Experiments to determine the precise effect of Bromide of Potassium in Epilepsy. By T. S. CLOUSTON, M.D. Edin., Medical Superintendent of the Cumberland and Westmoreland Asylum, Carlisle.

What asylum physician is there, who, in prescribing drugs for his patients, has any approach to a feeling of certainty that these drugs will have the effect he anticipates? I refer more particularly to sedative drugs. Is there any such physician who will lay down a rule by which it may be known whether opium, hyoscyamus, Indian hemp, or bromide of potassium is the best medicine to be given in a particular case? We have the statements of individual authors in regard to the right mode of giving some of these drugs, but after all those are merely opinions founded on most limited observations, and lack the exactitude of research, and the numerical basis on which alone scientific truth is founded. It is no wonder that many of our specialty are sceptics in regard to medical treatment in insanity, when we generally find that the advocates of particular medicines, or of special modes of administering them, merely give us "selected" cases. To anyone who has read something of the history of medicine, it seems a mere waste of words to advocate any new treatment of a disease, except it is clearly shown that the spirit of fairness and scientific impartiality has regulated the observations on which the would-be conclusions are founded. And as for discussing and quarrelling over the general question of the good effects of medical treatment *versus* moral treatment, surely the energy and acuteness so expended would be employed to far more purpose in observing and recording facts, so that we might have something certain on which to base an argument on the one side or the other. And by observing facts, I do not mean vaguely noticing the course of certain random cases subjected to unsystematic and desultory treatment, and accepting the confused impression of the result left on the mind as scientific truth, on which an argument may be founded or a boon to humanity conferred. It is surely possible for the physicians of asylums to combine their opportunities for observing the treatment of disease in one vast and systematic effort, all working on the same plans, and all adopting the same conditions. What accuracy might we not acquire in

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our notions as to the effects of morphia given in melancholia, if the drug was tried in the case of every melancholic patient in all our asylums for a year, and an accurate record of the results drawn up? The idea may seem in many respects chimerical and absurd, but it seems questionable if much accuracy in therapeutics will ever be attained until something of the kind is done. There is no single man who has opportunity sufficient to solve such a problem, except by careful experiments extending over years, and we know how difficult it is for a physician to continue careful experiments over long periods. And surely this exact, scientific, and statistical age will not allow the present state of utter doubt to continue much longer without making at least an effort to dispel it. We require to know the full and true result of giving drugs in every case, and not merely in a few favourable cases which may be natural recoveries.

Possessed with these ideas, and feeling conscience-smitten oftentimes at the uncertain way in which I gave drugs, and thinking that the action of the bromide of potassium in epilepsy, and that of opium in mania, afforded as simple fields of observation as could be found, I performed some experiments with those medicines. In regard to the bromide of potassium, my objects were to ascertain its precise effect: 1st—On the number of the fits. 2nd—On the character of the fits. 3rd—On the patient's mental condition between the fits. 4th—On the patient's weight, temperature, pulse, and general health. 5th—On the different varieties of the disease. 6th—To ascertain the most effectual dose for therapeutic objects. 7th—To determine the limits to which it may be pushed as to time and quantity. 8th—To find out the length of time to which its effects extend when it is stopped. To effect these objects I had all my male epileptic patients—29 in number—weighed, and took their morning and evening temperature and pulse every week for a month, having the number of fits recorded and the general mental state. This was when on their ordinary diet, and taking no medicine. I then gave them all bromide of potassium three times a day, one dose after each meal. I began with five grain doses, being fifteen grains per day. I gave that quantity for three weeks, increasing the dose at the end of that time to ten grains, continuing this for three weeks, and increasing the dose by five grains at the end of every period of three weeks until forty grain doses were reached. In case any ill effect might result from this or

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larger doses, I continued to give forty grains for seven weeks, so that I might have time to observe the patients carefully. At the end of that time I gave them forty-five grain doses for three weeks, and then fifty grain doses for ten weeks longer. I then stopped the medicine in all the cases. During all this time (thirty-eight weeks) the number and kind of fits had been noted, the patients had been weighed, and their temperatures and pulses examined and noted every week, while they had been otherwise subjected to very careful observation as to their mental and bodily state.

Effect of the medicine on the number of the fits.—I have put in a tabular form (see table I.), the results of my observations in regard to the number of fits taken by the patients when they were not taking the medicine, and during each of the periods of three weeks when they were taking the different doses of the drug.

TABLE I.

Quantity taken per day.	No. under treatment.	Total No. of fits in three weeks.	No. of fits to each patient in three weeks.
No Medicine	29	398	13·5
15 grains	29	344	11·9
30 ,,	29	269	9·3
45 ,,	29	348	12
75 ,,	29	174	6
90 ,,	26*	61	2·3
105 ,,	26	64	2·5
120 ,,	25	86	3·4
135 ,,	25	58	2·3
150 ,,	20†	48	2·4

As various causes prevented me from continuing the experiments in the cases of all the patients on whom they were begun, I have given in one column the number of

* One patient had taken acute rheumatism, one had turned over in a fit and died, and in the third, a boy of 15, the medicine had to be stopped.

† Besides the above it had to be stopped in four more cases, on account of its ill effects; in another boy I did not go on to the large doses; and in the ninth patient the delusion that it was poison I was giving him was so strong that I did not continue its use all the time.

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patients under treatment. By some mistake, the patients, after having been three weeks on fifteen grains three times a day, were put up to twenty-five grains, instead of the usual increase of five grains, so that in the column containing the quantity of medicine given to the patients it will be found that there is a leap from forty-five to seventy-five grains.

From this table it is seen that the total number of fits taken by the patients in three weeks diminished from 398, when the patients were taking no medicine, to forty-eight when they were taking 150 grains a day. But as there were only twenty patients under observation at the latter period, and twenty-nine at the former, we have to look to the last column to ascertain the ratio of fits to each patient. From this we see that the average number of fits taken by each patient was 13·5 with no medicine, that it fell to 11·9 under fifteen grains a day, to 9·3 under thirty grains; there was a leap up to 12 under forty-five grains, but that this increase was accidental seems to be shown by the number falling to 6 under seventy-five grains, and to 2·3 under ninety grains. This was the lowest point reached. After this, while the patients were taking from 105 up to 150 grains daily, the number of fits remained wonderfully uniform, not varying much from 2·4 to each patient. I kept them for ten weeks on 150 grains daily, and the average number of fits remained very uniform during all that time. The number of patients under treatment was evidently sufficient to give a very uniform and fair average, and to correct the imperfect results of treating individual cases.

The relative number of fits taken by the patients from six o'clock a.m. till eight o'clock p.m., as compared with those taken from eight p.m. till six a.m., was completely altered by the medicine. During the thirteen weeks which elapsed from the time the patients were placed under observation until they began to take twenty-five grain doses of the medicine, the number of fits taken during the day greatly exceeded those taken during the night, while after that time the fits taken during the night always exceeded those taken during the day. When taking no medicine the night fits were only eighty per cent. of the day fits; after they had taken fifty grain doses of the medicine for ten weeks, the night fits were twice as numerous as the day fits. The average number of fits to each patient was diminished to about one-sixth, the day fits being lessened to one-twelfth, and the night fits to one-third of those taken with no medicine.

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The above being the results, taking all the patients together, we shall next examine the results in regard to each of the patients separately. In table II. I have given the average weekly number of fits before and after taking the medicine in each case.

TABLE II.

Names.	Average No of fits per week without medicine.	Average No. of fits per week with medicine.	Percentage of reduction.	Names.	Average No. of fits per week without medicine.	Average No. of fits per week with medicine.	Per centage of reduction.
J. G.	36	4·4	718	H. O.	2·3	1·7	35
P. Mc.	5	·8	525	J. F.	2	1·6	25
T. S.	1·5	·3	400	T. J.	3·7	3·2	16
W. G.	4·1	1	310	T. F.	5·5	5·3	4
W. M.	7·2	1·8	300	T. K.	6·2	10·3	...
J. B.	5	1·3	290	F. L.	2	2·4	...
J. B.	7·7	2·4	220	R. S.	1	2·5	...
J. D.	1·7	·6	183	*			
R. M.	3·7	1·6	131	T.W.H.	·84	·1	740
W. L.	2	·9	122	J. Y.	1·81	1	171
J. W.	9·5	4·5	111	R. Mc.	1·23	·7	76
J. B.	14	7	100	J. C.	·3	·2	50
T. W.	1·7	1	70	J. G.	·3	·2	50
J. P.	8	5·2	54	J. S.	·3	·4	...
J. P.	1	·7	43	T. J.	·3	·4	...

This table is so far defective that the average without medicine was only taken, in most of the cases, over four weeks, while with medicine it is over thirty-four weeks. Then, too, the full effect of the larger doses of the medicine is not shown in the table, because in most of the cases the larger doses were vastly more effectual than the smaller doses. But taking the table as it stands, we see that in one-half the

* Below this are patients who took fits at very irregular intervals, in whom therefore I took the average number of fits without medicine over a period of 13 weeks instead of 4.

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cases the number of fits were reduced to or below one-half of their previous number, while in one-fourth of the cases they were reduced to below one-third of their previous number, and in two cases to about one-ninth of the average number taken without medicine. Even this does not at all represent the true result of large doses. In the case of J. G., at the head of the list, who took thirty-six fits per week without medic ne, after he had got up to half drachm doses he had no fits for ten weeks, and only had four fits for sixteen weeks thereafter. The reduction in this man's number of fits, therefore, amounted to 24,000 per cent! In another case, W. M., the average without medicine was 7·2 fits per week, while after he had got up to half drachm doses of the medicine he only had twenty-two fits in twenty-six weeks, amounting to a reduction of 806 per cent. Another case, W. G., had 4·1 fits per week without medicine; after he had got up to half drachm doses, he had only eleven fits in twenty-six weeks. This was a diminution of 876 per cent. Another case, P. Mc., had taken five fits per week, and after half drachm doses, was reduced to seventeen fits in twenty-six weeks, or 670 per cent. T. S., the third in the table, had, on an average, 1·5 fits per week; after he got half drachm doses he only had one in twenty-six weeks, showing a reduction of 3,650 per cent. J. D. had taken 1·7 fits per week, and only took six in twenty-six weeks, being a diminution of 640 per cent. J. F. took on an average two fits per week, while after getting up to half drachm doses of the medicine, he only took thirteen in twenty-six weeks, showing a diminution of 300 per cent. Had those seven patients not been taking any medicine they would have taken 1,495 fits in twenty-six weeks; as it was, they only took 74 fits in that time.

In only five of the twenty-nine cases were the number of fits more numerous after the medicine was taken than before; and in the only one of those (T. K.) in which this was markedly the case, the fits, which had been most severe before, were quite altered in character, and became much less violent after he took the medicine. He used to throw himself out of bed, and often to bruise himself severely during every fit he took at night before he got the medicine; he never did so afterwards. Another man (J. S.) in whom the fits were slightly more numerous, after getting the medicine became greatly more amiable and improved in mind.

Effect of the medicine on the character of the fits.—In seven cases out of the twenty-nine there was a most marked change

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in the severity and length of the convulsive state, and of the succeeding coma. In two cases, where the patients threw themselves about during some of the fits, and took others in the ordinary way, they have never had one of the former kind since they began to take—the one fifteen grain, and the other thirty grain doses. One lad, who rushed forward with extreme violence during the tonic stage of convulsion, and threw himself out of bed at night, has, to some extent, lost this tendency. In another, the fits, when they do come on, now resemble more the *petit mal*. Besides those nine marked cases, the fits seem, on the whole, less severe in fully half the others. In no case has there been noticed any aggravation of the severity of the fits. In one of the cases I have referred to as throwing himself about during certain of the fits he took, he saw a bright light fully half a minute before the fit. This light became brighter, and seemed to come nearer until it reached his eye, when unconsciousness came on. He tells me he has seen this light on several occasions since he took the medicine, but it never "came near."

Effect of the medicine on the patients' mental state between the fits.—In seven of the patients, the characteristic irritability and tendency to violence of epilepsy were most wonderfully lessened. Not only were the attacks of very marked and extreme irritability after or before fits almost abolished, but their normal mental condition became by far more rational. Those were some of the worst cases in the house. In three cases who had never before been able to go to chapel, to the amusements, or out to work, on account of the fits, they now go regularly to all of these; and consequently, life to them has far more of enjoyment and happiness than it had before.

The condition of these patients as regards comfort and safety to themselves and others, is most markedly improved, yet when the patients were imbecile before, they remained imbecile under the use of the medicine. It must be kept in mind that all the cases were of old standing, and many of them reduced to almost total dementia by the fits. Diminution of nervous and mental irritability was the one characteristic feature in those who benefited by the use of the drug. As the larger doses were approached, some of the patients became very torpid and somnolent. In three cases this was most marked. In two of them the medicine had to be stopped for this reason alone, when they had got up to forty-five grain doses thrice a day. In twelve of the other cases, where the alteration in the mental condition was not quite so great

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as in those seven, there has been on the whole a marked improvement. In ten of them there has been no perceptible change in their mental state. I have referred to one case where there has been a marked improvement in mental state, who has, nevertheless, slightly more fits per week with the medicine than without it.

Of the twenty cases who have taken the medicine all the time, only six of them have been excited or maniacal to any extent, and those on one occasion each, since they had twenty-five grain doses of the medicine. Only two of those had attacks of true epileptic mania.

Effects on the Patients' Weight, Temperature, Pulse, and General Health.—There is scarcely any surer rough test of health among a number of persons subjected to the same conditions as regards diet and exercise, than ascertaining their weight at stated intervals. As a means of testing the effects of any medicine on the general health, given as I gave the bromide of potassium, I regard it as even more valuable. It is impossible that any drug could act as a slow poison without bringing down the weight.

The general weight of the patients remained wonderfully uniform while taking the 5 and 10 grain doses. Taking the united weight of the 27 patients at the end of the 10 grain period,* there was only a loss of two pounds. (See Table 3.)

TABLE III.

Amount of Bromide taken per day.	No. of patients.	Original aggregate weight with no medicine.	Aggregate weights while taking the medicine.	Number who gained in weight.	Number who lost in weight.
30 grains	27	4,136 lbs.	4,134 lbs.	12	15
90 ,,	24	3,663 ,,	3,708 ,,	17	7
120 ,,	20	3,076 ,,	3,132 ,,	14	6
150 ,,	19	2,904 ,,	2,922 ,,	11	8

At that time 15 of them had lost weight, while 12 had gained, but the greatest difference in any one case was only seven pounds. By the time the patients had got up to half drachm doses there was an increase of 45 pounds in the united weight

* Two of the patients were boys whose weight was regularly increasing as they grew, so that I did not include them.

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of the 24 who were then taking the medicine. When they had been three weeks on 40 grain doses their united weights amounted to 56 pounds more than before they were put on treatment. This was an average increase of two pounds and three quarters for each of the 20 who were then taking the medicine, and only six of them had lost weight, while 14 had gained. One man had gained 15 pounds, but, with that exception, the gains had been pretty uniform and equally distributed. The greatest loss had only been five pounds. After the patients had been taking 50 grain doses for ten weeks, the aggregate weight of the 19 then under treatment was still 18 pounds more than it had been at first; but then this showed a loss of 40 pounds since the same patients had been on 40 grain doses of the medicine seventeen weeks before. They had all lost weight in that time except eight, and six of them had lost over six pounds each, while one had lost twenty pounds. The tendency was certainly to lose weight at that time, but this may have been partially accounted for by the fact that the time of year was summer, when most people lose weight. Taking those nineteen patients, eleven of them had gained in weight at the end of the nine months during which they had been under treatment.

There had been a continuous upward tendency, till the doses were forty grains three times a day in the month of March, and then the aggregate weight began to fall.

While the above was the general result, taking all the patients together, yet in four of the five cases in which the medicine had to be stopped on account of its causing ill effects, those patients had been losing in weight for a week or two when the other ill effects were coming on. Practically, the regular weighing of the patients under treatment was a very important matter, indicating, amongst other symptoms, when the drug should be stopped, or the dose lessened. In one of the cases the dose was reduced by one half, and the patient at once began to pick up in weight. The patients lost from three to twelve pounds in a week when the medicine was causing other ill effects.

Temperature.—In a former paper in this journal * I stated that I had found the average temperature of epileptics to be 97·48° in the morning, and 97·38° in the evening. Those results were obtained from the same twenty-nine patients I subsequently put under treatment for epilepsy. The average temperature after the patients had got up to ten grain doses

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was 97·35°; after they had got up to thirty grain doses it was 97·39° in the morning, and 97·27° in the evening. At the forty grain doses it was 97·17° in the morning, and 97·26° in the evening. This showed a slight falling in the temperature. According to the results of my previous investigations a morbid or fatal tendency in any class of cases is soonest and most certainly shown by a rise in the evening temperature over the morning temperature, or an approach to this. No such result seemed to be caused by the medicine up to that point. The average temperature of the twenty cases who continued to take fifty grain doses for ten weeks, was, at the end of that time, 98·16° in the morning, and 97·91° in the evening. This is ·68° higher than the normal morning temperature of epileptics, and ·53° higher than their evening temperature; but the weather was very hot at the time the patients were taking the fifty grain doses, and this may account for the increase at that time.

In the cases where this medicine had to be stopped on account of its ill effects an increased temperature was always observed. In one case it rose to 99·8°, in two others to 100°, and in one to 101·2°. In those cases, too, the evening temperature was always raised above the morning temperature. The lowering of the temperature observed by me at first agreed with recent German investigations into the physiological effects of the drug. When patients are taking many fits, too, in quick succession, their temperature is apt to become higher, and the average temperature might have been lowered on account of the fewer number of the fits taken.

Pulse.—The average normal pulse of the patients was 83 in the morning and 76 in the evening. During the ten grain dose period it was 82 in the morning and 72 in the evening; during the thirty grain dose period it was 83 in the morning, and 73 in the evening; during the forty-grain dose, it was 77 in the morning, and 70 in the evening, and at the end of the fifty grain dose it was 80 in the morning, and 73 in the evening. There was a tendency to fall, therefore, up to forty grain doses.

General Health.—During the time the patients took the medicine, with certain exceptions, they ate well, slept well, and all their bodily functions were unimpaired. It never produced sickness in a single case, except one, and this was obviated at once by being more diluted, and I never could make out that it affected the stomach and bowels in any way whatever. I had not the means of ascertaining its effect on the

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sexual function. It did not seem to impair the energy of the nervous system in the majority of the cases to any abnormal extent. As we have seen, it certainly in many cases reduced the superabundant and morbid energy and irritability. In some of the cases it certainly increased the appetite.

To those general statements there were certain exceptions. Out of the twenty-nine cases the medicine had to be discontinued in five on account of the ill effects it produced. The first case in which these ill effects were seen was in a boy of fifteen, who had taken fits almost from birth, who took an average of 5·5 per week without medicine, and who at the end of eleven weeks from the time the medicine was begun, and when he had been getting twenty-five grain doses for a fortnight, became drowsy and feverish, fell off his food, his tongue became coated with a thick white fur on each side, with a raw line down the middle, he lost weight, and had slight pneumonia at the extreme base of both lungs. In his case the fits had increased in number after the medicine had been pushed beyond ten grain doses, and they increased still more after the medicine was discontinued. In about a week after the medicine was discontinued he was in his usual state of health, with the exception of the increased number of fits, and it was three months before they came down to the average. After that, however, they became very infrequent. The next cases in which ill effects were manifested were two men, the one thirty and the other forty years of age, both of whom had taken fits from childhood, were quite demented, and took about two fits a week on an average. After they had taken the medicine for seventeen weeks, and had got to the end of the 35 grain dose period they both about the same time became drowsy and lethargic to an extreme degree, feverish, their tongues furred, and on examination double pneumonia for about the lower fourth of the lungs was found to exist in both of them. Previously to the coming on of this state the fits had ceased in both cases for about a month. They both recovered, but remained long in a torpid state of mind and body. As they recovered the fits began to come on as usual.

In the other two cases, one twenty-four and the other forty, both of them epileptics for many years, immediately after the two last had exhibited ill effects, and at thirty-five grain doses, the same symptoms began to appear, with the exception of the pneumonia. The medicine was discontinued earlier, being altogether stopped in one of the cases, and reduced to half doses in the other, and they both recovered their usual mental and bodily condition in a fortnight thereafter.

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The torpid state I have described seemed to me to result from a partial suspension and paralysis of the activity of the whole cerebro-spinal system. I could not detect any special effect on the functions of the spinal cord more than on those of the cerebrum. On the whole the drowsiness and mental torpor preceded the bodily inactivity. The tendency to pneumonia seemed distinctly to point to an interference with the functions of the ganglia, from which the roots of the pneumogastric nerve spring. The motor inactivity, indeed, seemed to me to result rather from the want of stimulus from above than from direct paralysis of the cord. I did not notice any marked deadening of the reflex action of the cord. This is not in accordance with recent German investigations into the physiological action of the drug. I observed no affection of the ganglionic system of nerves. In two cases there had been, to begin with, unequivocal signs of partial paralysis of the legs, and the co-ordinating power of the muscles of the legs was much impaired. In one of these the medicine did not aggravate this affection. In the other it did so considerably after the fifty grain doses had been reached, but not till then.

Effects of the medicine on the different varieties of the disease.—Examining the seven cases in which we have seen the medicine to have had most effect in diminishing the numbers of the fits, do we find that they had anything in common as to age, length of existence of the disease, cause of the disease, kind and frequency of the fits, or in any other respect? I shall investigate the same points in regard to the patients in whom the medicine caused ill effects.

Those patients in whose cases the fits were most diminished were of all ages, from twenty-four to fifty-five. In all of them the epilepsy had existed for many years. In three of them, indeed, it had existed from childhood, and in one from puberty. In no respect does there seem to be anything in common. In all of them, indeed, there is a certain amount of intelligence left, but it varies much. In J. G's. case, the patient who was most benefited of any, he is very nervous at all times, being easily startled by impressions on his sensory organs, and the majority of his fits consisted of those in which the body was violently jerked and thrown about with no clonic spasm, and of those he has in the meantime quite got rid. He saw a bright light immediately before those fits came on. They are not invariably the patients who have gained most in weight, or whose bodily health has in any way improved most while taking the medicine. The numbers

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of fits taken by those patients vary considerably, from an average of 36 per week down to an average of one fit. On the whole, however, the good effects of the drug in diminishing the number of fits, and in improving the mental state, were more marked among patients who took frequent fits, than among those who took fits at very rare intervals. All those who took frequent fits were not materially benefited, but in only three cases out of nine, whose average number of fits was one a week or under, were the beneficial effects of the drug very strongly marked. In one such case, while the fits did not come on for fourteen weeks, yet the mental condition of the patient during that time was weaker and less rational than usual. This is the only case in which this result was seen, and it may have been a mere coincidence. Even in that case the irritability was lessened along with the intelligence.

In regard to the causes of the epilepsy in those benefited by the drug, so far as they were assigned or could be ascertained, they were various. In the seven cases most benefited four were from childhood or puberty, it was brought on by drinking in one case, it was the result of a blow on the head in another case, and in another the cause was unknown. In one case where there are marked signs of organic disease of the motor centres, its good results in diminishing the number of the fits were very marked.

All the five cases in whom the medicine produced ill effects had the following characters in common. 1st—They had all taken the fits from childhood. 2nd—They were all demented in mind. 3rd—The fits, in all of them, were frequent, being more than one fit per week. As to age and cause of the disease, they differ much. In only one of the cases is there evidence of organic disease of the nervous centres.

The most effectual Doses of the Drug for Therapeutic purposes.—We have seen that while the patients were taking thirty grain doses thrice a day, the number of fits reached their minimum (Table I.); and that during this period also the maximum number attained an increase in weight (Table II.) At that dose the drug had not produced any ill effects on a single patient, except one boy of fifteen, to whom it was equivalent to twice that dose in an adult. At the thirty-five grain doses the drug had to be discontinued in three cases on account of its ill effects. There had been nothing in the patients' temperature or pulse at all to contra-indicate the continuance of the drug in thirty grain doses, while the dimi-

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nution of their mental and nervous irritability was as great as when they took larger doses.

The most effectual doses of the medicine, therefore, so far as these experiments lead to any result, would seem to be half-drachm doses given three times a day, and considering the total absence of any sickness or other disagreeable effect in the case of any of the patients to whom I gave it in the way I did, there would seem to be some grounds for beginning with smaller doses and giving it after meals.

The limits to which it may be pushed as to time and quantity.—Since I began my experiments the latter part of the enquiry has been worked out by physiological enquirers, and as no increased therapeutic effect was resulting from the increased doses, while there was a tendency among my patients to lose the weight they had gained, and to rise in temperature, I did not consider it justifiable to continue the fifty grain doses longer than ten weeks. Altogether my patients took the medicine for thirty-eight weeks. It having been ascertained by Laborde that 240 grains is a poisonous dose, I saw no use in continuing 150 grains per diem for more than ten weeks. It might well have been that the hot weather was causing the rise in temperature and the loss in weight among my patients, but I could not be sure of this. My investigation was a therapeutical, rather than a physiological one.

To what extent are the effects of the drug permanent?—After my patients had ceased to take the medicine, the number of fits taken in three weeks by the 20 patients who had been taking the medicine was 150, being 18 in the first week after giving it up, 76 in the second week, and 56 in the third week. In the fourth week the number fell to 39; but even this was four times more numerous than when taking the medicine. In the fifth week they took 46 fits, and two of them had maniacal attacks. Thus, instead of 2·3 fits per patient for three weeks, the number at once rose to 7·5, when the medicine was discontinued. In 5 cases the fits in these three weeks were more frequent than they had been at first; in 13 cases they were fewer, and in two they were equal in number. The man who took most frequent fits, and was most nearly cured, took only one fit in the first three weeks; but in the fifth week he began to "see the light," very frequently and very near. After this I began the medicine in all the cases.

General observations in regard to the effects of the medicine.—The preceding observations may be considered to some extent satisfactory, and to some extent unsatisfactory. My first object

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was to attain scientific accuracy in the method of making the experiments. Without this no accurate results could possibly have been attained. Certain of the results, viz., those relating to then umber of the fits, to the patients' weight, temperature, and pulse, and to the doses of the medicine, may be regarded as accurate so far as the number of cases under treatment can give any result. If the experiments were repeated in a sufficient number of cases, general laws might be laid down in regard to those points. The results in regard to the mental state, the general health, the character of the fits, and the varieties of the disease where absolute accuracy of observation is unattainable, may point towards the truth; but the number of observations on these points would require to be increased a thousand fold to establish general laws. Still, the knowledge arrived at by such a series of experiments, limited as their number was, is as light itself compared to the darkness of mind resulting from treating selected, scattered cases in the usual unsystematic, unscientific manner. I think that if we treated all our patients in asylums (where we have ample opportunities of doing so) in the same way for five years, we should then perhaps be able to argue the question of the value of medical treatment in insanity. I cannot but think that my observations furnish, at all events, an *a priori* assumption that medical treatment may in certain of our cases do much good.

I have tried the bromide of potassium in all sorts of cases in the same way as in epilepsy, but as yet I have not had a sufficient number of any kind of disease under treatment to give reliable results. In a certain kind of mild insanity that accompanies the change of life in women, I have found it apparently a specific. But then the number of cases of the kind in which I have been able to try it have been very few. I shall have to reserve my observations on this, as well as on the effects of opium in mania, for another communication at some future time.

Summary.—1. Twenty-nine cases of epilepsy of old standing, all having the same diet, and subject to the same conditions, were subjected to systematic treatment by bromide of potassium after their normal condition as to fits, weight, temperature, general health, and mental state, had been ascertained and noted. I gave them gradually increasing doses of the medicine up to fifty grains, three times a day, and the treatment was continued for thirty-eight weeks, every particular in regard to the disease and in regard to their bodily and mental condition being noted every week during that time.

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2. The total number of fits taken by the patients fell gradually under the use of the medicine to one-sixth of their average number without medicine.

3. The fits taken during the day were lessened to about one-twelfth, and those taken during the night to about one-third of the normal number.

4. The reduction in the fits was not uniform in all the cases. In one case it amounted to 24,000 per cent., in one-half of them to more than 100 per cent., and in five cases there was no reduction at all.

5. In one-fourth of the cases the fits were much less severe, in some being less severe, while as frequent as before.

6. In one-fourth of the cases the patients' mental state was very greatly improved. Nervous and mental irritability and tendency to sudden violence were wonderfully diminished in those cases, and they were the worst of the patients in that respect. Attacks of epileptic mania were diminished. In some cases the mental state was improved, while the fits remained as frequent as ever.

7. The majority of the patients gained considerably in weight while the doses were under thirty-five grains three times a day. Their aggregate weight was greater at the end of the thirty-eight weeks than it had been to begin with, though it began to fall after thirty-five grain doses had been reached.

8. The patients' temperature fell somewhat until they got up to fifty grain doses thrice a day.

9. The pulse gradually fell about seven beats up to forty grain doses. After that it rose, but not up to its usual standard without medicine.

10. None of the patients suffered in their general health except five. All the others were benefited in some way, except one,

11. The ill effects produced by the medicine in those five cases were torpor of mind and body, drowsiness, increase of temperature, loss of weight, loss of appetite, and in three of them slight double pneumonia.

12. The cases most benefited by the drug were very various as to the causes, number, and character of the fits, age, and in every other respect. On the whole the cases who took most fits benefited most.

13. The cases in whom the medicine had ill effects had all taken fits from childhood, were all very demented in mind, and took more than one fit per week, but seemed to have nothing else in common.

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14. The diminution of the fits and all the other good effects of the medicine reached their maximum in adults at thirty grain doses three times a day, while ill effects were manifested when thirty-five grain doses three times a day were reached.

15. There seemed to be no seriously ill effects produced in twenty of the cases by fifty grain doses of the medicine thrice a day, continued for ten weeks.

16. When the medicine was entirely discontinued in all the cases the average number of fits increased in 5 of the cases benefited, to or beyond their original number in four weeks; in 13 cases they remained considerably less. The total average during that time was a little more than one half the number of fits taken before the medicine was given, and the greatest number of fits occurred in the second week after the medicine was discontinued.

The Distinction, physiologically and psychologically considered, between Perception, Memory; Sensation, and Intellect: By The Rev. W. G. Davies, B.D., Chaplain, Joint Counties' Asylum, Abergavenny.

Perception we define to be the intellectual and presentative consciousness of objects of any kind, internal or external, and the primary gateway of knowledge. In every perception the object is a most prominent feature. It is in the invariable presence of the object in perception, and its absence from memory and imagination, that we behold the striking difference which there is between it and the latter; and it is on this distinction the universal assurance is grounded that what we perceive is different from what we remember or imagine. In every perception there is an intellectual and a sensational element, and memory proper is the persistence of the intellectual element after the sensational element has disappeared from consciousness, or after the peripheral nerves have ceased to excite the sense-centre. In no instance have we been able, by any amount of effort, to make an act of memory or imagination seem a perception; yet Hume divided perceptions into two classes, as distinguished by their different degrees of force and vivacity. The less lively he named thoughts and ideas; the more lively, impressions. Professor Bain seems to take the same view of the question. In refer-

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