise there has been observed a pigmentation of the ganglionic cells of the cervical sympathetic. The works of Luys and of Voisin (Arch. de Med., Dec. 1869) have shown that lesions may be met, not only in the medulla oblongata, but also in the cortical substance of the cerebrum in the cerebellum and in the cerebellar peduncles.

[1] Oxide of zinc (flowers of zinc, or philosophers' wool) is a white substance, tasteless, inodorous, insoluble in water, and is obtained by roasting metallic zinc in a crucible in contact with air. Oxide of zinc is given internally in the form of pills, or of powder, in the dose of twenty centigrammes to one gramme (from 3 to 15 grains). Herpin, of Geneva, employs oxide of zinc in the following way:

1. For adults during the first week, 3 grammes (45 grains), rubbed up with 4 grammes, (1 dram), of sugar, and divided into 20 doses; 3 doses a day, one hour after each meal. Increase by 1 gram (15 grains) a week till the weekly quantity of 15 grammes (225 grains) is reached; this to be continued for three months.

2. From 10 to 15 years of age, weekly quantity of 1 gramme (15 grains); increase by 1 gramme a week.

3. From 1 to 10 years, a weekly initial quantity of ½ a gramme (7½ grains); during the second week the dose is increased to 1 gramme; after that, a weekly increase of 1 gramme.

4. From the period of birth to 1 year, weekly initial dose of 25 centigrammes; increase by 25 centigrammes a week till 3½ grammes is attained, which is the maximum weekly dose.

Herpin, somewhat more recently, has substituted lactate of zinc for the oxide; he gives this salt in the weekly initial quantity of 3 grammes to adults and 1 to 2 grammes to children, according to their age. Valerianate of zinc has also been recommended as an antispasmodic. Devay, of Lyons, Cerulli, of Parme, and Martin Solon have published cases of cure from neuralgia and spasmodic affections by the use of pills of valerianate of zinc, containing 5 centigrammes (1 grain), and giving 2 to 4 of these pills a day.

More recently, Luton has recommended for rheumatic pains the cyanide of zinc, and this is his formula:

℞ Cyanide of zinc..... .20
Aquæ lauro cerasi..... 25.00
Mucilage 100.00

What physiological action can these metallic substances have in the treatment of epilepsy? We cannot say; possibly we must invoke, in explanation, the strange phenomena of metallotherapy observed in accordance with Burq's method. However this may be, silver is administered in the form of pills of the nitrate, and in doses sufficiently large and sufficiently prolonged to produce discoloration of the tissues. They tell a story of an aide-de-camp of King Louis Philippe, who had been cured of his epilepsy by this treatment, but whose skin was changed to a deep blue. I myself saw, twenty years ago, a man transformed into a negro (blue man, they called him) by the internal usage of nitrate of silver, but who, notwithstanding this kind of poisoning, was not cured of his disease.

Copper is administered in the form of ammonio-sulphate of copper, and is given in the dose of ten centigrammes a day in capsules. Zinc is given in the form of oxide; Herpin is the most zealous advocate of treatment by this remedy. Out of thirty-six patients treated by oxide of zinc, he obtained twenty-eight cures; the dose given was ten centigrammes three times a day, gradually increased till six grammes were taken in the twenty-four hours. Like the vegetable treatment above described, the metallic treatment of epilepsy has gone out of vogue, and to-day it is to the bromides that everyone has recourse.

When Balard,[2] in 1826, discovered bromine, and the striking resemblances

Mix and shake.
Dose.—One tablespoonful every hour. (*a*)

[2] It was in 1826 that Ballard discovered bromine. The first application which was made of this substance, and of its combination with potassa, under the name of hydrobromuret of potash, was directed against scrofula and goitre. Two years after the discovery of Ballard, in 1828, appeared a work by Pourché, Fellow of the Faculty of Montpelier, on the therapeutic employ of bromine. Ten years later, in 1838, bromine and bromide were again made the subject of experimentation, this time at the Pitiè in the service of Andral, and Fournet gives us an account of these trials. Then from 1840 to 1850, Ricord, at the hospital du Midi, endeavored to substitute bromide of potassium for the iodide. The two internes of this physician, Rames and Huette, studied the physiological and therapeutic effects of bromide of potassium. The first defended his thesis the 25th of April, 1850, and the second the 8th of May the same year. Rames, in his work, shows that bromide of potassium, in large doses, produces anæsthesia; he experimented on animals with this medicine, and compares the general action of the bromide with the symptoms which characterize the incomplete general paralysis of the insane. He mentions the loss of the sensibility of the pharynx, which makes it effectual against nausea, and also calls attention to the depression of the genital functions The thesis of Huette is much more complete. He points out all the symptoms of bromism, which he describes with great care, and shows the influence of bromide of potassium in syphilis. Locock, in 1851, was the first to apply the bromide of potassium to the treatment of epilepsy, and out of 15 cases he had 14 cures. Radcliffe repeated these experiments, and affirmed that the name of Sir Charles Locock deserved to be perpetuated in the grateful remembrance of all epileptics. Locock based his experiments on the results obtained several years before (1840–1842) by a German

(*a*) Herpin, of Geneva, on the Prognosis and Treatment of Epilepsy, Paris, 1852. Devay on Valerianate of Zinc (Gas. Med. de Paris, 1854). Martin Solon on Valerianate of Zinc in Neuralgias (Bull. de Ther., t. XXVII, p. 468). Luton on Cyanide of Zinc (Bull. de Ther., 1877, t. XCII, p. 97.

between this substance and iodine were pointed out, it was proposed to substitute the first medicament for the second, and it was in the treatment of syphilitic affections more especially that the substitution was made. From 1840 to 1850, in the Hôpital du Midi, the physicians attached to this hospital, and in particular Ricord, employed bromide of potassium in the place of iodide of potassium. The first labors recording the results of this treatment, and showing the physiological and therapeutical properties of the bromide, were made by two internes of the hospital—Rames, of Aurillac, and Huette, of Montargis. The thesis of Rames appeared April 25, 1850, and that of Huette several weeks after. Six years ago (in 1878) George Huette, in an excellent monograph on bromide of potassium, showed us the progress made in the usage of bromide of potassium since the first experimental and clinical studies of his father in 1850. Those early investigations, while clearly setting forth the physiological, therapeutical, and even toxic effects of the bromide, made no mention of any application of the drug to the treatment of the neuroses, and in particular to epilepsy.

The year following Locock, taking up a discovery, made several years be-

named Otto Graf, who had experimented on himself with bromide of potassium, and had remarked that 60 centigrammes of this salt (or about 10 grains), taken 3 times a day for a fortnight, had caused temporary sexual impotence; this is what led Locock to employ bromide in hysteria, in hystero-epilepsy, then in epilepsy. Williams, at the insane asylum at Northampton, experimented on 37 epileptics, 19 men and 18 women. The bromide was given for 5 months; the 19 men who had had 1,012 attacks in 5 months, had during the time of treatment only 706; and in the case of the females, the number of fits fell from 1,127 to 970. The same year, in 1864, Robert Macdonald experimented with this medicament in epilepsy, and obtained the same results as Locock. Blake, in 1864, employed the same medicament in a case of hystero-epilepsy. Bazin and Besnier published, in 1865, a case of cure of epilepsy. Then appeared, in 1866, in the Bulletin de Therapeutique, the much more complete memoir of Dr. Voisin, which was based on 24 observations of epileptic patients. From this period this kind of treatment became general, and special treatises, giving reports of successes obtained with this salt in epilepsy, have abounded in this and other countries, and their very titles are too numerous to mention here.

To judge of the constantly increasing use of this salt in the hospitals, I need only refer to the following statistics given by Lasègue and Regnauld, which indicate the consumption of bromide at the Pharmacie Centrale of the hospitals from 1855 to the year 1875:

1855	3.200 K.	1866	133.300 K.
1856	7.100 "	1867	135.643 "
1857	4.820 "	1868	211.650 "
1858	2.000 "	1869	406.313 "
1859	2.517 "	1870	389.900 "
1860	2.360 "	1871	319.690 "
1861	2 995 "	1872	529.740 "
1862	5.782 "	1873	596.620 "
1863	7.601 "	1874	741.358 "
1864	22.300 "	1875	730.910 "
1865	73.530 "		

From the table it appears that in twenty years the consumption of bromide of potassium which was $3\frac{1}{6}$ kilogrammes, or about 7 pounds, in 1855, had increased in 1875 to 735.910 k., or the enormous quantity of about 1,500 pounds. This ought to be enough to

fore by a German, Otto Graf, who had noted in himself a marked depressant action following the use of large doses of bromide of potassium, and in particular, sedation of the genital functions, for the first time applied these data to the treatment of hystero-epilepsy and of epilepsy, and out of fifteen cases treated by the bromide recorded fourteen cures. The name of Locock ought to be immortalized in the history of medicine ; he deserves the gratitude of the whole human race, because through his happy discovery of the use of bromide of potassium in epilepsy, he has enabled us to cure one half our cases.

After the labors of Locock, came those of Radcliffe, Brown-Sèquard, and especially of Williams, showing that one could in five months diminish in a marked manner the number of attacks in a given number of epileptics. From this moment, bromide of potassium has been almost exclusively employed in the treatment of epilepsy, and the memoirs of Voisin, Legrand du Saulle, Falret of Lasègue, etc., in our country show the beneficial results which may be expected.

Consult these documents, examine the statistics furnished by these physicians, and you will see that in more than half the cases we may favorably modify the condition of epileptic patients. I say modify, and not cure, for I range myself on the side of those who contend that a complete and permanent cure of real epilepsy by the bromide treatment is rare, without being, nevertheless exceptional. But it is possible, in one case out of every two, to cause the attacks to disappear, on condition, always, of prolonging indefinitely the medication ; and this is no small blessing. The bromide is, then (in the words of Legrand du Saulle), the muzzle of epilepsy, rather than a definite curative medicament.[3]

negative the assertion of some writers, and particularly Drouet, that the bromide medication is destined to have only a fleeting popularity, to be hereafter abandoned like all other kinds of treatment that preceded it. (*a*)

[3] Legrand du Saulle has given complete statistics pertaining to 272 epileptics treated both in the hospital at Bicetre and in his private practice by bromide. His facts are grouped as follows:

Clinical observations of the first series.—Absolute suspension of fits ; no vertigo or petit-mal.

A, during five years, 2.
B, during four years, 17.
C, during three years, 11.
D, during two years, 8.

(*a*) Otto Graf, on the Internal Efficacy of Bromide of Potassium, as shown by Experiments. Leipzig, 1840. Locock, The Lancet, 1857, vol. I, p. 528. Pourché, Observations on the Employ of Bromide and Hydrobromuret of Potash in Scrofula and Goitre. (Ephem. Med. de Montpeleier, t. VIII, p. 45 to 54, 1828.) Fournet, on the Therapeutic Use of Bromine in Chronic Arthritis, (Bull. de Ther., t. XIV, p. 87.) Rames, Studies on the Anæsthetic and Therapeutic Effects of Bromide of Potassium (Thesè de Paris, 1850). Williams, on the Action of Bromide of Potassium, 1864. MacDonnell, Observations in Support of the Treatment of Certain Forms of Epilepsy by Bromide of Potassium (Dublin Quarterly Journal of Med. Science, 1855). Blache, Hystero Epilepsy Treated by Bromide of Potassium (Bull. de Ther., t. LXXVII, 1864). Bazin et Besnier, Epilepsy Cured by Bromide of Potassium (Gaz. des Hop., 1865). Voisin, Clinical Researches on Bromide of Potassium and its Employ on the Treatment of Epilepsy (Bull de Ther., t. LXXII, 1866). Drouet, Documents to serve as a History of Bromide of Potassium (Annal. Med. Psych., Sept., 1873). Lasègue et Regnault, Therapeutics Judged by Statistics (Arch. Med., 1877).

How ought you to institute the bromide treatment? Which bromide ought you to choose? What are the inconveniences of this medicament? How long ought you to continue the treatment? These are questions which I must now answer.

But I must first of all say something about the physiological action of the bromides. Already, *apropos* of diseases of the heart, I referred to the action of bromide of potassium on the economy, and I need not repeat what I then said. All physiologists are to-day agreed in conceding to the bromide a sedative action on the cerebro-spinal axis, and in particular on the medulla oblongata. If any point is under dispute, it is not whether this substance has an elective action on the rachidian bulb, but whether this action is primitive or secondary. Some, as Germain Sée and Binz, maintain that the bromide acts first on the heart, and consecutively, by producing anæmia, on the bulb ; others, on the contrary, affirm that the heart is affected secondarily; that it is only influenced because the medulla oblongata has been first depressed. This depressant action on the excito-motor power of the mesocephalon is of marvellous applicability to epilepsy, since we have just seen that in this neurosis it is excitation

E, during eighteen months, 21.
Total, 49.

Clinical observations of the second series.—Suspension equally absolute of epileptic attacks :

A, during fifteen months, 11.
B, during one year, 8.
C, during eight months, 21.
Total, 41.

Clinical observations of the third series.—Considerable amelioration; no epileptic fit during the time which oscillates between three and seven months, 23.

Clinical observations of the fourth series.—Relative amelioration (remission of one to three months duration, disappearance of the major attacks, but persistence of occasional vertiginous attacks ; partial return of memory ; appreciable amendment in the mental condition ; complete cessation of the nocturnal incontinence of urine, of tongue-biting, and of headache, 30.

Clinical observations of the fifth series.—Failures, 129.

In his treatise on the action of the bromide of potassium, Voisin has gathered 96 observations of epileptics treated by bromide:

Complete cure, lasting for several years	22
Persistence of the aura, absences and vertigo	42
Failures	32
Total	96

Hughes-Bennett has furnished some statistics on the results of treatment by bromide; these statistics concern 117 cases. Twelve per-cent of the patients had their fits completely suppressed ; in 83-per-cent there was notable diminution, and in 5-per-cent only was there utter failure. (*a*)

(*a*) Legrand du Saulle, on the Prognosis and Treatment of Epilepsy, Second Ed., 1873, p. 15. Otto, on the Treatment of Epilepsy by Bromide Potassium (Arch. of Psychiatrie, und Nerven-Krank., Vol. V, fasc. 1, p. 24. Auguste Voisin, Bromide of Potassium in Nervous Diseases (Mem. del 'Acad. de Med., t. XXXI, 1875). H. Bennett, a Statistical Inquiry into the Action of the Bromides in Epilepsy (Edinb. Med. Journ., p. 706, Feb., 1881).

of the rachidian bulb which determines the congeries of symptoms which characterize epilepsy, and this physiological action explains why suspension of the convulsive attacks follows the use of the bromide.

In the bromides what is the active principle? Is it the bromine, or is it the base? This is a question which has been much studied, and which seems to us to-day to be solved. The bromine plays a considerable part in this depression of the bulbar functions, but the base does not by any means remain inactive or inert.[1] And this it is which explains the difference of action of the different bromides. We know, especially since the labors of Laborde, that the salts of potash have a much more marked depressant action than the salts of soda, and that they have a toxic effect on the heart in particular. Already, when treating of purgatives, I have showed you the difference which exists between the salts of potash and of soda; there is the same difference between chlorate of potash and chlorate of soda, as Laborde has shown; also between bromide of potassium and bromide of sodium, the first being more active than the second, while on the other hand the sodium salt is better tolerated than the potassium salt.

I have made many trials of bromide of sodium in epilepsy, and notwithstanding the considerable doses exhibited, 10 to 12 grammes (150 to 180 grains)

[1] Krosz in his experiments made on animals and on man, endeavored to show that in the action of bromide of potassium it is to *potassium*, to the base, that is due the paralysis of the heart muscle, the slowing of the respiration, the lowering of the temperature, the paralysis of the nerves and muscles. It is to the *bromine* on the contrary, that are to be attributed the insensibility of the pharynx, and the central paralysis of the nervous strands which connect the sensory with the motor ganglia. Sidney Ringer and Wm. Murrell have made comparative experiments with bromide of potassium and chloride of potassium, and they arrive at conclusions almost identical with those of Krosz. According to them, the action on the sensory nerves depends principally on the base, and not on the bromine. Nevertheless the paralyzing action cannot be due to the potassium alone, for the loss of sensibility lasts twice as long with bromide of potassium as with the chloride. Steinauer, of Berlin, has also experimented on animals with the bromine compounds.

Jules Cheron and Raoul Fouques, physicians at St. Lazarre, have experimented with the three bromides (bromides of potassium, sodium, and ammonium), and these are their conclusions: These salts act by their bromine as moderators of the reflex centers. Bromide of potassium to its sedative action on the nerve centers joins a depressant action on the muscular system; it is a neuro-muscular medicament. Bromide of sodium acts like bromide of potassium on the nerve centres, but it does not act on the muscular system; it is simply a moderator of the reflexes. The bromide of ammonium is a moderator of the reflexes by its bromine, like the two preceding, and by its ammonium, it is a diffusible excitant. Therefore when you wish to act on the reflex power and on the muscular system, you will choose the bromide of potasium. When you desires to act only on the reflex centres, the sodium salt is indicated. And lastly, when you wish to act on the nervous centres and induce a slowing of the circulation, a lowering of arterial tension without muscular depression, the bromide of ammonium should be chosen. (*a*)

(*a*) Krosz, on the Physiological Action of Bromide of Potassium (Arch. für Experiment. Pathol. und Phar., p. 1, 1876. Sydney Ringer and Wm. Murrell, Concerning the Action of Chloride of Potassium on the Nervous System of Frogs (Jour. of Anat. and Phy., t. XII, October, 1877). Steinauer, Untersuchungen übei die Physiologische Wirkung der Brompraparate (Arch. f. Path. Anat. Med. Physiol., LIX, lirr. 1). Jules Chèron and Raoul Fouques, on the Comparative Action of Bromide of Sodium, Bromide of Potassium, and Bromide of Ammonium (Jour. de Ther., 25, 1881, p. 617).

a day, I have never succeeded in arresting attacks either of petit-mal or grand-mal by this salt. I have, therefore, been astonished to see in Hammond's remarkable work on "Nervous Diseases," that this eminent neuropathologist gives the preference to bromide of sodium in epilepsy.[1]

By the side of bromide of potassium we must place bromide of ammonium, which has a still more powerful action than the first; then bromide of calcium, with which I have never experimented, but which is much employed in America, and especially by Hammond.[2] The latter, while giving the preference to bromide of sodium, considers bromide of calcium superior to the potassium salt; one gramme producing a sleep which is calm and refreshing. His vehicle of administration of the calcium preparation is syrup of the lacto-phosphate of lime.

I have enumerated the alkaline bromides, of which the most employed is assuredly bromide of potassium. These bromides are often associated in prescription, a mode of administration called the *mixed bromides*.

There are other bromide compounds which are sometimes given, as the bromide of zinc and bromide of camphor. Theoretically, the zinc bromide should be a good preparation, since zinc oxide possesses anti-epileptic properties, as we have before seen. Bromide of zinc is used in England and America in the form of a syrup. Hammond speaks highly of this salt in epilepsy.

Introduced into therapeutics by Deneffe, of Brussels, and investigated chemically by Clin, therapeutically by Bourneville, bromide of camphor[3] has been employed in the treatment of hysteria and epilepsy, and although favorable results have been obtained at the Saltpetriére, yet this preparation has not

[1] Hammond on Nervous Diseases, p. 806. Paris, 1879. (*a*)

[2] W. A. Hammond: The Therapeutic Usage of Calcium Bromide, New York Med. Jour., 1872, and Bulletin gen. de Therapeutique, 1872; also, Hammond on Diseases of the Nervous System, p. 886. Hammond's formula for bromide of zinc is as follows:

℞ Bromide zinc..... grammes iij. (or gr. xlv).
Syrup simplicis..... grammes xxx (1 fl. oz).

M. Dose.—Ten drops three times a day. The quantity to be gradually increased till thirty drops or more are given at a time. Each dose should be well diluted with water before taking, as it is apt to offend the stomach.

[3] Bromide of camphor has been obtained in the form of beautiful crystals by Olin and Silva. It has been studied from a physiological and therapeutical point of view by Deneffe, of Brussels, and Bourneville. It diminishes the pulsations of the heart, and the number of respirations; it also lowers the temperature. It has moderate hypnotic properties. Deneffe has treated delirium tremens with it, and Bourneville has employed it in chorea and epi-

(*a*) Dr. J. Leonard Corning, of New York, in the Medical Record, Sept. 29, 1883, takes the author to task for this denunciation of bromide of sodium in the treatment of epilepsy, and gives as the result of his own experience his preference for the sodium salt. He says: "If there is any one fact more thoroughly established than another, it is the superiority of bromide of sodium, and for this reason: that the prejudicial effects which are so conspicuous a concomitant of the other bromide preparations are, in great part, absent in the sodium salt." Dr. J. W. Morton gives testimony to the same effect. "It is," he says, "a matter of clinical experience that larger doses of bromide of sodium may be tolerated for months without evidences of the bromide rash, and without failure of health."