

committing myself to any positive statements concerning the forms of mental derangement in which electrification is most likely to prove successful. It has not yet been tried on a sufficiently wide scale to furnish us with the data necessary for such generalisations. States of depressed nerve-action seem, however, to have hitherto yielded most successes. Certain sensory paræsthesiæ hallucinations have likewise been stated to be amenable to appropriate galvanisation. Symptoms of excitement indicate that the utmost prudence is required in, if they do not forbid, the application of galvanic treatment. But it is obviously among those who are still hovering on "the borderlands of insanity," rather than among those who have for years passed the limits and have become confirmed inmates of our asylums, that the most fruitful field for electro-therapeutic activity will be found. An interesting field, too, the very paucity of implements for whose cultivation, should make the physician loth of allowing a single one, however humble, to escape him; a field the fruits of which—human reasons reclaimed—even if scanty in number are sufficiently valuable to stimulate us to the utmost efforts. It was with this thought in my mind that I ventured to offer these remarks to the readers of the *Journal*; for, as Littré so truly remarks, if the responsibility of the physician is great, his power is limited; whilst the narrower these limits, the more sacred is his duty to explore every inch of ground within the fatal precinct.

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*Clinical Observations on the Blood of the Insane.* By S. RUTHERFORD MACPHAIL, M.D.Edin., Assist. Med. Supt., Garlands Asylum, Carlisle; being the Essay to which the prize of £10 10s., together with the bronze medal of the Association, was awarded in 1884.

(Concluded from p. 389.)

### III.

While the condition of the blood vessels in General Paralysis has been a subject of discussion by many observers, and the state of the pulse, including sphygmographic tracings, has engaged the attention of Thompson\* and others, I have been

\* West Riding Reports, Vol. i.

unable, in the literature to which I have had access, to find reference to any observations on the state of the blood in this disease.

With the object of ascertaining the condition of the blood in General Paralysis, I selected five typical examples of male general paralytics at three different stages of the disease, and examined their blood. The three periods selected were (1) on admission, (2) in the demented and lethargic condition, and (3) in the bedridden and completely paralysed stage. The results are given in tabular form (C).

C. Tables showing the Quality of the Blood in Male General Paralytics at three different stages of the disease.

I. FIVE GENERAL PARALYTICS ON ADMISSION.

No.	Age.	Probable Duration of Disease.	Percentage of Hæmoglobin.	Percentage of Hæmacytes.	Proportion of White to Red Corpuscles.
1	40	6 mos.	68	89·2	1 to 280
2	36	12 mos.	62	88·1	1 to 350
3	32	9 mos.	66	88·4	1 to 260
4	45	3 mos.	70	90·3	1 to 310
5	48	4 mos.	65	87·6	1 to 340
Averages	40·2	6·8 mos.	66·2	88·7	1 to 308

II. FIVE GENERAL PARALYTICS OVER SIX MONTHS AFTER ADMISSION.

No.	Age.	Period of Residence.	Percentage of Hæmoglobin.	Percentage of Hæmacytes.	Proportion of White to Red Corpuscles.
1	32	Over 3 years	75	89·9	1 to 250
2	54	„ 9 mos.	65	87·6	1 to 130
3	67	„ 1 year	72	85·3	1 to 180
4	52	„ 1 year	70	84·4	1 to 180
5	38	„ 9 mos.	68	85·3	1 to 140
Averages	48·6	Over 15 mos.	70	86·5	1 to 176

## III. FIVE GENERAL PARALYTIKS IN LAST STAGE, BEDRIDDEN AND PARALYSED.

No.	Age.	Period of Residence.	Percentage of Hæmoglobin.	Percentage of Hæmacytes.	Proportion of White to Red Corpuscles.
1	49	Over 18 mos.	58	77·6	1 to 140
2	51	„ 16 mos.	64	81·1	1 to 140
3	42	„ 8 mos.	55	68·9	1 to 110
4	50	„ 6 mos.	66	82·5	1 to 120
5	45	„ 9 mos.	60	80·4	1 to 110
Averages	47·4	Over 11 mos.	60·6	78·1	1 to 124

From an analysis of the first of these tables we find that the average percentage of hæmoglobin is 30 per cent. below the normal standard, and that in individual cases, with one exception (No. 5), the longer the probable duration of the disease the lower is the percentage. The percentage of hæmacytes is also diminished, though to a less extent; and as in the case of the hæmoglobin, with one exception (No. 5), this decrease is coincident with the duration of the disease. The proportion of white to red corpuscles is increased, but this increase does not appear to vary in the same ratio as the hæmoglobin and hæmacytes with the duration of the disease.

The second table is composed of patients in the quiescent stage of the disease, who have resided in the asylum for an average of over fifteen months. The most noteworthy features in this series are an increase in the percentage of hæmoglobin and in the proportion of white to red corpuscles, and a decrease in the percentage of hæmacytes. An interesting point in this table is that, contrary to what one might expect from the preceding table, the percentage of hæmoglobin is higher, and the proportion of white to red corpuscles is lower in relation to the length of residence of the individual patients. There is also a similar increase in the relative proportion of hæmacytes, but there are two exceptions (Nos. 2 and 4) to this. The average percentage of hæmoglobin is higher, and the average percentage of hæmacytes is lower, than in the case of ordinary demented patients at the same age.

The third group is selected from advanced cases of paresis. In two instances (Nos. 1 and 3) the patients died on the day succeeding the observations, and in both these cases the percentages of hæmoglobin and of hæmacytes are very low. In

all the five cases the relative proportions of hæmoglobin and hæmacytes are much below the percentages in either of the preceding groups. The proportion of white to red corpuscles is much increased.

In the last group the blood in each instance was dark, venous in character, and drawn with difficulty from the finger. In the hæmacytometric observations the individual corpuscles were so irregular in outline and deformed that it was deemed advisable to examine the blood on a slide in the ordinary way. The white corpuscles were much increased; there was little tendency of the red corpuscles to form rouleaux; in all the cases the individual corpuscles were crenated; in two they were irregular in outline, and in one observation many of the corpuscles were tailed or had processes. In two cases in the second group the blood contained a large number of corpuscles of small size; in two the larger proportion of the corpuscles were crenated; and in one their outlines were irregular. In both the first and second groups the blood was darker than normal. Small granule cells were observed in four instances in the first series, twice in the second, and not at all in the last series.

These observations may be summarised thus:—

(1) The percentage of hæmoglobin is low on admission, it improves in the quiescent stage of the disease, and falls again in the paralytic stage.

(2) The red corpuscles deteriorate both in quality and quantity coincident with the progress of the disease.

(3) Small granule cells are not present in the blood during the last stage.

(4) The relative proportion of white to red corpuscles is increased, and this increase is coincident with the progress of the disease.

Defective nutrition of the body, including anæmia, has long been recognised as a predisposing cause of epilepsy. In idiopathic epilepsy no constant anatomical lesion has been discovered, and it may therefore be inferred that the lesion is a molecular one. According to Nothnagel's theory, continued excitation of the vaso-motor centre is the necessary pathological condition of the epileptic paroxysm. In other words, he believes that irritation of the vaso-motor centre causes contraction of all the arteries of the body, including those of the brain; and that the anæmia caused by the contraction of the vessels of the brain is the active factor in producing epilepsy. He has not, however, so far as I am aware, supplemented this theory by recording a series of observations on the blood of epileptics.

In this asylum all the male epileptic patients, with three exceptions, have, as part of their routine treatment, continuous doses of Bromide of Potassium (grs. xxx thrice daily), and many of the patients have had this treatment with occasional intermission for a number of years.

With the object of determining whether the blood is deteriorated in patients suffering from epilepsy, as Nothnagel's theory suggests, I have examined the blood in a series of epileptics. As all the patients were being treated with continuous doses of Bromide of Potassium, I have taken as the bases of my observations the length of time this treatment had been carried on.

D. Tables showing Condition of the Blood in Male Epileptic Patients treated with 90 grain doses daily of Bromide of Potassium for different periods.

I. FIVE EPILEPTIC PATIENTS ON ADMISSION.

No.	Age.	Percentage of Hæmoglobin.	Percentage of Hæmacytes.	Proportion of White to Red Corpuscles.
1	45	65	87·9	1 to 320
2	20	68	82·4	1 to 350
3	38	68	82·9	1 to 220
4	26	60	76·9	1 to 200
5	27	62	81·3	1 to 410
Averages	31·2	64·6	82·28	1 to 300

II. FIVE PATIENTS WHO HAVE TAKEN BROMIDE OF POTASSIUM CONTINUOUSLY FOR MORE THAN TWO AND LESS THAN FIVE YEARS.

No.	Age.	Percentage of Hæmoglobin.	Percentage of Hæmacytes.	Proportion of White to Red Corpuscles.
1	29	68	88·5	1 to 350
2	27	70	92·7	1 to 220
3	29	72	93·8	1 to 190
4	34	72	88·2	1 to 380
5	22	75	89·4	1 to 400
Averages	28·2	71·4	90·52	1 to 308

III. FIVE PATIENTS WHO HAVE TAKEN BROMIDE OF POTASSIUM CONTINUOUSLY FOR MORE THAN TWO AND LESS THAN FIVE YEARS.

No.	Age.	Percentage of Hæmoglobin.	Percentage of Hæmacytes.	Proportion of White to Red Corpuscles.
1	23	75	87·9	1 to 500
2	44	60	85·4	1 to 380
3	33	74	89·2	1 to 380
4	33	75	90·8	1 to 310
5	31	80	93·2	1 to 240
Averages	32·8	72·8	89·3	1 to 362

IV. FIVE PATIENTS WHO HAVE TAKEN BROMIDE OF POTASSIUM CONTINUOUSLY FOR MORE THAN TEN AND LESS THAN FIFTEEN YEARS.

No.	Age.	Percentage of Hæmoglobin.	Percentage of Hæmacytes.	Proportion of White to Red Corpuscles.
1	36	60	85·2	1 to 400
2	33	75	96·3	1 to 340
3	49	70	90·1	1 to 260
4	32	80	93·2	1 to 260
5	35	72	89·6	1 to 340
Averages	37	71·4	90·9	1 to 360

V. FIVE PATIENTS WHO HAVE TAKEN BROMIDE OF POTASSIUM CONTINUOUSLY FOR OVER FIFTEEN YEARS.

No.	Age.	Percentage of Hæmoglobin.	Percentage of Hæmacytes.	Proportion of White to Red Corpuscles.
1	53	70	89·6	1 to 440
2	41	70	86·2	1 to 480
3	32	60	85·7	1 to 560
4	53	75	90·6	1 to 380
5	66	65	90·7	1 to 220
Averages	49	68	88·56	1 to 416

Clouston \* states that patients gain in health and weight while taking average doses of Bromide of Potassium, and his observations are corroborated by Hughes Bennett † in a recent paper on the prolonged administration of the Bromides in Epilepsy.

Analysing the tables (D) we find:—(1) As to hæmoglobin, that on admission the average percentage is considerably below the normal standard; that the blood improves in this respect during the first 10 years of treatment, after which there is a slight decrease; and that the percentage of hæmoglobin in epileptic demented is slightly higher than in ordinary demented at the same age. (2) That the average amount of hæmocytes in the blood of Epileptic patients when admitted is almost 20 per cent. below the normal standard; that with slight fluctuations the blood improves during the next 15 years, after which there is a slight deterioration; and that the percentage of hæmocytes is a fraction higher in epileptics than in demented at the same age. (3) That the proportion of white to red corpuscles diminishes in ratio to the period of residence. (4) That the quality of the blood improves during treatment with bromide of potassium, and that the prolonged use of the drug exercises no deteriorating influence in decreasing the percentages of hæmoglobin and of hæmocytes.

There was considerable variation in the size of the individual corpuscles. In two instances more than one-fourth of the hæmocytes were of large size. These cases were Nos. 1 and 2 in Table III., and probably this fact influenced the average percentage in this group; for, as I have already stated, the larger the individual corpuscles, the fewer can be counted in the square of the hæmacytometer. In Nos. 2 and 4 in Table IV. the larger proportion of the corpuscles were small in size, and this, of course, would affect the general average in the opposite direction. In several other instances the blood-cells were of varying size, but not to such a marked extent as in any way to affect the results. Crenated corpuscles were observed in about half the cases, and cells with irregular outlines were occasionally met with. Small spherical bodies were noticed in a large proportion of the cases, especially in the first three groups.

#### IV.

In order to ascertain what variations occur in the blood of patients subject to periodic attacks of excitement, I selected

\* "Journal of Mental Science," Oct., 1868.

† "Lancet," 1884, Vol. i, page 883.

six female patients of this class and made a series of observations on their blood. The number of observations was 68. As it is difficult to represent the results in a tabular form without taking up more space than the limits of a short paper will allow, I shall not attempt to do more than summarise the series of observations as briefly as possible.

In two instances the observations represent a period of one year. Twenty-three observations in the case of one, and 20 in that of another patient. In other two the observations were taken over a period of nine months, eight in one case, seven in another. In the two remaining cases five observations were made on each, within a period of six months. The ages of the patients varied from 18 to 44 years, and with one exception they had resided in the asylum for over a year. The observations were made on each patient in all the various stages of the attacks of excitement, and also in the intervals between the attacks when the patient was either in a quiescent, partly demented condition, or on the other hand was to all appearance in a normal mental state.

In the two patients in whom the observations were continued periodically for a year each passed through seven attacks of excitement, varying in duration from 30 hours to two months. In the cases where the observations represent a period of nine months' duration, and in one of those during a period of six months, there were three attacks of excitement in each. In the remaining case there were two outbursts of maniacal excitement. Of these six individuals two have been discharged recovered, one has drifted into dementia, and three continue to have periodic attacks of excitement.

The weights of the patients were taken periodically. Considerable variation occurred in each instance. One patient lost 12lbs. in one month during a prolonged attack of excitement, while another gained 8lbs. in three weeks of freedom from excitement between two attacks. Short periods of excitement had little effect in altering the weight, but when a maniacal outburst lasted over a fortnight there was usually a sensible diminution in weight. The two cases which recovered were those which showed the least depreciation in weight even during the periods of excitement, and were likewise those in which the greatest gain in weight took place.

The percentage amount of hæmoglobin varied from 56 to 80. The lowest percentage occurred during the fifth week of an attack of excitement, the highest was registered when the patient had kept free of excitement for 28 days, and two days



before the commencement of another maniacal outburst. The greatest variation in an individual case was from 58 per cent. to 80 per cent. In the earlier period of the attacks of excitement the hæmoglobin in many instances did not diminish in quantity, and in two instances the patient passed through an attack of excitement of a week's duration, leaving the percentage of hæmoglobin higher at the end of the attack than it was at the commencement. This, however, was exceptional, and in 14 of the 25 attacks of excitement represented by these six individuals, the amount of hæmoglobin diminished during the attack; in the remaining nine attacks no change in the percentage of hæmoglobin was recorded. With a few trivial fluctuations, the decrease in the percentage of hæmoglobin progressed in apparent ratio with the length and severity of the attack of excitement.

The lowest percentage of hæmacytes recorded was 79·7, and the occasion was the 13th day of an acute attack of excitement which rapidly followed a similar attack lasting one month. The highest percentage (93·6) occurred in the same patient during convalescence from a third attack of excitement. This patient had no further relapse, and has since been discharged recovered.

The greatest fluctuation in the amount of hæmacytes in the three cases which remain *in statu quo* is also worthy of remark. In one case the highest percentage (91·8) was registered on the seventh day, after an attack of excitement had passed off; the lowest (81·3) on the 19th day of an acute maniacal attack. In the second case the highest percentage (88·7) occurred on the second day of an acute attack of excitement, the patient having been quiet for three weeks previously, the longest period of freedom from excitement during the year; the lowest percentage (80·7) on the third day after settling down from an attack of excitement which had lasted two months. In the third case the highest percentage was 89·6, and the lowest 84·5; the one occurred during a period of freedom from excitement, the other during a prolonged maniacal seizure.

In the 68 observations with the hæmacytometer 30 were taken when the patients were free of excitement, 38 while they were in an excited state. The average of the first observations was 87·8, that of the second series 84·8 per cent. Thus we see that, taking the cases in bulk, there was a decrease of three per cent. in the observations made while the patients were excited. Though there are a few exceptions, this fact is brought out in an examination of the individual cases and of the

individual attacks. As in the case of the hæmoglobin, the decrease apparently progresses in relation to the length and severity of the attack of excitement. Another noteworthy point is that the decrease in the percentage of hæmacytes during an attack of excitement progresses more rapidly than the increase during convalescence or between attacks. For example, in one case the percentage of hæmacytes decreased in 14 days during an attack of excitement from 87·5 to 81·3; for the next fortnight the patient kept free of excitement, and during that time the percentage only increased to 84·4.

The proportion of white to red corpuscles varied from 1 in 170, to 1 in 480. The average of the 68 observations was 1 in 312. There were considerable variations in the proportions in each of the six cases, the proportions in one individual fluctuating between 1 in 210, and 1 in 410. These fluctuations, however, did not occur in any constant ratio to the mental condition of the patients at the time of the observation. Although the proportion of white corpuscles was higher in the observations during the periods of freedom from excitement (30 observations, 1 in 317; 38 observations, 1 in 308), the variations were so numerous and irregular that no general conclusion was possible. Crenated corpuscles were observed more frequently in the periods of quiescence than when the patients were excited. Small and irregular forms were more numerous during the excited stage, while small granule cells were observed with equal frequency at both periods.

A more extended series of observations and greater frequency of examination in individual cases are necessary before one is justified in forming many deductions from the foregoing researches on the blood of female patients subject to attacks of periodic mania. There is one possible source of fallacy to which my attention was not drawn till I had completed my observations, and which in a great measure detracts from the scientific value of this portion of the subject. I refer to the influence of the catamenia in lowering the percentage of the blood corpuscles. Hunt \* in a large number of observations on chlorotic anæmia, has shown that a definite numerical fall in the number of hæmacytes occurs shortly before the onset of the menstrual flow, and other observers, notably Gowers † and Willcocks' ‡ have made similar statements. It would be

\* "Lancet," July 17th, 1880.

† "Practitioner," Vol. xxi, p. 11.

‡ "Practitioner," Vol. xxxi, page 103.

advisable, therefore, in view of this statement, to pay attention to the menstrual period in any further observations.

I therefore submit the following deductions, recognising that the results may possibly be fallacious:—

(1.) Prolonged periods of excitement cause a reduction in weight.

(2.) The percentage of hæmoglobin is less during an attack of excitement than in the periods of quiet preceding and following the attack.

(3.) During an attack of excitement the average amount of hæmacytes is less, and small forms are more numerous than in periods of freedom from excitement.

(4.) Maniacal attacks do not appear to influence to any great extent the relative proportion of white to red corpuscles.

(5.) The more prolonged and severe the attack of excitement the greater is the deterioration in the quality of the blood.

## V.

The tables in this section (E 1 and E 2) represent fifteen consecutive admissions of either sex. These may, I think, be regarded as fairly typical examples of the class of patients admitted to asylums. None of the cases were transfers from other asylums.

The points in the tables which call for special comment are—

(1) The ages of the male patients vary from 20 to 58 years, average 36·5 years; the females from 21 to 63 years, average 35·4 years. There appears to be no uniform relation between the ages of the respective individuals and the quality of their blood. (2) The weights also show considerable variation, between 108 lbs. the lowest and 164 lbs. the highest for men; and 83 lbs. and 154 lbs. for women, the respective average weights being 136·7 lbs. and 110·2 lbs. The relation of the weight to the quality of the blood is by no means constant, although the blood of the larger proportion of the heavier patients is richer in hæmoglobin and in hæmacytes than in the case of the male patients whose weights are below 128 lbs., and the female patients below 100 lbs. (3) The duration of the mental symptoms on admission varies from one week to four years in men, and from three days to two years in women. There appears to be some connection between the duration of the attack and the amount of hæmoglobin and hæmacytes in the blood. In the male series, of six cases with a percentage of hæmoglobin of 70 or over, in five the symptoms had lasted under a month, while in three of the four highest percentages

of hæmacytes the mental disease was of short duration (ten days and under). A prolonged duration of attack does not however necessarily cause a deterioration, for in the four cases where the symptoms had lasted a year and upwards the average amount of hæmoglobin is 68, and the average of hæmacytes 87 per cent., or a fraction above the averages in the tables. While the exceptions are more numerous in the female group, in these also the blood appears to deteriorate in quantity of hæmoglobin and hæmacytes *pari passu* with the length and severity of the attack. (4) The quality of the blood varies considerably in the different types of mental disease. In the three epileptics in Table E. I., the average amount of hæmoglobin is 2 per cent. below the average for the fifteen cases, while the average percentage of hæmacytes is reduced to 80·7. General Paralytics also have a low percentage of hæmoglobin, while the amount of hæmacytes is above the average in the table. In the melancholic type the hæmoglobin is below, and the hæmacytes are above the general averages. The highest percentages of hæmoglobin and hæmacytes are found in the three cases of acute mania, and in one patient suffering from *delirium tremens*. In the remaining cases of mania there are considerable fluctuations in the quality of the blood. In Table E. II., the average percentages of hæmoglobin and hæmacytes in the eight cases of mania are 61 and 78; in the five cases of melancholia 59·2 and 81·5. In other words, the hæmacytes are below the average of the fifteen cases in mania, while the hæmoglobin is decreased and the hæmacytes are increased in melancholia. (5) Seven men and seven women are stated to be in weak bodily health. Only three of these had active physical disease, viz., one man convalescing from an attack of pneumonia, and two women in a very feeble state suffering from bronchitis. The bodily health does not appear to affect the quality of the blood in a uniform ratio, for the three patients, physically ill, occupy a middle position in the series in this respect, and one female in good bodily health has a low percentage of hæmoglobin and hæmacytes. (6) In males the percentage of hæmoglobin is almost 30 below the normal standard, the average of the fifteen cases being 67·2, the same amount as registered in the case of demented of the same age. In females the percentage varies in individual cases from 50 to 70, with an average amount of 61, or 24 per cent. below the normal standard. (7) The average amount of hæmacytes is 86·9 per cent. for men, and 80·4 for women. In no case does the amount reach the normal standard, and in the male series

E. I.—TABLE OF FIFTEEN CONSECUTIVE MALE ADMISSIONS.

No.	Age.	Weight in lbs.	Duration of Attack.	Mental Disease.	Bodily Health.	Percentage of Hæmoglobin.	Percentage of Hæmocytes.	Proportion of White to Red B. C.
1	40	164	Over a year ...	Melancholia ...	Weak ...	68	89.1	1 to 3:0
2	55	158	10 weeks ...	General Paralysis ...	Weak ...	66	86.4	1 to 2:60
3	43	154	8 days ...	Acute Mania ...	Weak ...	62	90.9	1 to 1:80
4	21	112	One month ...	Mania ...	Average... ..	69	87.1	1 to 2:20
5	20	108	Three years ...	Epileptic Mania ...	Weak ...	68	82.4	1 to 3:50
6	47	140	One week ...	Mania ...	Good ...	70	88.9	1 to 4:80
7	23	122	One month ...	Mania ...	Weak ...	70	87.6	1 to 3:20
8	20	112	Two years ...	Mania ...	Average... ..	74	90.5	1 to 2:20
9	52	142	10 days ...	Mania à potu ...	Weak ...	78	90	1 to 2:80
10	36	151	14 days ...	General Paralysis ...	Average... ..	62	88.1	1 to 3:50
11	32	140	One week ...	Mania ...	Good ...	70	84	1 to 2:20
12	38	134	Three months ...	Epileptic Mania ...	Average... ..	68	82.9	1 to 2:20
13	34	136	Two days ...	Acute Mania ...	Average... ..	70	90.9	1 to 3:20
14	26	128	Two weeks ...	Epileptic Mania ...	Average... ..	60	76.9	1 to 2:00
15	48	150	Four years ...	Melancholia ...	Weak ...	62	86.1	1 to 3:80
Averages	36.5	136.7				67.2	86.92	1 to 2:89

E. II.—TABLE OF FIFTEEN CONSECUTIVE FEMALE ADMISSIONS.

No.	Age.	Weight in lbs.	Duration of Attack.	Mental disease.	Bodily Health.	Percentage of Hæmoglobin.	Percentage of Hæmacytes.	Proportion of White to Red B. C.
1	21	128	One month ...	Mania ...	Average ...	58	78	1 to 200
2	34	90	Two weeks ...	Melancholia ...	Weak ...	50	80·5	1 to 280
3	33	100	Two months ...	Mania ...	Average ...	65	85·9	1 to 300
4	30	100	One year ...	Mania ...	Weak ...	56	64·2	1 to 360
5	35	112	Three months ...	Melancholia ...	Average ...	64	76·3	1 to 260
6	41	104	Two weeks ...	Mania ...	Average ...	62	77·7	1 to 400
7	63	90	One week ...	Dementia... ..	Very feeble ...	62	84	1 to 260
8	31	83	Two years ...	Melancholia ...	Very weak ...	60	82·1	1 to 400
9	26	132	Three months ...	Mania ...	Average ...	70	88·2	1 to 280
10	22	154	Three weeks... ..	Mania ...	Good ...	58	76·7	1 to 420
11	27	112	Seven months ...	Melancholia ...	Average ...	62	82·6	1 to 300
12	37	104	Two years ...	Melancholia ...	Average ...	60	86·1	1 to 440
13	50	121	Three days ...	Mania ...	Weak ...	65	79·3	1 to 250
14	52	110	One year ...	Mania ...	Weak ...	60	78·1	1 to 340
15	29	114	One week ...	Puerperal Mania ...	Weak ...	64	86·3	1 to 210
Averages	35·4	110·2				61	80·4	1 to 320

F. I.—TABLE OF TEN CONSECUTIVE MALE RECOVERIES.

No.	Age.	Weight.		Period of Residence.	Mental Disease.	Percentage of Hæmoglobin.		Percentage of Hæmacytes.		Proportion of White to Red Corpuscles on Discharge.
		On Admission.	On Discharge.			On Admission.	On Discharge.	On Admission.	On Discharge.	
1	42	160	175	Over 2 months ...	Melancholia ...					1 to 350
2	22	146	161	Over 1 month ...	Acute Mania ...	70	82	90.5	101.7	1 to 190
3	60	166	166	Over 4 months ...	Melancholia ...	62	76	84.7	91.5	1 to 340
4	39	158	164	Over 1 month ...	Mania ...	70	72	88.8	97.4	1 to 440
5	45	130	150	Over 5 months ...	Mania ...	70	80	88.9	97	1 to 420
6	27	126	142	Over 19 months ...	Mania ...		85		92.7	1 to 300
7	75	150	174	Over 3 months ...	Melancholia ...	58	86	75.9	87.9	1 to 440
8	52	142	151	Over 1 month ...	Mania à potu ...	78	70	90	92.1	1 to 380
9	15	101	115	Over 6 months ...	Mania ...	60	84	77.3	91.3	1 to 320
10	29	164	168	Over 15 months ...	Mania ...		75		95.7	1 to 280
Averages	40.6	144.3	156.6	5.7 months		*66.8	79.0	*85.1	93.82	1 to 344

\* Average of seven observations.

F. II.—TABLE OF TEN CONSECUTIVE FEMALE RECOVERIES.

No.	Age.	Weight.		Period of Residence.	Mental Disease.	Percentage of Hemoglobin.		Percentage of Hemocytes.		Proportion of White to Red Corpuscles on Discharge.
		On Admission.	On Discharge.			On Admission.	On Discharge.	On Admission.	On Discharge.	
1	21	128	138	Over 3 months ...	Mania ... ..	58	80	87.1	94	1 to 220
2	28	93	129	Over 5 months ...	Puerperal Mania	65	78	76.2	91.1	1 to 580
3	30	124	124	Over 6 months ...	Melancholia ...	65	78	87.9	91.5	1 to 340
4	22	106	124	Over 4 months ...	Mania ... ..	55	65	81.4	90.2	1 to 280
5	20	126	124	Over 18 months ...	Melancholia ...	62	70	84.3	90.9	1 to 240
6	32	134	138	Over 4 months ...	Mania ... ..	58	85	82.7	95.5	1 to 210
7	40	126	154	Over 19 months ...	Melancholia ...	58	78	82.7	93.1	1 to 320
8	19	92	138	Over 10 months ...	Acute Mania ...	58	75	82.7	92.1	1 to 450
9	33	112	114	Over 19 months ...	Mania... ..	60	80	80.5	88	1 to 430
10	50	136	154	Over 8 months ...	Melancholia ..	60	78	80.5	91.6	1 to 220
Averages	29.5	117.7	133.7	8.6 months		*60.4	76.7	*82.8	91.8	1 to 329

\* Average of seven observations.



the average is 3 per cent. below that of demented at the same age. (8) The average proportion of white to red corpuscles is increased, especially in the male admissions. In individual instances the fluctuations appear to bear no definite ratio either to the duration of attack or to the mental disease, although, speaking generally, the increase is more obvious when the attack is of short duration, and in the types of mental disease represented by Acute Mania, General Paralysis, and Epilepsy. The individual corpuscles in this series were regular, and, for the most part, uniform in size, though cells of small size were seen in several of the observations. Small granule-cells were seen in less than a third of the cases.

## VI.

An examination of the blood of ten consecutive recoveries of either sex, as represented in the foregoing tables (F. I. and F. II.), furnishes us with some interesting and very uniform results:—The average age of the men is more than 10 years over that of the women. With two exceptions, one male who remained stationary and one female who lost 2 lbs., there is a uniform gain in weight in these patients during their residence in the asylum. The average amount gained by men is 12·3 lbs. in 5·7 months; by women 16 lbs. in 8·6 months. Some of the gains in weight are very remarkable, one man gaining 24 lbs. in three months, another 20 lbs. in five months, and a third 15 lbs. in two months, while one woman gained 46 lbs. in nine months, another 36 lbs. in five months, and a third 18 lbs. in four months. In seven cases of either sex the blood was examined on admission, the remaining six cases having been admitted before I commenced the series of observations. Without an exception, the blood in these cases is richer in hæmoglobin and in hæmocytes on discharge than when the patients were admitted. In males the average percentage of hæmoglobin on admission is 66·8, that of these seven cases on discharge 77·4, while the average for the ten cases is 79. The average percentage of hæmocytes is 85·1 on admission, that of the seven cases on discharge 92·4, while the average of the ten cases is 93·82. In females the respective percentages are hæmoglobin 60·4 on admission; 77 for seven cases and 76·7 for ten cases on discharge; hæmocytes 82·8 on admission, 92·2 for seven cases and 91·8 for ten cases on discharge. We thus see that there is an individual and a collective gain in the richness of the blood among patients

who recover. The improvement is more noticeable, and the percentages of hæmoglobin and hæmacytes approach more nearly the normal standard, in the case of female recoveries than in those of males. In neither sex does the period of residence or the type of mental disease appear to affect the quality of the blood in any uniform ratio.

The proportion of white to red corpuscles is rather higher than normal, the average being 1 to 344 in men and 1 to 329 in women. The individual corpuscles were regular in outline, and large and small cells were observed with greater frequency than in normal blood. Small forms especially were numerous. Clusters of hæmatoblasts were seen in all the cases.

Of the 20 patients, eight men and seven women had tonic treatment. The average per cent. of hæmoglobin in these 15 cases was 80 for men, 76·8 for women; the average percentage of hæmacytes, men 94·5, women 92·3. In other words the blood showed greater improvement in those who had undergone a course of tonics than in those who had no medical treatment.

## VII.

The influence of tonics on the quality of the blood of patients during the early period of residence in asylums is an interesting and important study. I hope on some future occasion, after making a sufficient number of observations, to treat this subject at greater length than I am able to do at present.

The following remarks are based on a series of 130 observations on 22 individuals—15 men and seven women. The number of observations on individual cases varied from three to ten, and the period of time represented by each series from six weeks to eleven months. Of the 22 cases, eight have recovered, six are convalescing, one has died, and seven have not improved. Tonic treatment was administered to the patients on ordinary general principles, and their blood was examined while they were undergoing the particular line of treatment. By this I mean that the patients were not selected and then given special treatment with the view of collecting data for this enquiry.

For the sake of comparison, I examined the blood of three patients who were not receiving any tonic treatment; these represent 20 of the 130 observations. One case was treated with cod-liver oil, extract of malt, and quassia respectively, two with arsenic, three with iron, seven with iron and quinine, and four with a combination of iron, quinine, and strychnia.

The ages ranged from 16 to 62 years. The only remark

which calls for comment under this head is that the improvement in the quality of the blood was more pronounced in the young, and in those advanced in years, than in the middle-aged. In the aggregate the 22 patients gained 179 lbs in 78 months, or an average of 8·1 lb. in 3·5 months; 18 gained an aggregate of 188 lbs., three lost an aggregate of 9 lbs., and one remained stationary. The average percentage of hæmoglobin in the first observations on each individual, *i.e.*, before the treatment was commenced, was 61; in the last observations, or when the treatment was discontinued, 70. In 18 cases there was a definite increase varying from six to twenty per cent., in two a diminution—eight per cent. in one case, nine per cent. in the other; while two cases did not vary. The average amount of hæmocytes was 81·1 for the first observation, 89·2 for the last. The percentage was increased in twenty cases, the gain fluctuating between 1·9 the lowest and 26·3 the highest amount gained. In two cases there was loss, but in neither instance did this exceed two per cent. The proportion of white to red corpuscles showed considerable variations, but not in any definite direction. The average of the first observation was 1 to 384, of the last 1 to 320. Hæmatoblasts were seen in nearly all of the observations, the exceptions being the first observation in three cases, and the last observation in the individual who died. Many of the red-blood corpuscles throughout the series were of smaller size than normal, and in addition were feebly coloured. In no case did the blood show any marked deterioration after the tonic treatment was discontinued.

The cases which had no medical treatment, and those treated with cod-liver oil and a bitter tonic (quassia), differed from the rest of the series in that there were considerable fluctuations in the quality of the blood at the different periods. In the instances where an increase in the amount of hæmoglobin and hæmocytes was recorded this did not take place uniformly, and the total increase did not amount to 10 per cent. in either case. On the other hand the blood of those in whom iron, either alone or in combination, formed part of the treatment, varied in a definite and particular way. For the first fortnight the hæmoglobin remained stationary, while the amount of hæmocytes was largely increased. In the third and fourth weeks the hæmoglobin continued stationary and the hæmocytes were diminished. During the second month the hæmoglobin was slightly increased in all the cases, while the percentage of hæmocytes increased in the patients progressing towards mental recovery, but diminished in the others. In each instance improvement in the amount of hæmocytes preceded

the increase in the percentage of hæmoglobin. The greatest increase was observed in the cases treated with iron, quinine, and strychnia, next in those treated with iron and quinine, and a less though quite a definite improvement in quality in those treated with iron alone. The blood in the two patients treated for two months with arsenic showed slight variation in the quantity of hæmoglobin and hæmacytes; in both cases the treatment was changed to iron and quassia when a definite improvement took place. Considerable improvement was observed in the case treated with extract of malt. The increase in the amount of the hæmoglobin and hæmacytes was gradual and progressive, and, as in the cases where iron was given, the blood improved in hæmacytes before the percentage of hæmoglobin was much increased. In every instance where there was a marked increase in weight the quality of the blood improved. While this improvement was more noticeable in cases which improved, or were mentally convalescing, it also occurred to some extent in the others.

I have not sufficient data to discuss the effect of mental relapses and maniacal outbursts in these cases, and I regret that the limits of the paper prevent my giving the whole series of observations in tabular form. The influence of large and small doses of the various tonics on cases of recent admission must be omitted for similar reasons. Indeed I feel diffident in attempting to discuss the subject of blood-tonics in a fragmentary form before my observations have been completed, and my only excuse is that the paper should contain at least an introduction to this, the practical outcome of the whole subject. The observations I have made so far are encouraging, and sufficiently uniform to enable one to anticipate valuable and accurate results if this method of clinical research is persevered in, and engages the attention of several observers.

### VIII.

*Summary.*—I have endeavoured to approach the subject from an unbiassed and scientific standpoint, to avoid theorising and to arrive at my deductions only from observed facts. Each series of observations has been summed up and commented on separately, but the following general conclusions seem warranted:—

(1.) While there is no evidence to show that anæmia in itself is a cause of insanity, yet an anæmic condition of the blood is undoubtedly in many cases intimately associated with mental disease.

(2.) The blood in the demented class of asylum patients is

deficient in hæmoglobin and in hæmocytes, and the deterioration progresses as age advances.

(3.) The blood in patients known to be addicted to masturbation is deteriorated in a marked degree.

(4.) The blood is below the normal standard in General Paralysis, and the deficiency is greater in the active and completely paralysed stages of the disease than in the intervening periods of inactivity and quiescence.

(5.) While there is a deficiency in the quality of the blood in Epileptics, the decrease is not so pronounced as in ordinary demented at the same age.

(6.) Prolonged and continuous doses of Bromide of Potassium do not cause deterioration in the quality of the blood.

(7.) Prolonged attacks of excitement have a deteriorating influence on the quality of the blood.

(8.) The blood of the average number of patients on admission is considerably below the normal standard.

(9.) In patients who recover, the quality of their blood improves during residence in the asylum, and on discharge is not much below the normal standard.

(10.) There appears to be a close connection between gain in weight, improvement in the quality of the blood, and mental recovery.

(11.) While there is a definite improvement in the condition of the blood during mental convalescence in all cases, the improvement is both more pronounced and more rapid in those who have had tonic treatment.

(12.) The four tonics which either alone or in combination proved most efficacious in restoring the quality of the blood as shown by these observations may be classed in order of value thus (*a*) iron, quinine and strychnia (*b*) iron and quinine (*c*) iron alone (*d*) malt extract.

(13.) Arsenic proved of little value as a blood tonic in these cases, and the observations with quassia and cod-liver oil did not give satisfactory results.

(14.) The close connection which exists between improvement in the quality of the blood, increase in weight, and mental recovery, the converse which exists in cases of persistent and incurable dementia, and the marked improvement which is effected by certain remedial agents, show that this line of clinical research, more especially with reference to the curative treatment of the insane, should have more attention paid to it than has hitherto been the case.