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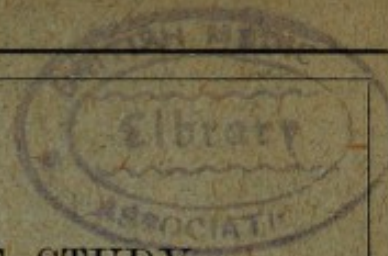
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OF
DISEASES OF THE CIRCULATORY SYSTEM
IN THE INSANE.

BY

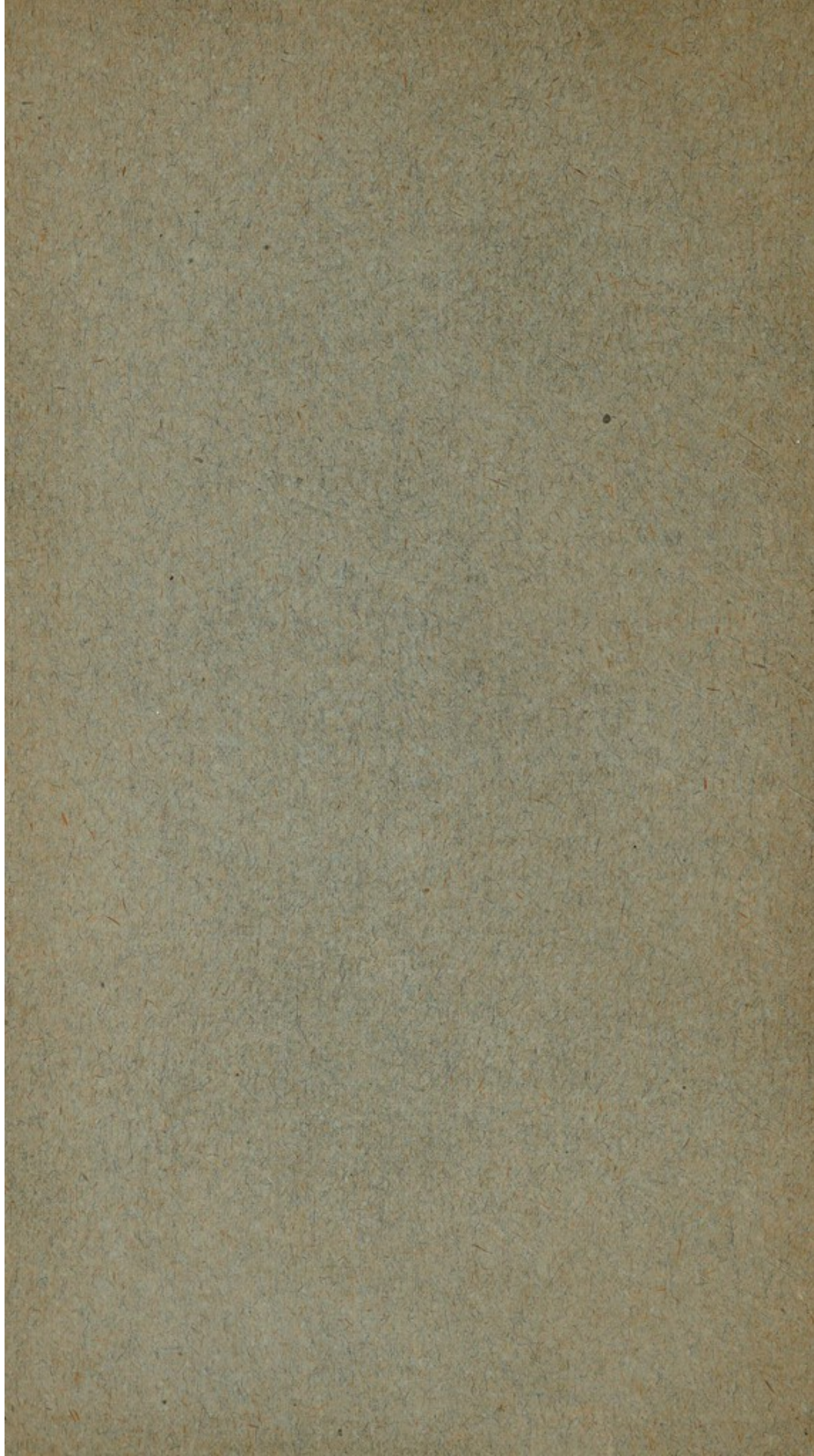
BY T. DUNCAN GREENLEES, M.B. EDIN.,

Assistant Medical Officer, Cumberland and Westmorland Asylum, Carlisle.

[*Reprinted from "The Journal of Mental Science," Oct., 1885.*]

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A CONTRIBUTION TO THE STUDY OF DISEASES OF THE CIRCULATORY SYSTEM IN THE INSANE.*

By T. DUNCAN GREENLEES, M.B. EDIN.,

Assistant Medical Officer Cumberland and Westmorland Asylum, Carlisle.

It has long been recognised that a sympathetic connection exists between the body and the mind; irritability of temper from a sluggish action of the liver, and the hopeful view phthisical patients frequently take of their ultimate recovery (the "*spes phthisica*" of some authors), are familiar examples of the influence of abnormal conditions of the body upon the mind.

The ancients were in the habit of treating all cases of insanity solely as bodily diseases, and Hippocrates taught that mental diseases were all due to the circulation of black bile in the blood, while others of the same school considered that insanity was due to a determination of blood to the head—a view still maintained by many who consider the more acute types of insanity as essentially due to cerebral hyperæmia.

Dr. Ellist† classifies, among the causes of insanity, those acting upon the brain (a) physically or morally, and (b) those whose action is purely sympathetic. He states that diseases of the various viscera are very frequently causes of insanity, the brain in these cases acting in sympathy with the diseased organ. Although he mentions pathological conditions of most of the viscera among those physical causes of insanity, he omits diseases of the circulatory organs in proof of his argument.

* The Essay for which the Prize of the Medico-Psychological Association was awarded in 1885.

† "Treatise on Insanity," 1838, page 82.

Several observers, both before and after Ellis, have directed attention to the connection between heart disease and insanity; many of their observations were so limited in extent that their deductions are variable, and their conclusions can only be accepted *pro tanto*.

Of the more trustworthy of these observers may be mentioned Esquirol, who found heart disease to exist in $\frac{1}{15}$ of his melancholic patients; Bayle in $\frac{1}{6}$; Calmeil and Thore in nearly $\frac{1}{3}$; Webster in $\frac{1}{8}$; and, more recently, Sutherland in $\frac{1}{6}$ of all cases of insanity examined. In 602 post-mortem examinations made in the Insane Department of Vienna Hospital the heart was found to be diseased in 75 cases, but in some of these the disease was very slight. Defour* found lesions of the heart in 74 per cent. of his autopsies, and Dr. Sutherland† in his Croonian Lectures states that he found heart disease to exist in 34 cases out of 42 post-mortem examinations. In an exhaustive paper by Dr. Burman,‡ to which I shall have occasion to refer frequently, he states that the heart was diseased in 169 cases out of 500 post-mortem examinations.

Before entering more precisely into a consideration of the relationship between heart disease and insanity, I commence my inquiry by tabulating the causes of death in 218 consecutive autopsies of insane individuals in this asylum:—

TABLE I.—Showing the Cause of Death in 218 Consecutive Autopsies.

Cause of Death.	M.	F.	Total.	Percentage.
Diseases of Nervous System	47	24	71	32·56
Exhaustion : Senile or from Mental Disease	16	20	36	16·51
Diseases of Lungs (excluding Phthisis)... ..	11	11	22	10·08
Tubercular Disease of Lungs	18	13	31	14·12
Diseases of Heart	21	11	32	14·67
Diseases of Digestive System	9	7	16	7·33
Diseases of Genito-Urinary System	2	1	3	1·33
Diseases of Locomotory System	4	3	7	3·21
Totals	128	90	218	

* "Journal Mental Science," Vol. xxiv., p. 136.

† "Journal Mental Science," July, 1861.

‡ "West Riding Asylum Reports," Vol. iii., p. 235.

The above table shows that, in point of frequency, heart disease occupies an important position as a cause of death among the insane, occurring third in the list; diseases of the cerebro-spinal system being first with nearly one-third of the total; and exhaustion from either senile decay or mental disease second, forming $16\frac{1}{2}$ per cent. of the total. It is interesting to note the relative frequency of phthisis as a cause of death in asylums. Dr. Clouston* found phthisis to exist with such frequency and to give such distinctive characters to the type of insanity as to justify the name of "phthisical insanity" being applied to this disease. According to this table phthisis, as a cause of death, does not occur with the same frequency as heart disease, although no doubt in many of the cases tubercular deposits were found in one or both lungs. The difference, however, in point of frequency between phthisis pulmonalis and heart disease as causes of death, in my statistics, is very slight.

An inquiry into the condition of the heart and blood-vessels among the insane, and the relationship between pathological changes in the circulatory system and insanity, naturally subdivides itself into two parts—a statistical and a pathological division.

I. *Statistical Division.*

In order to elucidate this subject it is my intention to consider the following:—

(1.) The condition of the heart as found among the living insane.

(2.) The condition of the general circulation and the pulse in the insane.

(3.) Heart disease as a primary cause of death among the insane.

(4.) Pathological changes observed in the heart and blood-vessels of those dying insane, including those changes not necessarily contributing to the fatal issue.

(5.) The percentage of deaths from heart disease or arterial changes among the general public.

(6.) Conclusions and deductions from the above.

(1.) *The condition of the heart as found among the living insane.*

In the following table the state of the heart is described in patients on their admission, as it is probable that, at this

* "Journal Mental Science," April, 1863.

time, the patients' mental state is at its worst, and most likely, if ever, to have some deleterious influence on the heart's action.

TABLE II. Showing the Condition of the Heart on Admission.

Mental Condition.	Total No. of Cases Examined.			Cardiac Disease Present.			Cardiac Functional Derangements.			Percentage of Heart Disease.	Percentage of Functional Derangements.
	M.	F.	T.	M.	F.	T.	M.	F.	T.		
Mania	183	225	408	19	31	50	70	102	172	12·25	42·15
Melancholia	48	74	122	5	7	12	23	39	62	9·83	50·80
General Paralysis... ..	31	8	39	5	1	6	14	3	17	15·38	43·58
Epileptic Insanity	15	12	27	1	1	2	5	5	10	7·40	37·03
Dementia and Imbecility	40	27	67	5	10	15	19	8	27	22·38	40·29
Other Cases... ..	6	3	9	0	1	1	4	2	6	11·11	66·66
Totals and Averages...	323	349	672	35	51	86	135	159	294	12·94	43·75

This table represents a total of 672 individuals, 323 males and 349 females; 86, or almost 13 per cent. of the total, were found to suffer from recognisable heart disease, and 294, or nearly 44 per cent., had functional disorders of that organ—a condition in which the functions of the heart were not normal, although actual evidence of organic disease could not be detected on examination. I have classified under this heading such conditions as the heart-sounds being weak or almost inaudible; the rhythm irregular; re-duplication or accentuation of one or other of the sounds; the heart's action being loud and tumultuous, associated with a pulse rapid or abnormally slow, irregular or intermitting, weak or compressible. It is difficult to assign the effect of the mental condition of the patient upon the functions of the heart, but a reference to the table shows that as functional derangements occur with greater frequency among recent and acute cases of insanity than among the more chronic and stationary types, it is reasonable to assume that excitement has some effect in producing deranged action of the heart. It would appear that heart disease occurs with greater frequency among chronic types of insanity, such as dementia and imbecility, where, according to the above table, it is present in

one out of every four cases. It is a more frequent accompaniment of mania than of melancholia, although the proportion of cases of cardiac functional disorder is greater in the latter condition. The state of the heart and circulation in general paralysis is an interesting study; it is difficult to explain the frequency of heart disease in this condition. If we accept the theory, propounded first, so far as I am aware, by Dr. Milner Fothergill,* that general paralysis is a disease essentially originating in a hyperæmic and distended condition of the perivascular spaces in the brain resulting in increased arterial tension, we might expect to find, in long-standing cases, hypertrophy of the left side of the heart, and probably in time, evidences of valvular lesions, especially of the aorta. Dr. Fothergill, however, states that he did not discover sufficient evidence to show that the heart was diseased; in fact, he argues that general paralytics enjoy a comparative immunity from heart disease.

In epilepsy heart disease does not appear to be common. The ages of the patients may probably assist in explaining this fact, most of the epileptics being between the ages of 20 and 30 on admission, some under 20, and few above 40 years of age, and, according to the Registrar General, heart disease, as a cause of death, is rare in persons under 20 years of age. Of the 27 epileptics examined, the only two who presented evidence of organic cardiac disease were both upwards of 60 years of age, one male and one female. Both patients had a well-defined presystolic mitral murmur.

It will be advisable at this stage of inquiry to consider more fully the condition of the heart in those patients who presented the clinical symptoms of cardiac disease or arterial atheroma on admission.

Of the cases which I am able to classify, the following is a list:—

(1.) *Mitral Systolic Murmurs*.—This murmur generally replaces the first sound of the heart, and is booming in character; it occurred in 32 cases, and in point of relative frequency in the following types of mental disease:—Mania, melancholia, dementia, general paralysis, and epilepsy.

(2.) *Presystolic Murmurs*.—A murmur occurring immediately before the first sound of the heart, and harsh, grating, or rubbing in character. This condition was found in 15

* "The Heart Sounds in General Paralysis." (West Riding Asylum Reports, Vol. iii., p. 113.)

cases, and, according to its relative frequency, in mania, dementia, melancholia, and epilepsy.

(3.) *Double Aortic Murmurs*.—A double “see-saw” murmur, replacing both the systole and the diastole of the heart, a condition, according to authorities, indicating a very serious condition of the organ. 11 cases are recorded as having this murmur, and of the cardiac lesions found in general paralytics, this is the chief form of disease from which they suffer.

(4.) *Hypertrophy of the Heart*.—It is, as a rule, difficult in insane patients to make a satisfactory examination of the extent of the cardiac area of dulness; hence this will explain why only six cases are recorded presenting this condition to any marked extent. This condition occurred in two cases of mania, three of dementia, and one melancholic. Although I have been unable to find any increase in the area of cardiac dulness among general paralytics during life, examination of the heart after death generally reveals some amount of hypertrophy.

(5.) *Accentuation or Reduplication* of one or other of the heart's sounds or other abnormal conditions of the heart's action, was found in 43 per cent. of the total. The peculiar condition of the heart's action and sounds in some of these cases, was such as to convince me of some organic change, although of what nature I was unable to decide.

An accentuated or reduplicated condition of one or other of the heart's sounds occurs very commonly in general paralysis. In nine cases of general paralysis which I recently examined, only one had normal sounds; in five, the second sound was accentuated, terminating suddenly, and ending in a “click;” in two the first sound was impure, and the second accentuated, and in another case the first sound was markedly accentuated. An accentuation of the second sound of the heart Dr. Fothergill explains as due to the aortic valves being closed by a larger volume of blood above them than is usually the case.

(6.) *Atheroma, or Thickening of the Arteries*, was found in eight cases, occurring in point of frequency in the following mental conditions:—Mania, general paralysis, dementia, and melancholia; the average age of the eight cases was $69\frac{1}{2}$ years.

Forms of Insanity in which heart disease occurs in the living insane.

As the preceding remarks refer to the condition of the circulatory organs of patients on their admission, it is important

to note that the mental condition of the inmates of asylums frequently undergoes changes.

Cases of mania or melancholia sometimes merge into secondary dementia, or even in time develop the symptoms of general paralysis. Thus, although heart disease is found to occur most frequently in cases exhibiting the symptoms of mania on admission, from a systematic examination of the present residents in the asylum I find that heart disease occurs more frequently among cases exhibiting the mental phenomena of secondary dementia and melancholia than among other types of insanity. With regard to the mental characteristics of such of the inmates as exhibit the physical signs of heart disease, they are generally morose, suspicious, or passionate, and cases of profound melancholia are liable to outbursts of temper. The connection between the delusions of the insane and the presence of organic visceral disease is an interesting study, and the irregular action of the heart in many cases gives rise to strange delusions, such as the workings of an unseen agency, as electricity, within them. It has been noticed that occasionally sane patients who suffer from heart disease exhibit the same mental characteristics; they are not infrequently found to be quick-tempered, easily excited, and sometimes extremely passionate. Probably in both cases the altered condition of the temper and mental faculties is due either to the local irritation of a diseased heart, or to a diminution of the proper nourishment to the brain, or else an actual poisoning of the nerve-centres from failure of the eliminating apparatus to remove the effete matters in the circulating blood.

(2.) *The Condition of the General Circulation of the Insane.*

In every asylum population cases are to be found in which the circulation is impaired, the pulse slow and feeble, and the extremities cold, or even livid and swollen. These cases are generally to be found among two classes of patients—(1) recent cases of acute melancholia, and (2) old standing cases of dementia or other chronic forms of insanity. With respect to the first class, it would appear that the impaired action of the circulation, from some of the many causes that give rise to starvation of the tissues, is the cause of the diseased mental condition. In the second class, the slow process of the evolution of impulses from the nerve-centres to the peripheral organs acting in some way as an inhibitor of the heart, is probably the true explanation. In a population of 530 insane (280 males and 250 females), I have found

one or other of the above conditions present in 59 cases (28 males and 31 females), the temperature at the time of examination being above 60° in the open air. These cases may be classified as follows:—Chronic mania, 7 males and 7 females; melancholia, 8 males and 5 females; general paralysis, 1 female; epileptic insanity, 4 males and 4 females; dementia, 8 males and 10 females; imbecility, 1 male and 2 females. Two female examples of *folie circulaire* also presented this condition of extreme coldness of the extremities.

An impaired circulation thus occurs with greater frequency among demented, and is not necessarily associated with heart disease, for in very few of these cases did I find evidence of organic cardiac disease. A course of stimulating treatment in the first class of cases is often successful in causing a disappearance of the physical symptoms of impaired cardiac action, followed by an improvement in the mental condition of the patient.

TABLE III.—Showing the Average Pulse-Rate in the Insane at Three Different times.

Mental Condition.	No. of Cases Examined.			Pulse Rate on Admission.	Average Pulse Rate. Morning.			Average Pulse Rate. Evening.			Averages.	
	M.	F.	Total.		M.	F.	Total.	M.	F.	Total.	M.	F.
Acute Mania ...	24	30	54	98.78	107.17	85.12	96.14	86.33	79.18	82.75	97.42	87.69
Mania ...	66	66	132	82.00	85.33	80.14	82.74	78.21	81.82	80.02	81.84	81.32
Melancholia ...	33	33	66	96.30	87.56	82.20	84.88	75.39	81.85	78.62	86.41	86.81
General Paralysis ...	23	8	31	78.16	82.26	80.25	81.25	81.39	80.75	81.07	80.60	79.72
Epilepsy ...	17	11	28	83.50	87.17	75.00	81.09	80.24	74.18	77.21	81.89	77.56
Dementia ...	15	17	32	84.30	82.66	76.88	79.77	70.80	80.58	75.69	83.90	80.58
Imbecility ...	10	5	15	82.60	79.40	76.80	78.10	71.20	75.20	73.20	77.73	78.20
Totals and Averages ...	188	170	358	86.52	87.36	79.49	83.42	77.93	79.02	78.47	84.25	81.70
Healthy pulse...					82	87	84	74	80	77	78	83

The subject of the condition of the pulse as found among the insane has been so well worked at that there will be no

necessity of very extended observations in this place. The figures in the above table differ only slightly from those given by Dr. Clouston,* who found the average rate of the pulse in the insane to be—morning, 84; evening, 74. The pulse, according to my observations, is quicker in insane males than in sane males, and slower in insane females than in sane females; and my observations agree with Dr. Clouston, who states that, although the temperature of the evening is, as a rule, above that of the morning, the evening pulse is, with a few slight exceptions, below the pulse of the morning. As might be expected, acute mental excitement acting upon the heart increases its pulsations, hence we find that in both acute and sub-acute mania the pulse is rapid. On the other hand, the morning and evening pulse-rates in imbecility, and the average morning pulse-rate in dementia, are below the normal standard. In general paralysis the pulse-rate is only slightly above normal; it is, however, the character of the pulse in this disease that is of interest. Dr. Milner Fothergill† describes it as “the hard pulse of increased arterial tension, such as characterises chronic Bright’s disease,” and, according to Dr. Thompson,‡ the sphygmographic tracings of the pulse in this disease represent what is seen in spasm of the muscular coats of the arteries, “due to a heightened susceptibility on the part of the vaso-motor system to such influences as are likely to affect it.”

In epilepsy the pulse-rate is slightly above normal; and, with respect to its character, Dr. Thompson states that the tracings represent a lax condition of the vessels.

It will be seen from the above observations that the pulse-rate is higher in the insane than the sane, the exceptions to this rule being cases of dementia and imbecility, where, however, as was previously pointed out, the heart’s action is frequently slow and the circulation generally sluggish. The morning pulse-rate is, as a rule, higher than the evening pulse-rate in insanity—the average difference being about five beats per minute. This average difference is most in acute mania, and least in general paralysis. The pulse-rate is over all about two beats per minute more rapid in male insane patients than in female patients. It may be as well to state that Dr. Clouston found the female pulse-rate

* “Journ. Mental Science,” April, 1863.

† “West Riding Asylum Reports,” Vol. iii., p. 117.

‡ “Journ. Mental Science,” 1875, p. 582.

to be five beats more on an average per minute than the male pulse-rate. The greatest difference in the rate of the pulse in the different sexes was found in acute mania, and the least difference in general paralysis.

(3) *Heart Disease as a Primary Cause of Death among the Insane.*

TABLE IV.—Showing the Proportion of Deaths from Heart Disease and Cardiac Lesions during a period of five years in this Asylum.

Mental Condition.	No. of Cases Examined.			Heart Disease as the Cause of Death.			Pathological changes in Heart or Vessels.			Percentage of Cases of Heart Disease.	Percentage of Cases of Changes.
	M.	F.	T.	M.	F.	T.	M.	F.	T.		
Mania ...	50	53	103	7	10	17	36	40	76	16·60	73·78
Melancholia ...	20	13	33	3	2	5	12	9	21	15·15	63·90
General Paralysis ...	29	4	33	3	0	3	14	4	18	9·99	54·54
Epileptic Insanity ...	16	3	19	0	0	0	10	4	14	0·00	73·68
Dementia and Imbecility ...	19	12	31	4	1	5	14	8	22	16·13	70·96
Other Cases ...	2	1	3	0	0	0	2	0	2	0·00	66·66
Totals and Averages ...	136	86	222	17	13	30	88	65	153	13·51	68·72

This table is formed from accurate records of the post-mortem appearances observed of all deaths during a period of five years.

A reference to the table shows that during this period 222 autopsies were made, that the heart was diseased to such an extent as to constitute of itself the primary cause of death in 30 cases, being 1 in every 7·4 cases examined, and that in 153 cases, or 68·7 per cent. of the total, the heart and vessels were not healthy, being sufficiently diseased to constitute a secondary or more remote factor in the fatal issue. In the 33 examples of general paralysis, the paralysis was the primary cause of death: of these three were stated to be "heart deaths," while in 18 of the remainder, or fully one-half of the total cases, the heart or vessels presented changes more or less pathological.

A similar state of matters existed where, in other cases, the primary factor in the causation of death was a lesion of the nerve centres; the heart disease present in these cases being considered only the secondary cause of death.

It will be observed that, according to this table, the proportion of deaths from heart disease during five years closely corresponds with the proportion of insane who exhibited symptoms of heart disease on admission during the same five years as detailed in Table II.

Thus, on admission, heart disease occurs in the proportion of one in every 7·81 cases, and it is the assigned cause of death in one of every 7·40 deaths, a proportion considerably higher than that given by Dr. Burman, who found that heart disease was the cause of death in one out of every 13·45 deaths.

TABLE V.—Showing the Ages of Patients who were recognised to have Heart Disease on their Admission, and at Death.

Age.	Total No. of Cases Examined.		Heart Disease.	Heart Disease.
	On Admission.	At Death.	On Admission.	At Death.
Under 20 ...	35	0	0	0
20 under 30 ...	138	13	11	0
30 „ 40 ...	160	40	6	4
40 „ 50 ...	136	43	15	4
50 „ 60 ...	93	40	21	8
60 „ 70 ...	76	42	24	9
70 „ 80 ...	27	37	8	5
80 upwards ...	7	7	1	0
Totals ...	672	222	86	30

It will be observed that, according to my statistics, heart disease occurs on admission with greater frequency in the female sex, but that, as a cause of death, it is more frequent in the male sex. Both on admission and at death, heart disease occurs with greater frequency between the ages of 60 and 70, being in the proportion of 1 in 3·12 of the

total admissions, and 1 in 3·66 of the total deaths at this age.

To supplement the information derived from deaths from heart disease at this asylum, I add another table giving the proportion of deaths from heart disease in other asylums. This table is made up from statistics contained in the annual reports of these asylums during the year 1881, and, in addition, I have summed up the total number of deaths due to heart disease in this asylum during the twenty years previous to the five years from which my previous statistics are taken.

The following statistics refer to 31 annual reports of English asylums, 10 reports of Irish asylums, 18 reports of Scotch asylums for the year 1881, and 20 annual reports of this asylum.

TABLE VI.—Showing the Relative Frequency of Heart Disease in various Asylums.

	Average No. Resident.			No. of Deaths.			No. of Deaths from Heart Disease.			Percentage of Heart Disease
	M.	F.	Totals.	M.	F.	Totals.	M.	F.	Totals.	
English (31)	8826	10087	18913	965	755	1720	52	50	102	5·90
Scotch (18) ...	3548·7	3973·5	7522·2	287	323	610	27	32	59	9·70
Irish (10) ...	3110	2915	6025	310	258	568	19	18	37	6·50
20 years here	3955	3376	7331	356	235	591	19	17	36	6·09
Totals and Averages ..	19,489·7	20,351·5	39,791·2	1918	1571	3498	117	117	234	7·05

The general object I had in compiling this table was to show the proportion of deaths from heart disease in a large insane population; it represents a total average of 39,791 individuals, with a mortality of 3498, a percentage of 8·79 calculated on the resident population. Of these deaths from all causes, 234 were due to heart disease, a percentage of 7·05 of the total deaths, and ·51 per cent. of the total living population.

Analysing the table, it is interesting to note that in 20 years at this asylum the mortality from heart disease is as low as 6·09 per cent., whereas in the following five years it rises to 13·51 per cent.; it is difficult to explain this fact. In the infancy of this asylum a large majority of the deaths

were due to "nerve lesions," and the percentage of "heart deaths" was almost *nil*. I noticed that as the number of inmates increased the death-rate rose, and at the same time the proportion of cases of heart disease increased even out of all proportion to the mortality.

The following English asylums had upwards of 10 per cent. of deaths from heart disease, calculated on the total number of deaths in the year recorded:—Broadmoor (18.18 per cent.), Kent (13.79 per cent.), Cumberland and Westmorland (12.50 per cent.), Stafford (11.32 per cent.), West Riding (10.95 per cent.), and Salop and Montgomery (10.25 per cent.). In the remaining 21 asylums the percentage was below 10 during the year.

In connection with this subject it is interesting to compare the geographical distribution of insanity with the distribution of heart diseases in the country. Dr. Clouston* has published a table showing the distribution of insanity in the different counties. This table has been used in a slightly modified form by Dr. Burman in his paper already referred to. It is found that the above six counties are—with the exception of West Riding—contained in Dr. Burman's first group which represents the counties where the proportion of the insane to the sane population is above the general average, being, as he shows, in the proportion of 2.34 per thousand in the upper, or first, group, as compared with 2.14 per thousand in the lower group. With respect to the presence of West Riding in this upper group, Dr. Burman found a percentage of 7.43 from heart disease in a large number of consecutive deaths, while in the annual report to which I refer the death-rate from heart disease was 10.95 per cent.

From the above facts, and from similar conclusions arrived at by Dr. Burman, it is inferred that heart disease, as a cause of death among the insane, occurs with greater frequency in those localities where the proportion of the insane to the sane is greatest.

(4.) *Pathological Changes observed in the Heart and Blood Vessels of those Dying Insane, including those changes not necessarily contributing to the fatal issue.*

The following table represents the pathological changes found in the heart and vessels in 222 consecutive post-mortem examinations, and the information contained in

* "Journal Mental Science," 1873.

it will be better understood if each column is considered separately.

TABLE VII.—Showing the Pathological Changes found in the Heart and Vessels of those Dying Insane in this Asylum during a period of Five Years.

Mental Condition.	Total Number Examined.			Average Weight of Heart in ounces.			Hypertrophy of Heart.		Atrophy of Heart.	Muscular substance fatty, pale, or flabby.	Pericardial changes.	Valvular Disease of Heart.		Disease of Arteries, Local or General.
	M.	F.	T.	M.	F.	Average.	Right.	Left.				Aortic.	Mitral.	
Acute Mania ...	3	2	5	8.25	8.50	8.38	1	1	1	2	0	0	0	2
Mania ...	47	51	98	12.36	13.97	11.67	18	26	4	50	37	15	22	50
Melancholia ...	20	13	33	11.12	10.40	10.76	4	10	0	19	9	7	7	19
General Paralysis ...	29	4	33	17.56	9.11	10.83	4	9	1	16	8	3	10	23
Epileptic Insanity ...	16	3	19	10.08	9.37	9.72	0	1	1	10	0	0	0	9
Dementia ...	17	10	27	11.90	8.12	10.01	3	8	2	15	7	5	4	17
Imbecility ...	4	3	7	17.25	5.50	11.37	1	3	0	3	1	1	3	3
Totals and Averages ...	136	86	222	11.93	8.86	10.40	31	58	9	115	62	31	46	123

(1.) *Weight of the Heart.*—It is evident that an increase in the size, and hence weight, of the heart is indicative of more or less hypertrophy, but it is important not to forget that an excess of fat deposited external to the organ may increase its weight although there may be no evidence of true hypertrophy. The healthy human adult heart weighs, according to Mæckel, about 10 ounces. Dr. Peacock† is more precise, for he states that the heart of a male adult weighs on an average 9oz. 8drs., and of a female adult 8oz. 13drs.; or it may be more roughly put, male heart = $9\frac{1}{2}$ oz.; female heart = $8\frac{1}{2}$ oz. Dr. Boyd‡ gives a higher average weight; in 2,614 autopsies (about 1-5th of which were on insane subjects) the male heart weighed on an

* "Monthly Journal of Medical Science" (Edin.), Vol. xix., p. 211.

† "Philosophical Transactions," 1861, p. 241,

average 11·83oz., and the female heart 9·86oz. Among the insane he found the average weights to be somewhat below these figures, viz., 11·14oz. and 8·67oz. respectively. Dr. Burman gives the average weight in 487 autopsies in West Riding Asylum as, males = 12·62oz., and females = 10·26oz., or nearly one ounce and half an ounce respectively higher than the weights given by Dr. Boyd.

In 222 autopsies, I found the average weight of the hearts of the insane to be 11·93oz. and 8·86oz. respectively, a proportion between that recorded by the above two observers.

A reference to the weight of the heart detailed in the above table shows that the lightest hearts were found among cases of acute mania, where the organ appears, as a rule, to be both light and atrophied. On the other hand, in ordinary mania, the weight is greater than in any other of the forms of mental disease.

The heaviest hearts in the series were found in general paralysis: three paralytics were recorded as having had organic cardiac disease; and the weights of these hearts were respectively 31½oz., 29oz., and 24oz., an average of 28·16oz. in the three.

In two cases of melancholia, the heart weighed 17oz. each; in two demented, 15oz. and 14oz.; and in two imbeciles, both with pronounced organic disease, the hearts weighed respectively 21oz. and 19oz.

In epileptic insanity, the average weight of the heart is lower than in other types of mental disease, with the exception of acute mania; in 19 cases it weighed 10·08oz. and 9·37 oz. respectively.

If we consider the average weight of the healthy adult heart to be 11·93oz. in males, and 9·86oz. in females, the hearts of the male insane are a fraction above this figure, and those of the female insane considerably below that of the healthy female. If, however, we exclude from the calculation the five cases of acute mania, where a small or even atrophied heart appeared to be common, then the average weights of the heart among the insane will be respectively 13·38oz. and 9·84oz., a considerable increase over the weight of the heart of the sane male, but still the heart of the female insane is lighter by ·02oz. than that of the healthy female.

(2.) *Hypertrophy of the Heart.*—A hypertrophied condition of the heart has already been pointed out by several observers to exist in general paralysis, and other diseases associated

with disorganisation of the brain; it would seem that in these cases of brain atrophy and thickened vessels, the cerebral circulation is much interfered with, and that this in time results in cardiac hypertrophy. Long continued muscular exercise causes an increase in the growth of muscular fibre, and the cardiac muscle is not exempt from hypertrophic change. Not only does muscular strain exercise this influence over the heart's muscle, but cases are on record of mental excitement or emotional states, if long continued, resulting in dilation of the cavities or hypertrophy of the walls of the heart. Tissot* observes that emotional states or even chagrin may produce dilatation of the heart and aorta, which, if not immediately fatal, must in time result in more or less hypertrophy; and, reasoning from this, long-continued mental excitement must necessarily cause a dilated, and latterly a hypertrophied, heart.

Dr. Pietro† states that he found hypertrophy of the heart common among the insane; in 48 examinations, 43 cases were hypertrophied. He believes the condition to commence in the right ventricle, and to be due to changes in the sympathetic. A reference to Table VII. shows that of 222 cases examined, the heart was hypertrophied in 89; in 31, the hypertrophy affected chiefly the right side, while in 58 the left side was involved. In the larger number the hypertrophy was most marked in the left ventricle, and in many of the cases of right-sided hypertrophy, the left side took part in the change as well. Hypertrophy occurred in 44·9 per cent. of the cases of mania examined; 42·4 per cent. in melancholia; 40·7 per cent. in dementia; and 39·3 per cent. in general paralysis.

This percentage in general paralysis exceeds that of Dr. Boyd,‡ who found cardiac hypertrophy in 22 per cent. of his cases of general paralysis.

(3.) *Atrophy of the Heart.*—This condition is not a common one in the insane; it occurred in only nine cases, 4·05 per cent. of the total number examined. In no case was the weight of the heart as low as 5oz. The paucity of examples of cardiac atrophy among asylum patients is curious, for, according to the various text books,§ atrophy of the heart is generally consequent upon wasting diseases, and a large

* Quoted by Dr. D. H. Tuke, "Journ. Ment. Science, Vol. xvii., p. 164.

† Quoted "London Medical Record," March, 1885.

‡ "Journal Mental Science," Vol. xvii., p. 20.

§ "Tanner's Practice of Medicine," Vol. ii., p. 28.

proportion of the deaths in asylum practice are those of long-continued and exhausting diseases. The smallest heart which I have found occurred in a dement, the organ weighing only $5\frac{1}{2}$ oz. In the cases of atrophy recorded, the heart weighed from 6 oz. to 7 oz. as a rule.

(4.) *The Muscular Substance* of the heart is frequently found pale, flabby, soft or fatty, in patients dying insane. Some of the cases recorded in this column had an excess of fat accumulated external to the organ, others presented a pale yellow or greasy condition of the muscular substance, but in the majority the muscle was pale, flabby, and softened. Although few cases were examined microscopically, yet from the peculiar condition of the muscular wall, probably many of these hearts had a true infiltration of fat between the muscular fibres. Dr. Howden* found four examples of true fatty degeneration of the heart, all in females, in 235 autopsies. In the 222 cases which I have recorded, 26 are reported to have had pale yellow or greasy hearts, most of these cases occurring either in old age or associated with slow and exhausting diseases. Two died from pernicious anæmia, a few from pneumonia, but it was chiefly in connection with phthisis pulmonalis that the heart, together with the other organs of the body, was found to present a fatty appearance.

(5.) *Affections of the Pericardium*.—Inflammation of the pericardium, although rare as a recent condition in the insane, is met with not unfrequently after death. An excess of the normal fluid in the pericardial sac, short of hydro-pericardium, old adhesive bands uniting the visceral and parietal layers of the pericardium, or "milk-spots" of varying size over the surface of the heart, are the conditions most commonly found. According to the above table, 27·91 per cent. of the total presented evidences of having had pericarditis at one time or another. This percentage is considerably above that of Dr. Howden,† who found changes of the pericardium in 18·3 per cent. of his cases.

It would appear that in the mental condition where hypertrophy of the heart is most common pericarditis occurs with greater frequency; in other words, pericardial changes were found in 37 per cent. of all the cases suffering from mania. It is difficult to say whether the pericarditis is consequent on the hypertrophy or the converse.

(6.) *Valvular Lesions of the Heart*.—In this column are

* "Journal Mental Science," Vol. xvii., p. 92.

† *Op. cit.*, p. 88.

recorded all the cases of disease or abnormality of the valvular apparatus of the heart, and it is interesting to note that although 13·51 per cent. died from heart disease, 77, or nearly 34·7 per cent. of the total, had disease of one or other of the valves. This proportion is somewhat above that of Dr. Howden, who found the valves abnormal in 25·5 per cent. of his cases, and of Dr. Burman, who states that in his autopsies the valves were diseased in 27·2 per cent. Dementia was the only mental condition in which affections of the aortic valves were more common than those of the mitral orifices. Although heart disease as a cause of death in general paralysis is comparatively uncommon, the valves, more especially the mitral, were found diseased in fully one-third of the cases examined. In this disease the aortic valves were seldom incompetent, although there occurred frequently a roughened condition of the cusps and the lining membrane of the aorta, and the lower portion of the aorta itself was frequently found considerably dilated.

(7.) *Arterial Disease in the Insane.*—In this place I will refer only to such naked-eye appearances as are met with in the post-mortem examinations, reserving the microscopic appearances found in the cerebral blood-vessels for the second portion of this paper.

Thickening or atheroma of the walls of the arteries is comparatively common among the insane, and when this condition occurs in the cerebral arteries it exercises an important influence on the functions of the brain. If the lumen of the vessels is constricted the brain receives a diminished supply of nourishment, the blood-pressure in the brain is increased, extra work is thrown back on the heart to overcome the resistance, and this results ultimately in cardiac hypertrophy. It will be thus seen that there exists a close connection between arterial degeneration and hypertrophy of the heart. Atheromatous degeneration or thickening of the vessels is a condition which occurs naturally in old age, but, as will be seen by a reference to the following table, age appears to exercise a less influence over the state of the blood vessels in the insane than in the sane.

According to the following table, atheroma of the arteries appears most frequently between the ages of 50 and 60, if we exclude cases above 75 years of age, when atheromatous degeneration is almost constant. With the exception of general paralysis, it does not occur frequently before the age of 50; in this disease thickening of the coats or atheroma of the vessels occurs at an early age, and there can be no

doubt that this change is to be regarded as a pathological condition occurring as a result of the morbid process of the disease.

TABLE VIII.—Showing the age and percentage of patients who had evidence of distinct atheromatous disease of their arteries after death.

Age of Patients at Death.	Total No. Examined.			Mania.		Melancholia.		General Paralysis.		Epilepsy.		Dementia.		Imbecility.		Total No. presenting Atheroma.			Percentage on Totals.
	M.	F.	T.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	T.	
20 under 30 ...	11	2	13	...	...	...	...	1	...	...	...	...	...	...	...	1	...	1	7.69
30 „ 40 ...	24	14	40	2	1	...	1	4	2	...	...	...	...	...	...	6	4	10	25.00
40 „ 50 ...	26	17	43	3	...	...	1	4	4	3	...	...	...	...	...	10	5	15	34.88
50 „ 60 ..	27	14	41	4	6	2	1	6	2	3	...	3	...	1	1	19	10	29	80.48
60 „ 70 ...	22	20	42	7	9	3	4	...	...	...	3	2	3	1	...	13	19	32	76.11
70 „ 80 ...	19	17	36	6	8	5	1	...	...	...	...	6	3	...	...	17	12	29	80.55
80 upwards ...	5	2	7	4	2	2	1	...	...	...	...	...	...	...	...	5	2	7	100.00
Totals & Average.	136	86	222	26	26	11	8	15	8	6	3	11	6	2	1	71	52	123	55.4

Of the 123 cases presenting atheroma of the vessels, 31 males and 19 females had valvular disease or other morbid conditions of the heart, while only 16 cases (9 males and 7 females) had atheroma of the vessels, but presented no cardiac disease.* Of the 50 cases of heart disease associated with atheroma, one male suffered from Bright's disease as well; there were two cases of cardiac hypertrophy alone without any valvular lesion, and three cases of extensive pericardial effusion. According to the above statistics atheroma appears to occur more frequently in females (60 per cent.) than in males (52 per cent.).

(5). *The Percentage of Deaths from Heart Disease or Arterial Change among the General Public.*

I regret that the limits of this paper and the time at my disposal prevent me bestowing sufficient attention on this portion of my observations, particularly as it is more by a

* Hitchman (quoted by Griesinger, p. 417) found atheroma of the cerebral vessels in 37 females of 97 autopsies on insane subjects. A percentage of 38.1.

study of the relative frequency of heart disease among a sane population and an asylum community that a true comparison can be instituted.

The observations which follow are founded on Public Health Reports, Pathological Registers, and the Registrar-General's Returns.

(1.) Infirmary, which during four years (1881-84) had 2,445 cases under treatment.

(2.) City (Health Reports), representing a population of 37,000, and an annual death rate of upwards of 700.

(3.) Middlesex Hospital (Pathological Reports), with a description of the appearances found in 568 autopsies during two years.

(4.) Registrar-General's Returns (Scotland, 1881), with a total mortality of 72,325.

In all the cases where a percentage of deaths from heart disease has been obtained from a population of mixed ages, 20 per cent. of the total has been deducted to allow of those deaths under 20 years of age,[†] as below this heart disease is rare as a cause of death, and also to bring the statistics more into comparison with an asylum population.

(1.) Of the 2,445 cases treated at Infirmary during the four years under review, 75 suffered from heart disease, and 19 were under treatment for cardiac functional disorders or arterial diseases, a percentage of 3.83 and .097 respectively. Few autopsies are, however, allowed in this institution, and a pathological register is not published.

(2.) City. From the report issued by the medical officer of health I find that, during the year 1883, 779 deaths occurred, and that of these 84, or 13.46 per cent., were due to heart disease. During the following year 783 deaths were registered, and 72, or 13.4 per cent., were ascribed to heart disease; three deaths only were said to be due to arterial disease.

(3.) In the Middlesex Hospital during the two years 1881-82, 568 autopsies were made, and of these 53 deaths, or 9.25 per cent., were ascribed to heart disease; and 106, or 16 per cent., presented lesions of the heart or vessels occurring as a secondary factor in the fatal issue. There were 2,086 admissions during the two years under review; 161 were known to have had heart disease, and 42 individuals suffered

[†] According to the Registrar-General (England, 1884), 19.1 per cent. of the total deaths occur under 20 years of age.

from some functional cardiac disorder, percentages of 7·7 and 2·01 respectively.

(4.) From the Registrar-General's Annual Return (1881) I find that 72,325 deaths were registered; disease of the heart ended fatally in 4,840 cases, a percentage of 8·36 of the total; it is interesting to note that heart disease is more fatal on the mainland and in rural districts than in the insular districts, where it was responsible for only 6·22 per cent. of the total deaths.

Taking the average of the above statistics, it is found that 8·72 per cent. of the total deaths among a sane population is ascribed to heart disease.

In this asylum the death rate from heart disease is only a fraction above the death rate from the same cause in the neighbourhood; but, according to the above statistics, heart disease is more frequent in this county, and at the same time the ratio of the insane to the sane is greater than in many other counties, as it occupies a position in the upper group of the table used by Dr. Burman, and previously referred to.

(6.) *General Summary and Conclusions.*

The following are the conclusions at which I have arrived from a consideration of the preceding observations:—

(1.) That heart disease occurs with greater frequency among the insane than among the sane.

(2.) That this increase in frequency is in part regulated by the frequency of heart disease among the sane population in the vicinity of the asylum where the observations are made.

(3.) That heart disease is more frequent among the insane in the counties where the ratio of the insane to the sane is greatest.

(4.) That the distribution of heart disease among the sane is regulated by the geographical position, dietetic and other influences acting as predisposing causes. Similar conditions appear to exercise an influence over the frequency of heart disease in the insane.

(5.) That the numerical difference between heart disease in the sane and the insane, if considered over all, is not great, being 8·72 per cent. of the total deaths in the former, and 9·36 per cent. in the latter.

(6.) That, according to my observations conducted in this asylum, heart disease is present in 12·94 per cent. of the living insane, and is the cause of death in 13·51 per cent.

Both on admission and at death the age of the greatest number who had heart disease was between 60 and 70.

(7.) That the clinical symptoms of mitral regurgitation in the living insane, and mitral disease with left-sided hypertrophy post-mortem, are the most common affections.

(8.) That the hearts of the insane are heavier than those of the sane, and this condition is more especially noted in general paralysis, where the heart is very frequently hypertrophied.

(9.) That in many cases of insanity the general circulation is sluggish, and the extremities are cold, livid, or even swollen. This condition occurs most frequently in cases of chronic or advanced types of insanity.

(10.) That the arteries are frequently affected in the insane, but that, with respect to the age, atheromatous degeneration of the arterial coats does not appear to occur earlier than among the sane. In general paralysis, however, thickening of the arterial tunics, or even atheromatous degeneration of the cerebral arteries, occurs quite independently of the age of the patient, and appears to be influenced more by the duration of the disease than by the age.

(11.) That, among the sane, heart disease appears to exercise an important influence on the mind, changing the temperament and altering the character of the patient, and that this change may become so prominent that the psychical phenomena exhibited may be those actually of insanity.

(12.) That, not only does heart disease alter the type and delusions of insanity, but also some cases occur among the insane, in whom the only ascertained predisposing cause of the mental aberration is the diseased condition of the heart, or general derangement of the circulatory system, and that, in these cases, the cardiac lesion is, no doubt, the predisposing cause of the insanity.

II. *Pathological Division.*

The following observations are founded on the microscopic examinations of 16 brains, taken in sequence; in four of these the vessels were dissected out from a given portion of the brain, and in the remaining 12 cases two portions of the brain—the right ascending parietal convolution and the corpus striatum—were removed and hardened preparatory to sections being made. Upwards of 140 sections were selected from these different portions, and the drawings which accompany this paper were taken from those specimens which

presented any peculiarities in the course or the structure of the vessels. These drawings were all done by the writer. *

The mental condition of the patients, whose brains I examined, was as follows:—Dementia, eight—four of whom were cases of senile decay; epilepsy, two; general paralysis, three; paralytic insanity, one; *folie circulaire*, one; and congenital imbecility, one. Three of these 16 cases had extensive organic disease of the heart.

Previous to detailing the changes which were observed in these cases, I propose to describe briefly the normal structure of the cerebral vessels according to the latest observers and from my own investigations.

Structure of the Vessels of the Brain in Health.

The medium-sized arteries of the brain are said by most authorities to possess four coats—the endothelium, the *membrana fenestrata*, the *tunica muscularis*, and the *tunica adventitia*. Th. Deecke† has described two, and, in many of the larger vessels, three additional tunics.

(1.) *The Endothelial tunic* is the innermost lining membrane of the arteries, and is continuous throughout the whole vascular system. In the arteries it consists of a layer of flattened endothelial cells, the outlines of which can be demonstrated by the ordinary silver process. The nuclei of these cells are oval or elongated in shape, and arranged with their long axis corresponding to the long axis of the vessel.

(2.) *The Membrana fenestrata* is a non-nucleated, irregular and reticulated web of compact bands, in which minute bright spots are seen, stated to be foramina by Deecke. They are generally found immediately above or in the neighbourhood of the nuclei, belonging to the subjacent endothelial tunic, are round in shape, and so small that a high magnifying power is requisite in studying their characters.

(3.) *The tunica Muscularis* consists of bundles of circularly-arranged, unstriated muscular fibres, and the thickness of the vessel as a rule depends on the number of these fibres present. Their nuclei are oval in shape, arranged transversely to the long axis of the vessel, and stain well with carmine. Interwoven with the muscular fibres are elastic bundles and connective tissue corpuscles whose peculiar-shaped nuclei are well seen in carmine-stained preparations.

(4.) *The tunica Adventitia* (the seventh layer of Deecke) is

* Only a few of the drawings can be published.—Eds.

† "American Journal of Insanity," July, 1877.

composed of broad connective tissue elements, in health generally lying in close apposition to the subjacent coat, with slight dilatations here and there, and it is only in pathological conditions that it is extensively separated from the muscular coat forming the "adventitial lymph space" of Virchow and Robin. The nuclei of its outer layers are oblong and more rounded in shape in its inner layers.

. *The Perivascular Space* is the interval between the adventitia and the brain tissue; in the healthy condition it is not extensive. Obersteiner* states that he observed numerous lymphoid corpuscles within it, but whether they were of the nature of wandering leucocytes he is unable to decide. The perivascular spaces, "the lymph ducts" of His, have no definite wall, but are lined by the brain tissue, and, according to Obersteiner, communicate with the "pericellular spaces" which surround the large ganglion cells of the brain. They are supposed to be lymphatic channels through which the neurine receives its proper nourishment. Dr. Batty Tuke† considered that this space was an abnormal condition, but at the same time he recognises "a pure hyaline membrane forming a somewhat loose envelope to the vessel" in healthy brains.

Structure of the Capillaries and Veins.

The *Capillaries* consist of two tunics, the internal of which is a delicate endothelial membrane, a continuation of the lining membrane of the arteries and the veins; and the external or adventitial sheath, firmer here, however, than in the arteries or the veins.

The *Veins* possess three coats, an internal endothelial tunic, a middle coat consisting of bundles of connective tissue, and an external adventitial sheath.

It is thus seen that the tunica adventitia surrounds the whole of the circulatory system in the brain, even to the most minute capillaries, leaving a space between it and the subjacent coat, more or less theoretical in the larger arteries, but in the smaller vessels forming in places a loose enveloping membrane.

Changes in the Blood Vessels of the Insane.

General Paralysis: In this disease, the morbid process of which is said to originate in the vascular system of the brain

* "Brain," October, 1884.

† "British and Foreign Medico-Chirurgical Review," Vol. cii., p. 873.

according to recent authorities, numerous important pathological changes were observed both in and around the vessels.

In small arteries which were traced from the pia mater inwards some considerable distance in the convolutions, I found a slight degree of tortuosity, and in places localised dilatations, but neither of these conditions occurred to the extent usually described in this disease. The vascular walls were generally thickened, more, however, from hypertrophy of the muscular coat than by atheromatous deposits. The adventitial sheath formed a loose enveloping membrane to the vessel and all its branches, with wide spaces at the points of bifurcation, and here and there along the course of the artery bulging out, leaving a considerable interval between the vessel and its sheath. Within and upon the sheath, more especially at the angles caused by the bifurcation of the vessel into two smaller branches, were deposited small particles of pigment and minute globules of fat. The pigment varied in colour from a pale primrose tint to deep brown mahogany. Obersteiner states that the paler varieties of pigment are in all probability metamorphosed fat granules, and this statement received some support from the action of osmic acid, which blackened the pale varieties, while those of a darker tint remained unaffected by the reagent. I experienced considerable difficulty in making satisfactory sections from the hardened brains of paralytics; this was due to the brittle and peculiar sieve-like appearance the section had. Under the microscope this condition was recognised as being due to numerous spaces which were considered by Lockhart Clarke* to be perivascular spaces from which the blood vessels had either dropped out or remained in a shrivelled up condition.

In general paralysis the perivascular spaces were enormously distended, and their outline was irregular and rugged. The nuclei of the adventitia were proliferated, and the walls of the vessels had a hypertrophied appearance. In the case of a male paralytic who succumbed to a series of epileptiform fits, the *veins* were filled with red blood corpuscles, and there was an extensive proliferation of the nuclei of the venous coats, the veins themselves being considerably distended.

Paralytic Insanity.—This was a male, aged 61, who

* Quoted "Journal of Mental Science," Vol. xv., p. 500.

was paralysed, and at intervals bedridden for upwards of three years, and although some of the clinical features were those of general paralysis, and the pathological appearances of the cerebral membranes were similar to those generally found in this disease, yet the microscopical examination of the cerebral arteries presented none of the conditions which I have found common in general paralysis. The adventitial sheath was in close apposition to the subjacent tunic, with the exception of the parts at the point of division of the vessels, when it became loose and bridged over from one branch to the other, forming a triangular space which contained numerous fat and pigment granules. The arterial coats, more especially the muscular tunic, were considerably thickened, and small calcareous crystals were deposited on the adventitia. Osmic acid stained the muscular fibres to so deep an extent as to indicate the presence of fatty degeneration of the muscular fibres, a condition, according to Obersteiner, not uncommon in old subjects.

Dementia (Senile).—A study of the condition of the blood-vessels in an advanced stage of cerebral atrophy is full of interest, and I have been fortunate in securing four brains illustrating this condition. These were from three females, aged 82, 80, and 76 respectively, and one male, aged 75. In this condition of old age the brain was generally found water-logged, the arteries very atheromatous, the convolutions much atrophied, and the brain on section softer than normal. Microscopically the perivascular spaces in all were considerably distended, and contained large quantities of pigment granules. In one specimen these pigment granules were large, round, in places isolated and apparently within the muscular tunic, others were united in the form of masses—mulberry-like—and lying upon the outer coat of the vessel. In all these cases, on transverse section of the vessels, the tunica muscularis was extensively hypertrophied, the lumen of the vessel diminished, and the tunica intima had a wavy appearance. In longitudinal sections the intima presented a peculiar roughened or “ground-glass” appearance, and in places had deposits of globular bodies, which stained well with carmine, regarding the nature of which I am still uncertain. The arteries generally had a hard, brittle appearance, their outline was irregular, and in places notched. The tunica adventitia in a female dement, aged 80, hung much looser round the arteries, especially the smaller vessels, than is usually the case, and

the space between the adventitia and the muscular coat contained bright crystals of lime salts. In a male dement, aged 75, the perivascular spaces were large, but their walls were smooth, and they did not present the rugged outline found in general paralysis. E. C., a female, aged 37, suffering from secondary dementia, had a severe attack of hæmatemesis, during which she died, and at the autopsy a large aneurism of the abdominal aorta was found, which had ruptured into the upper portion of the small intestine. The skull cap presented a small bony protuberance over its frontal portion. There was no history of specific disease. On examining the cerebral arteries I found their walls considerably thickened, due to a cellular infiltration immediately underneath the tunica intima bulging out this coat in places—an appearance described by some authors as essentially syphilitic in nature. There were minute spindle-shaped aneurismal dilatations in several of the vessels, and many of the arteries were filled with red blood corpuscles.

In another case of secondary dementia with extreme mitral stenosis and cardiac hypertrophy, I found a condition of the blood-vessels, which I can only ascribe to the effects of the cardiac disease. The cerebral arteries were tortuous, and in some cases so twisted as to be almost bent upon themselves, this condition necessitating dilatation of the perivascular spaces; the walls of the arteries were also considerably hypertrophied.

Epilepsy.—The changes in the blood-vessels of the brain in epilepsy are not conspicuous, and are similar to those generally found in long-continued cases of cerebral congestion. In a female epileptic imbecile, aged 27, who died from a series of fits, the muscular coat of the cerebral arteries was thickened, the veins considerably distended, their walls hypertrophied, and their lumen choked up with red blood corpuscles. There was extensive pigmentary deposit external to the vessels, and within them were minute dark granular bodies, evidently fatty in nature. The large ganglion cells of the brain were atrophied and in an advanced stage of pigmentary degeneration for a patient so young. The other case of epilepsy examined was that of a male, aged 45, who died from phthisis, and here, with the exception of slight hypertrophy of the tunica muscularis, and deposits of fatty granular matter within the arteries, little change of a pathological nature was observed. In both these cases, although the perivascular spaces were somewhat distended,

the adventitial sheath was, for the most part, in close contact with the subjacent tunic.

There is a form of brain disease associated with paralysis which occurs occasionally among the insane, and invariably ends fatally, and the naked-eye appearance of the brain appears normal. The clinical symptoms in some respects are similar to some forms of general paralysis, and the microscopic appearances of the brain are closely similar to what I have found in this disease. The following is a brief description of a typical case:—M. B., female, aged 43. Her mental condition was that described by authors as *folie circulaire*. About a week previous to her death she became dull, stupid, and impaired in her gait after an attack of excitement. In walking she staggered and trailed her limbs. She rapidly became worse, the paralysis increased, and her temperature rose. She had several attacks of an epileptiform character, and after each attack the paralysis was more pronounced. The ordinary reflexes disappeared, and she had extreme dysphagia for some time before her death.

At the autopsy the skull-cap was found thickened, the membranes congested, and there was slight subarachnoid opacity, especially over the parietal convolutions, which were atrophied. Other than these changes the brain presented nothing abnormal to the naked eye.

Sections of different portions of the brain were examined under the microscope. The minute arteries were thickened from hypertrophy of the muscular tunic, and proliferation of the nuclei of the adventitia was a very marked condition. The arteries in many portions, especially in the basal ganglia of the brain, were tortuous, and presented here and there minute dilatations from localised paralysis of the muscular fibres forming the muscular coat. The perivascular spaces were increased to a considerable extent, and there was extensive pigmentary deposit in and around the vessels. The matrix of the brain contained, in addition, dark brown granules of hæmatoidin in the neighbourhood of some of the vessels. The cells, both of the cortex and basal ganglia of the brain, were considerably atrophied, and had undergone extensive fuscous degeneration, the nuclei in many had disappeared, and were replaced by little round granules of pigment united in masses. The cell processes in many of the specimens were either much shortened or had entirely disappeared.

Many of these appearances are identical with those described in connection with general paralysis, but until I have examined the spinal cord in other cases of a similar nature I must refrain from arriving at a conclusion as to the true pathology of this disease.

REFERENCE TO PLATES.

PLATE I.

Fig. 1.—Minute showing cerebral artery the structure of the different coats. \times over 800.

Fig. 2.—Portion of small cerebral artery, showing the tunica adventitia in close apposition to the subjacent muscular coat. \times 350.

Fig. 3.—Artery from brain of male general paralytic; contour irregular; adventitia hangs loosely round the vessel, and there is a pigmentary deposit, especially in angles, caused by the bifurcations of the artery. \times 350.

Fig. 4.—Artery from brain of senile dement, aged 80; muscular coat thickened; adventitia loosely surrounds vessel, and contains, in addition to pigment deposits, small club-shaped crystals of lime salts. \times 350.

Fig. 5.—Section of corpus striatum of male paralytic, showing ampullations of arteries, dilated perivascular spaces, and atrophy and pigmentary degeneration of the cells. Stained in picrocarmine and \times 500.

PLATE II.

Fig. 1.—Section of right asc. pariet. convol. from a female with extreme mitral stenosis, showing peculiarly twisted and tortuous condition of a small artery. \times 500.

Fig. 2.—Section of corpus striatum from a male general paralytic, showing proliferation of nuclei of muscular tunic of arteries, with atrophy and pigmentation of cells. \times 500.

Fig. 3.—Section of right asc. pariet. convol. from brain of *M. B.* (*vide* page 30), showing ampullated and tortuous condition of arteries, proliferation of nuclei, and yellow pigmentation of cells—appearances similar to those found in cases of general paralysis. \times 700.

Fig. 4.—Section of right asc. pariet. convol. from a senile dement, aged 76; stained in picrocarmine and cleared up by oil of cloves; arteries are atheromatous, their outline is irregular; perivascular spaces much dilated; and a "ground-glass" appearance of intima. \times 500.

Fig. 5.—Section of corpus striatum from female, aged 82, showing branch of artery compressed by patch of sclerosis; tunica muscularis thickened, and presents large yellow globules; within the lumen of vessel are collections of small round granules, which stain well with carmine. \times 500.

