Clinical observations on the blood of the insane / by S. Rutherford MacPhail.

CLINICAL OBSERVATIONS ON THE BLOOD OF THE INSANE.*

By S. RUTHERFORD MACPHAIL, M.D. Edin.,

The older writers on Insanity including Pinel, and Esquirol, believed that functional disturbances of the higher nervous centres were the chief factors in producing mental disease. Whether this is the case or not, and whether functional disease of the brain may exist without appreciable change of structure, there can be no question that the quantity and quality of the blood circulating through the higher nervous centres affect their functions in an important manner.

First as to quantity. According to Bucknill and Tuke† the effect of blood on the brain, when in excess, is that of lethargy, while a diminution of its quantity is productive of syncope and unconsciousness. Both these conditions, described as congestion and anæmia, may be due to temporary irregularities in the supply of blood to the brain, and may pass away without leaving any ill consequences behind, although their frequent occurrence acting on a highly susceptible organism may produce minute changes, manifesting themselves by various morbid mental phenomena. Andral, quoted by Bucknill and Tuke, lays down the axiom that "in every organ the diminution of the normal quantity of blood which it should contain produces functional disturbances, as well as the presence of excessive quantity of blood." It is difficult to determine whether these alterations in the quantity of blood circulating through the brain are local or general in character, but it seems reasonable to premise that both conditions are possible. It is not, however, sufficient to refer mental symptoms to hyperæmia in one case and to anæmia in another, for they themselves are frequently mere effects. In this connection the importance of the vaso-motor system must not be overlooked. Maudsley‡

* The Essay which gained the Medal and Prize of the Medico-Psychological Association in 1884.

† "Psychological Medicine," page 586. ‡ "Pathology of Mind," page 193.

believes that all active emotions are accompanied by changes in the circulation, through vaso-motor inhibition, and that vascular disturbances may be produced by them within the brain very much as blushing of the face and neck is produced by shame. Irregularity in the blood-supply of the brain produces a condition of irritation of that organ, though this need not necessarily go on to actual mental disease. The sluggishness of the circulation in the extremities of many asylum patients, especially dements, is very noticeable; and if this be any criterion of the state of their cerebral circulation, there is little difficulty in accounting for their mental symptoms.

The quality of the blood may be impure from some error in the processes of digestion, assimilation, or excretion. To take the most common instance of this, the presence of bile in the blood, even in healthy and strong-minded individuals, gives rise to gloomy forebodings and melancholy conceptions. Also uric acid in the blood of a gouty patient causes an irritability of temper which is sometimes so severe that it passes into an outbreak of maniacal excitement. Arguing from such well-known facts as these, and knowing the effects of certain drugs, as chloroform producing anæsthesia, nitrous oxide gas producing laughter, and alcohol producing hilarity and excitement, we must admit that the brain may be affected through its nutrition, or, in other words, through the quality of its blood-supply.

Of course the affections of the nervous system must not be approached from the vascular side only, but this aspect of the question is worthy of attention. In this connection it is interesting to remark that nervine sedatives are more or less vascular depressants, and that nervine tonics tend to raise the blood pressure.*

The bodily symptoms of insanity have had a fair share of attention devoted to them in late years. If we believe, as many do, that mental disease can be regarded by the physician only as abnormal manifestation of the psychical function of the brain due to bodily conditions, it is desirable to investigate thoroughly the physical condition of all patients who are mentally affected.

Patients admitted into asylums may be broadly divided into three classes—

(1) A small group consisting chiefly of cases of recent

* "Handbook of Treatment," Fothergill, page 500.

insanity with no ostensible symptoms except those of mental derangement.

(2) A large group with well-marked symptoms of bodily disease which can be directly connected with the psychical symptoms.

(3) A group, intermediate in size, suffering from general debility or want of tone of the system, and in whom no organic or absolute physical disease can be detected.

Clouston* describes this third group as "such a lowering of the general condition of the body that it must be reckoned truly abnormal. This condition of body undoubtedly precedes certain forms of insanity and accompanies them. That there is no specific disease in most of such cases is proved by the recovery of many of them, and by the long life of many of the others." In 100 patients whose mental symptoms had lasted under six months, Dr. Clouston found 13 cases of this description. I have gone over the records of the last 500 patients admitted into this asylum, and I find that 47 men and 62 women of that number were in weak bodily health on admission, and in whom no specific disease was discovered after repeated physical examination. This excludes all old people over 65 years of age. Of these 109 cases 23 men and 29 women, or 47·7 per cent. of the total number, have been discharged recovered.

Griesinger† goes further than Clouston, and says that many inmates of asylums die from anæmia and marasmus without any serious local affection except perhaps a slight degree of atheroma of the vessels being discovered.

Chiefly with the object of ascertaining whether poverty of blood plays the same weighty predisposing part in the production of insanity that it does in the production of other diseases, I have made a series of observations, extending over a period of sixteen months, on the blood of insane patients. This is a field of clinical investigation which, so far as asylum-physicians are concerned, has as yet had little attention paid to it, although in the case of many diseases, physicians have been helped to a right diagnosis, and have derived many indications for treatment from a systematic examination of the blood.

The morphological elements of the blood in the normal state are the red and white corpuscles; by the aid of the

* "The Bodily Symptoms of Insanity." "Practitioner," 1871, Vol. ii., page 12.

† "Mental Diseases." New Sydenham Society's Translation, page 437.

microscope small granules floating in the serum may also be recognised, and when coagulation has taken place, a reticulum of fibrin. The colouring matter of the red corpuscles, or hæmacytes, which gives to the blood its red colour, is called hæmoglobin.

In examining the blood for clinical purposes there are three points to be considered—(1) Its richness in corpuscles; (2) The richness of the corpuscles in hæmoglobin; and (3) The amount of water diluting the corpuscles. Instruments of considerable precision, called respectively the Hæmacytometer and Hæmoglobinometer, have been devised for ascertaining the richness of the blood in corpuscles and in hæmoglobin. Inasmuch as the number of corpuscles present in any given bulk of blood is merely an expression of the proportion of corpuscles to the amount of plasma, variations in the number of hæmacytes counted might be caused by an increase or decrease in the quantity of plasma occurring, while the actual number of the corpuscles is stationary. Unfortunately we have as yet no means for determining this third factor during life, and this diminishes the value of results obtained by the above-named instruments.

All the methods devised for ascertaining the corpuscular richness of the blood consist in making a definite dilution of a certain quantity of blood, and counting the corpuscles in a certain volume of that dilution. Potain, Malassez, and Hayem have each devised an instrument adapted for clinical purposes, but their methods are cumbrous and inconvenient. The instrument I have used is Dr. Gower's hæmacytometer,* which is more simple for ordinary use, and is accurate enough for all practical purposes.

To eliminate as far as possible any instrumental error in the numerations, I invariably counted more than one drop of the mixture, and in the case of any marked discrepancy three or four drops have been examined and the mean of all the observations taken. The same instrument has been used throughout, and the blood to be examined was drawn from the finger without pressure.

The amount of hæmoglobin in the blood is ascertained by means of the hæmoglobinometer. The method consists in diluting a known volume of blood and comparing it with a standard solution. The average amount of hæmoglobin in

* For full description see "Lancet," 1st December, 1877, and "Practitioner," 1878, page 1.

each corpuscle is represented by a fraction of which the numerator is the percentage of hæmoglobin, and the percentage of red corpuscles the denominator. The observations with the hæmacytometer and the hæmoglobinometer were made simultaneously. Each observation took over half an hour to complete, and in not a few of the cases considerable difficulty was experienced in inducing patients to submit to the necessary puncture. The total number of observations represented by this paper is 420.

It is obvious that limitations of time and opportunity must narrow the scope of any experimental observations in such an extensive field of investigation; but the observations, which up to this time I have made may serve as an introduction to the further study of this important and interesting subject.

The special points I have endeavoured to determine are:—

(1) What is the amount of hæmoglobin and of red and white corpuscles in the normal condition of the blood?

(2) What is the condition of the blood in the class of patients who constitute the chronic inmates of asylums?

(3) Is the blood deteriorated in well-marked types of insanity, as General Paralysis and Epilepsy?

(4) Do variations occur in the blood of patients subject to attacks of periodic excitement?

(5) What is the state of the blood in patients when admitted?

(6) What is the state of the blood in patients who recover?

(7) What are the effects of various blood tonics on cases of recent insanity?

(8) Can any definite conclusions be arrived at from these observations which would be of practical value in the curative treatment of the insane?

I.

As a basis from which to work I first of all made a series of observations upon 30 cases of persons in presumably perfect health of body and mind. These, 15 males and 15 females, were selected chiefly from officials of the Asylum, and their respective ages ranged from 22 to 38 years. I give the results in a tabular form, showing the percentage amount of hæmoglobin and hæmacytes, and the proportion of white to red corpuscles in each instance.

A Table giving Percentage amount of Hæmoglobin and of Hæmacytes, and proportion of White to Red Corpuscles in the blood of 15 healthy persons of either sex.

Healthy Male Blood.				Healthy Female Blood.			
No.	Percentage of Hæmoglobin	Percentage of Hæmacytes.	Proportion of White to R. B. C.	No.	Percentage of Hæmoglobin	Percentage of Hæmacytes.	Proportion of White to R. B. C.
1	100	99·9	1 to 440	1	85	94·7	1 to 360
2	96	103·2	1 to 350	2	78	91·5	1 to 310
3	90	101·4	1 to 450	3	90	96·7	1 to 420
4	96	98·8	1 to 360	4	90	94·	1 to 280
5	90	99·2	1 to 430	5	88	90·9	1 to 360
6	100	102·4	1 to 480	6	80	93·2	1 to 380
7	90	99·	1 to 380	7	85	94·1	1 to 220
8	105	99·8	1 to 420	8	78	92·3	1 to 280
9	85	95·2	1 to 380	9	95	95·9	1 to 360
10	100	102·6	1 to 480	10	82	96·1	1 to 480
11	100	103·4	1 to 420	11	84	92·	1 to 380
12	95	102·5	1 to 340	12	88	91·7	1 to 430
13	95	101·9	1 to 440	13	80	89·8	1 to 210
14	104	105·1	1 to 510	14	90	95·2	1 to 290
15	95	102·7	1 to 450	15	86	94·8	1 to 460
Averages.	96	101·14	1 to 442		85·2	93·52	1 to 348

The average percentage of hæmoglobin is 96 in men and 85 in women. The variations are considerable, and there are greater fluctuations between the highest and lowest percentages in the observations in males than in those of females. The average number of red blood corpuscles per cubic millimetre is in men 5,075,000; and in women 4,676,000, or, expressing this in percentage form, male healthy blood, 101·14; female, 93·52. These results are rather higher than those of Laache,* who, in an analysis

* "Die Anäemie" von S. Laache. Christiania, 1883. Reviewed "Medical Times," 1884, page 28.

of 60 cases, found the mean to be 4,970,000 per cubic millimetre for men, and 4,430,000 for women (99·4 and 88·6 per cent.). Speaking generally, we may represent the amount of red corpuscles in healthy male blood by 100, in females by a slightly lower percentage. In my observations the average proportion of white to red corpuscles is 1 to 442 for males; 1 to 348 for females. There were variations in the individual percentages and proportions, but these call for no special comment.

In the observations with the hæmacytometer a diluting fluid of constant strength, that recommended by Gowers, (sodae sulph. grs. 104, acid acet. ʒi, aquæ destill. ad ℥iv) was employed. This solution has some effect in changing the shape of the corpuscles, but has no influence on their diameter. The size of the red discs varies considerably, even in healthy blood. Hayem, quoted by Dr. Norris,* says that 75 per cent. of the corpuscles are of average size, 12 per cent. small, and 12 per cent. large. This is an important point, for it is obvious that if the small forms are more numerous, the average corpuscular diameter is lower than normal, and if there be a number of large cells in the blood under observation the corpuscular diameter of the cells is relatively increased. In my observations I simply made a general note of the relative size of the corpuscles in each instance, and did not attempt to go into detail. In healthy male and female blood the large majority of the hæmacytes were of an average uniform size, while large and small forms collectively did not exceed 10 per cent. of the total number. In two instances in the case of men I noted that large-sized corpuscles were more numerous than usual, and the blood of one female contained about 50 per cent. of blood discs below the normal size. In none of these cases, however, did the percentage of hæmacytes vary much from the normal standard.

Small granule-cells were observed in fully two-thirds of the cases. These small particles, called by some "hæmatoblasts," are a normal constituent of the blood, and, unlike the ordinary red blood corpuscles, are stained red by carmine. It is stated that they become relatively more numerous in blood which is undergoing recuperation. A few corpuscles were crenated, but I am not prepared to say whether this crenated condition of the cells was influenced by the diluting solution employed.

* "The Physiology and Pathology of the Blood," page 165.

II.

I adopted the following means for ascertaining the condition of the blood in the class who form the unrecovered residuum of asylum-patients:—I took 40 dements or chronic maniacs in average bodily health, and had them weighed periodically. These patients had been resident in the asylum for periods varying from four to 22 years, and none had been under medical treatment for some years previously. I give the series of observations in tabular form, dividing the cases into four groups according to age. I submit also a few remarks on each group.

B. Tables showing percentage of Hæmoglobin and Hæmacytes in the blood of a series of Dements at three different periods, and Weights at four different periods.

TABLE I.—TEN DEMENTS BETWEEN 20 AND 30 YEARS.

Case.	Period of Residence.	Weights in lbs. at four different Periods.				Percentage of Hæmoglobin.				Percentage of Hæmacytes.			
		Jan, '82.	June, '83.	Nov, '83.	Mar, '84.	June.	Nov.	Mar.	Average.	June.	Nov.	Mar.	Average.
1	6 yrs.	143	146	146	146	75	70	74	73	96·8	97·4	96·9	97
2	5 yrs.	134	130	128	129	64	66	65	65	95·7	90·8	92·2	92·9
3	8 yrs.	153	150	144	147	62	64	62	62·6	89·7	85·9	87·8	87·8
4	4 yrs.	160	164	162	162	65	68	65	66	88·6	90·1	89·5	89·4
5	4 yrs.	156	154	156	155	62	68	66	65·3	95·6	94·5	94·2	94·7
6	7 yrs.	158	156	155	155	70	68	62	66·6	94·7	93·3	94·1	94
7	5 yrs.	149	151	152	149	68	64	64	65·3	86·2	85·1	86·8	86
8	11 yrs.	139	144	146	145	68	68	68	68	87·7	89·2	88·5	88·4
9	7 yrs.	133	125	126	126	55	55	55	55	82·7	81·8	82·2	82·2
10	4 yrs.	164	159	158	158	70	72	72	71·3	91·4	92·1	91·8	91·7
Avgs.	6·1	148·9	147·9	147·3	148·03	65·9	66·3	65·3	65·8	90·91	90·02	90·40	90·44

The period of residence of the patients varies from four to 11 years. Their weights range from 126 to 164 lbs., and it will be observed that the weights, taken at four different periods in 26 months, show slight variation in individual instances, the difference never exceeding 7 lbs., while the

average weight for the 10 patients at each period of the year is very uniform. The percentage of hæmoglobin is considerably below normal, and varies from 55 to 75 per cent., as compared with 96, the normal standard. While the amount of hæmoglobin varied in individual cases, the percentage in each is very uniform at the three different periods, thus showing that the season of the year has little effect on the quantity of hæmoglobin. Although the lowest percentage of hæmoglobin was observed in the lightest patient, it is not clear that we are justified in assuming any relation between the variations in weights and variations in the percentage of hæmoglobin, for in two of the cases a higher percentage was registered during the period when the weight was lowest. The percentage of hæmacytes varies from 3·7 to 19·3 below normal, while the average is fully 10 per cent. below the standard. As in the case of the hæmoglobin, there are variations in the absolute and relative averages at different seasons of the year; but this does not occur in such a precise form as to enable one to make any deductions.

TABLE II.—TEN DEMENTS BETWEEN 30 AND 40 YEARS.

Case.	Period of Residence.	Weights in lbs. at four different periods.				Percentage of Hæmoglobin.				Percentage of Hæmacytes.			
		Jan, '82.	Nov, '83.	Feb, '84.	May, '84.	Nov.	Feb.	May.	Average.	Nov.	Feb.	May.	Average.
1	18 yrs.	166	162	167	164	70	70	70	70	92·8	92·6	91·8	92·4
2	14 yrs.	148	150	148	148	70	70	72	70	92·1	91·7	92	91·9
3	11 yrs.	139	133	136	136	68	74	70	70·6	89·2	92·0	90·7	90·6
4	9 yrs.	138	138	139	138	66	70	64	66·6	86·7	90·9	87·8	88·4
5	14 yrs.	170	166	166	164	66	68	68	67·3	90·5	86·1	88·4	88·3
6	21 yrs.	151	150	147	148	74	68	72	71·3	93·9	92·5	92·8	93
7	9 yrs.	121	116	120	119	65	64	65	64·6	86·5	83·8	85	85·1
8	6 yrs.	135	129	130	128	60	58	62	60	87·4	89·7	87·9	88·3
9	4 yrs.	152	152	150	152	75	70	72	72·3	89·2	90	88·7	89·3
10	11 yrs.	138	135	130	124	58	60	60	59·3	85	87·2	85·6	85·9
Avgs.	11·5	145·8	143·0	143·3	142·1	67·2	67·2	67·5	67·3	89·33	89·65	89·07	89·35

It is worthy of remark that we have diminution of the percentage of corpuscles with an increase of hæmoglobin. The converse likewise occurs, and we have a decrease in the percentage of hæmoglobin and an increase in the number of corpuscles.

The average period of residence of the patients in this group is 11½ years. There is a greater variation in the weights at different periods than in the previous group, one patient alone losing 14 lbs. in 29 months, while the average loss of weight for the 10 patients during that period is 3·7 lbs. The percentage of hæmoglobin is very uniform, both in the individual cases and in the average of each period. The average amount of hæmoglobin is slightly higher than in the first group. On the other hand, the average number of hæmacytes is 1·1 per cent. lower, while the variations in the averages for each period of the year are more uniform, and the individual averages are less uniform than in Table I. There appears to be no relation between variation in weight and increase or decrease in the percentage of hæmoglobin and hæmacytes.

TABLE III.—TEN DEMENTS BETWEEN 40 AND 50 YEARS.

Case.	Period of Residence.	Weights in lbs. at four different periods.				Percentage of Hæmoglobin.				Percentage of Hæmacytes.			
		Jan, '82.	Dec, '83.	Mar, '84.	May, '84.	Dec.	Mar.	May.	Average.	Dec.	Mar.	May.	Average.
1	15 yrs.	160	158	156	154	75	70	70	71·6	96·1	91·7	92·5	93·4
2	7 yrs.	158	150	148	148	65	68	65	66	89·2	96·1	92·2	92·5
3	20 yrs.	140	133	132	132	62	64	64	63·3	90·8	89·5	90·8	90·3
4	5 yrs.	150	154	150	150	78	75	75	76	95·1	91·5	91·9	92·8
5	6 yrs.	152	151	154	154	65	65	68	66	91·7	94·1	92·7	92·8
6	17 yrs.	164	158	162	161	65	68	68	67	88·9	91·7	87·9	89·5
7	22 yrs.	140	144	139	138	64	65	65	64.6	88·9	90·2	89·1	89·4
8	18 yrs.	184	190	190	196	64	65	64	64·3	87·8	89·2	88·1	88·3
9	22 yrs.	154	154	152	150	58	55	58	57	79·3	79	80·9	79·7
10	15 yrs.	140	137	139	136	62	65	60	62·3	84·6	85·7	83·9	84·7
Avgs.	14½	154·2	152·9	152·2	151·9	65·8	66·0	65·7	65·8	89·24	89·87	89	89·37

The special points in this table are : An average period of residence of 14½ years; an average loss of weight of 2·3 lbs. in 29 months; an average percentage of hæmoglobin similar in amount to that in Table I., but less than in Table II.; a lower percentage of red corpuscles than in either of the previous groups.

TABLE IV.—TEN DEMENTS BETWEEN 50 AND 60 YEARS.

Case.	Period of Residence.	Weights in lbs. at four different periods.				Percentage of Hæmoglobin.				Percentage of Hæmacytes.			
		Jan, '83.	Dec, '83.	Mar, '84.	May, '84.	Dec.	Mar.	May.	Average.	Dec.	Mar.	May.	Average.
1	14 yrs.	172	176	174	175	65	68	68	67	87	86·9	87·8	87·2
2	22 yrs.	118	108	108	110	74	68	70	70·6	87·4	87	88·9	87·7
3	12 yrs.	156	155	*—	—	66	—	—	66	87·7	—	—	87·7
4	22 yrs.	158	154	148	152	68	70	65	67·6	87·8	87·1	86·6	87·1
5	13 yrs.	172	168	172	173	55	60	60	58·3	88·4	87·3	87·8	87·8
6	7 yrs.	163	158	156	158	68	70	70	69·3	87·7	86·9	86·5	87
7	15 yrs.	174	176	172	172	70	70	70	70	86·3	85·9	86·7	86·3
8	22 yrs.	148	148	154	149	70	72	70	70·6	86·7	87·2	87·2	87
9	22 yrs.	175	171	170	166	60	58	60	59·3	87·4	86·9	85·4	86·5
10	22 yrs.	138	143	145	147	58	60	58	58·6	87·8	89·2	88·6	88·5
Avgs.	17·1	157·4	155·7	155·4†	155·7†	65·4	66·2†	65·6†	65·73	87·42	87·15†	87·27†	87·28

* Died of Pneumonia, March, 1884. † Average of Nine Observations.

This table is incomplete, inasmuch as one of the patients died of an intercurrent attack of pneumonia, and his blood was examined only on one occasion. The table, however, brings out more forcibly the diminution in the average percentage of red corpuscles noted in the third group.

The proportion of white to red corpuscles was also ascertained, but as they showed so little variation from the normal standard, I have not given the results in the tables.

The relative size of the corpuscles was fairly uniform.

There was an almost complete absence of small forms, though corpuscles of large size were observed in several of the cases. Small granule-cells were seen in only six of the 40 cases under observation, and when they were detected they were ill-defined, and did not occur in groups, as is the case in normal blood.

Of these 40 patients, six in the first group, five in the second group, three in the third group, and four in the fourth group had a course of ferruginous or nervine tonics during the earlier period of their residence in the asylum, but in no instance had tonics been administered during the three years preceding the observations.

Four patients in the first group, three in the second, and one in the third group were known to be masturbators, and it is worthy of remark that the average percentages of hæmoglobin and of hæmacytes in these cases were rather below the percentages in the tables in which the observations on their blood is detailed. With the object of seeing whether this was merely a coincidence, I examined the blood of four other patients known to be addicted to masturbation; and, without entering into detail, I am in a position to state that the percentage of hæmacytes in the patients examined was considerably below the normal standard, while the amount of hæmoglobin was also diminished, though to a less extent.

Summarising the results of my observations on the class of dements or chronic maniacs, an examination of the fore going tables appears to warrant the following conclusions:—

(1) The percentage of hæmoglobin is considerably below the normal standard, and does not appear to be influenced by the age of the patients.

(2) The percentage of hæmacytes is likewise diminished, and this diminution progresses with the age of the individual.

(3) The proportion of white to red corpuscles is normal.

(4) The blood is deficient in hæmatoblasts.

(5) In the patients over 30 years the weight decreases, but this decrease does not appear to influence the relative percentage of hæmoglobin and of hæmacytes.

(6) The period of residence and the season of the year do not affect the absolute proportional averages of the constituents of the blood.

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 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

* West Riding Reports, Vol. i.

III. Five General Paralytics 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	85·3	1 to 400
2	33	75	96·3	1 to 340
3	49	70	90·1	1 to 360
4	32	80	93·2	1 to 360
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 epilleptic dements is slightly higher than in ordinary dements at the same age. (2) That the average amount of hæmacytes 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 hæmacytes is a fraction higher in epileptics than in dements 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 hæmacytes.

There was considerable variation in the size of the individual corpuscles. In two instances more than one-fourth of the hæmacytes 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 16 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 lower 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 copuscles

(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 dements 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 Hæmacytes.	Proportion of White to Red B. C.
1	40	164	Over a year	Melancholia	Weak	68	89.1	1 to 310
2	58	158	10 weeks	General Paralysis ...	Weak	66	88·4	1 to 260
3	43	154	8 days	Acute Mania	Weak	62	90·9	1 to 180
4	21	112	One month	Mania	Average... ...	60	87·1	1 to 220
5	20	108	Three years	Epileptic Mania	Weak	68	82·4	1 to 350
6	47	140	One week	Mania	Good	70	88·9	1 to 480
7	23	122	One month	Mania	Weak	70	87·6	1 to 320
8	20	112	Two years	Mania	Average... ...	74	90·5	1 to 220
9	52	142	10 days	Mania à potu	Weak	78	90	1 to 280
10	36	151	14 days	General Paralysis	Average... ...	62	88·1	1 to 350
11	32	140	One week	Mania	Good	70	84	1 to 220
12	38	134	Three months ...	Epileptic Mania	Average... ...	68	82·9	1 to 220
13	34	136	Two days	Acute Mania	Average... ...	70	90·9	1 to 320
14	26	128	Two weeks	Epileptic Mania	Average... ...	60	76·9	1 to 200
15	58	150	Four years	Melancholia	Weak	62	86·1	1 to 380
Averages	36·5	136·7				67·2	86·92	1 to 289

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 360
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 ...		82		101·7	1 to 350
2	22	146	161	Over 1 month ...	Acute Mania ...	70	76	90·5	90·9	1 to 190
3	60	166	166	Over 4 months ..	Melancholia ...	62	72	84·7	91·5	1 to 340
4	39	158	164	Over 1 month ..	Mania	70	80	88·8	97·4	1 to 440
5	45	130	150	Over 5 months ...	Mania	70	85	88·9	97	1 to 420
6	27	126	142	Over 19 months ...	Mania		86		92·7	1 to 300
7	75	150	17	Over 3 months ...	Melancholia ...	58	70	75·9	87·9	1 to 440
8	52	142	151	Over 1 month ...	Mania à potu ...	78	84	90	92·1	1 to 360
9	15	101	115	Over 6 months ...	Mania	60	75	77·3	91·3	1 to 320
10	29	164	168	Over 15 months ...	Mania		80		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 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	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 ...		70		90·9	1 to 240
6	32	134	138	Over 4 months ...	Mania	62	85	84·3	95·5	1 to 210
7	40	126	154	Over 19 months...	Melancholia ...		78		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 1 months...	Mania...		80		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	*82·8	91·8	1 to 329

* Average of seven observations

the average is 3 per cent. below that of dements 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 hæmacytes 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 hæmacytes 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; hæmacytes 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 hæmacytes 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 hæmacytes 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 hæmacytes was largely increased. In the third and fourth weeks the hæmoglobin continued stationary and the hæmacytes were diminished. During the second month the hæmoglobin was slightly increased in all the cases, while the percentage of hæmacytes increased in the patients progressing towards mental recovery, but diminished in the others. In each instance improvement in the amount of hæmacytes 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 hæmacytes, 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 dements 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.