Observations on the Morbid Anatomy of Mental Disease. By GEORGE A. WATSON, M.B., Pathologist to the Lancaster County Asylum, Rainhill.

THE following observations are founded upon the records of 301 autopsies performed by myself at Rainhill Asylum. They are concerned principally with certain abnormal and morbid manifestations which occur within the crania of the insane. Of these the chief are, on the one hand, indications of subevolution, as shown by macroscopic structural defects of the cerebral hemispheres, such as deficiency of weight or of convolutional complexity, and on the other, evidence of dissolution as exhibited by wasting of the cerebral hemispheres. The relationship existing between these abnormal and morbid manifestations and certain other intracranial appearances is also discussed. No attempt, however, has been made—for reasons which will afterwards be given—at any close correlation between these abnormal and morbid manifestations and the mental states recorded during life. The observations, therefore, are of a pathological rather than a clinical nature.

The method of recording the intracranial appearances has been the same as that used by Dr. Bolton at Claybury Asylum and subsequently there by myself. Adoption of the method at Claybury led me to conclusions similar to those of Dr. Bolton, and I thought it desirable to know whether or not a further and more extended experience of the method in another asylum would confirm these conclusions.[1]

The subject will be dealt with under the following headings :

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PART I.

EXAMINATION OF MATERIAL FROM RAINHILL ASYLUM.

1. *Method of Recording the Intracranial Appearances.*

The intracranial appearances to which attention has been paid are : Conditions of the dura and pia-arachnoid ; the amount of sub-dural and sub-arachnoid fluid—whether natural or in slight, moderate, large, or great excess ; the manner in which the cerebral hemispheres strip—whether naturally or more readily than naturally, readily, very readily, or extremely readily ; and the amount, if any, of cerebral wasting. The absence or presence of degeneration of the cerebral vessels, and the degree of degeneration when present, has also been recorded, together with notes concerning the general conformation and convolutional pattern of the cerebral hemispheres.

The cerebral hemispheres are weighed, firstly unstripped, and then one or other, usually the left, sometimes both, after being stripped of its membranes. The amount of loss after stripping is noted, this serving as a useful check upon the other

observations concerning the intracranial appearances.[1] It has been found convenient for other purposes to confine the stripping of the cerebrum to that of one hemisphere in the majority of instances, and the left has usually been chosen for certain practical reasons.   This, however, is of no particular moment in so far as the following statistics are concerned, because in cases of gross lesion, general paralysis, and perhaps epilepsy excepted, it has not been common to find a difference in weight between the right and left hemispheres of more than a few grammes.   The rare instances in which any marked difference has occurred have not been included.

For reasons which will appear obvious, all cases of gross lesion which would be at all likely to appreciably affect the weight of the cerebral hemispheres have been excluded, as also have all general paralytics, epileptics, idiots, and imbeciles. Many of the cases, and certainly all the doubtful ones, have been examined microscopically. The cases from which the data used in compiling the statistics have been derived are, therefore, examples of the ordinary asylum population—cases of confusional insanity, mania, melancholia, paranoia, and the dementias, excepting, as before stated, those affections associated with gross lesion, general paralysis, or epilepsy. The tables are thus founded upon observations in 301 consecutive cases of insanity, in no way selected, with exception of the above mentioned necessary omissions, and of a very few cases which, for some special reason or other, could not be included.

A grouping of the intracranial appearances found in these cases has been made in the following manner :

Group I : No morbid appearances. No, or very slight, excess of fluid ; membranes appear normal, and strip about naturally ; no obvious wasting of the cerebral hemispheres.

Group II : Slight morbid appearances. Slight to moderate excess of fluid ; membranes strip a little more readily than naturally ; slight cerebral wasting.

Group III : Moderate morbid appearances. Moderate to considerable excess of fluid ; membranes strip readily ; moderate to fairly marked cerebral wasting.

[1] The actual amount lost after stripping will probably vary a little with different observers according to the extent to which the hemisphere is drained of fluid before the preliminary weighing, but the relative amount of loss, in the different groups to be presently described, should remain fairly constant in a given series of cases examined by an individual observer.

Group IV: Marked morbid appearances. Large excess of fluid; membranes strip very readily; well-marked cerebral wasting.

Group V: Gross morbid appearances. Great excess of fluid; membranes strip extremely readily; very marked cerebral wasting.

The above will serve as a guide to the method of placing the individual cases in the different groups. It is not pretended that all the particulars associated with a certain group will apply absolutely and in every detail to some isolated cases, although in the majority they will do so. At times instances occur in which, owing to certain bodily conditions or modes of death, the amount of intracranial fluid is increased above that which one is accustomed to find when these conditions are absent, or the membranes separate either with unwonted facility or with unusual difficulty, or in which it is difficult to estimate the degree of cerebral wasting, if any, owing to this being obscured by œdema of the brain substance. Hence, sometimes some little judgment may be required before a given case can be placed in what appears to be its appropriate group, and occasionally the intracranial morbid appearances taken together are so anomalous as to necessitate the actual omission of the case; but such instances as the latter are rare, and are invariably explicable on the grounds of the bodily conditions present.

The most important of these bodily conditions which may, but do not always do, modify the ordinary intracranial appearances, is tuberculosis—the most important because of its frequency. Certain other bodily diseases which tend towards a general water-logging of the system may have the same deleterious effect. With regard to tuberculosis, this was the actual cause of death in 31 *per cent.* of the total cases, *viz.*, of those in Group I 37 *per cent.*, in Group II 40 *per cent.*, in Group III 31 *per cent.*, in Group IV 19 *per cent.*, and in Group V 20 *per cent.* Thus tuberculosis was most frequently found in the cases in Groups I and II and least frequently in those in Groups IV and V.

Naturally also, as the grouping is an entirely artificial one, the groups tend to shade into one another to some extent. Whilst Group III stands out fairly clearly by itself, it is not always quite easy to decide whether a given case should be allotted to Group I or to Group II, which groups somewhat resemble each

other, or similarly to Group IV or to Group V. Still, it is quite unlikely, for example, that any case which properly should have been placed in Group II has been included in Group IV, and as regards the smaller differences, which might be put down to the personal equation of individual workers, these would be greatly discounted by the large number of instances involved. In an investigation of this description great exactitude of detail is almost an impossibility ; all that can be hoped for as the outcome is a generalisation. The method, however, in spite of these strictures, is one that can be readily applied by any close observer of intracranial appearances, and, indeed, substantially accurate results should be obtained by all but the most inexperienced.

2. The groups may now be considered from the following aspects :

(*a*) The average weight of the cerebral hemispheres.
(*b*) The convolutional pattern of the hemispheres.
(*c*) The mental state of the patients.

2 (*a*). *The Average Weight of the Cerebral Hemispheres.*
This is shown in the following table.

TABLE I.—*Weights of the Stripped Hemispheres in Grammes.*

	Males.		Females.		Average loss of weight after stripping the hemispheres.	
	Number of cases.	Average weight of hemispheres.	Number of cases.	Average weight of hemispheres.	Males.	Females.
Group I.—No morbid appearances . .	20	540	34	510	22·5	19
Group II.—Slight morbid appearances .	37	569	47	494	25·5	24
Group III.—Moderate morbid appearances .	46	561	30	509	32	29
Group IV. — Marked morbid appearances .	24	557	28	506	38	32
Group V.—Gross morbid appearances .	22	545	13	482	48	40·5
	Total number of cases.	General average weight of hemispheres	Total number of cases	General average weight of hemispheres.		
	149	554	152	500		

The most outstanding feature shown by the table is the small difference in the weights of the hemispheres in the different groups, considering that the hemispheres placed in Group I and II presented no or little wasting, and those in Groups III, IV, and V either moderate, marked, or gross wasting. In the case of the males, indeed, the average weight of the hemispheres with gross wasting in Group V slightly exceeds that of the hemispheres with no wasting placed in Group I. In the case of the females the average weight of the hemispheres in Group V only falls short of those in Group I by 28 grm.

The weight of any given hemisphere in Groups I and II must be either that of, or nearly that of, its original weight. It is, of course, impossible to say what was the original weight of any individual hemisphere in the Groups III to V, but those in Group III must have lost a not inconsiderable amount of their original weight—may be 30 to 50 grm.—whilst those in Groups IV and V may have lost anything from 50 to 80 grm., and in some instances, particularly in the case of the larger hemispheres, probably much more. Therefore the hemispheres in Groups III to V must have originally weighed decidedly more than those in Groups I and II, and it is thus evident that the cerebra which have undergone most wasting are, on the whole, those which were originally the heavier ones.

The relationship of the weights of the hemispheres in the different groups to one another is naturally the significant feature rather than the relationship of these to a supposed normal average. It would, however, be of interest, if not of advantage, to compare these weights with that of the average weight of the cerebral hemispheres of the sane population of the district from which the inmates of this asylum are derived. Unfortunately such average weight is not known, and the mean brain weight appears to differ to some extent in different localities.

The most recent and comprehensive statistics bearing upon the question of the normal average brain weight, at all ages from fifteen to eighty years, are those of Marchand.[2] According to this observer the average weight of the unstripped encephalon in 1,234 cases was 1,400 grm. for the male and 1,275 grm. for the female. By using Huschke's ratio of 13 to 87 for the conjoined cerebellum and pons to the cerebrum, and

by allowing 20 grm. as being approximately the amount which the normal hemisphere loses on stripping, it may be readily calculated that the average weight of the normal stripped hemisphere is about 589 grm. for the male, and about 534 grm. for the female. Marchand, however, derived his data entirely from Hessians. From the statistics of the older investigators it is not easy to arrive at a correct idea of the average weight of the brain at all ages. In the tables compiled by Marshall, from extensive data collected by Boyd, the number of cases in each of the columns is not stated, so that the exact average of the whole cannot be calculated, but it would appear from these tables that the general average weight of the brain for both sexes is lower than that given by Marchand. Boyd found the mean weight of the brain at from twenty to forty years to be 1,360 grm. for the male and 1,230 grm. for the female, or calculated as above about 572 and 515 grm. respectively for the stripped male and female hemispheres. Between the ages of thirty and thirty-five years Broca gives an average weight of 1,421 grm. for the male and 1,269 grm. for the female brain, or about 618 grm. and 532 grm. for the stripped hemispheres of the males and females.[3]

So far as can be judged, it would appear that the mean weights of the normal male and female cerebral hemispheres, as calculated from Marchand's figures, are probably approximately applicable to the average hemisphere weights of the general sane population of this district, and at least there is every reason for believing that these weights so applied are not excessive. Although the matter is of very secondary importance, these average weights for the stripped male and female hemispheres, viz., 589 and 534 grm. respectively, may therefore for the moment be compared with the average hemisphere weights of the cases in the different groups in Table I. The following facts will then be noticed. Firstly, that the average weights of the hemispheres in Groups I and II are appreciably below the above figures; especially is this noteworthy in Group I, which includes hemispheres showing no wasting. Secondly, if a reasonable number is added to the average weights of the hemispheres in each of the Groups III, IV, and V, in order to compensate for the amount lost owing to wasting, it is plain that the majority of the hemispheres in these groups cannot originally have weighed less than the presumed normal

average, and the probability is that they weighed considerably more.

It is obvious that the *defect* of weight of the hemispheres in Group I, taken as a group, is the consequence of subevolution, seeing that these hemispheres presented no evidence of wasting ; and it is equally clear that most of the deficiency of those in Group II is similarly the result of subevolution, as the loss due to wasting in these cases was slight. Also, it is evident that the lack of weight of the hemispheres in the Groups III to V, taken as groups, is largely, and in some instances probably entirely, the result of a *loss* due to dissolution, for all these hemispheres showed wasting in various degrees from moderate to gross.

A point worthy of special mention when dealing with the weights of the cerebral hemispheres in this connection, is that a given deficiency of weight which is the consequence of sub-evolution is probably of more significance than is the same loss of weight the result of dissolution. In the first place, in subevolution microscopical examination shows that the actual defect may lie not so much in gross diminution in the number and size of the cortical neurones as in deficiency of the finer connections of the latter, and the weight of these finer con-nections must be comparatively small, whereas in dissolution not only are the more delicate neuronic connections affected, but the bodies of the neurones themselves are actually more or less destroyed. Also in definite cerebral dissolution, naked-eye demonstration of marked destruction of the whole neurone is given by such manifestations as thinning of the white matter and dilatation of the ventricles ; in cerebral subevolution uncom-plicated by gross lesions such manifestations are absent or slight. Further, in subevolution deficiency of weight is gene-rally the equivalent of almost purely neuronic defect, and is, therefore, the actual deficiency. Loss of weight which is the result of dissolution does not usually represent the total neuronic loss, this being greater than appears, because such loss may be, and so often is, compensated for to some extent by vascular and neuroglial proliferation, particularly in the outer layers of the cortex. Hence, from these considerations it seems cer-tain that more importance may be attached to the defect in weight of the hemispheres placed in Groups I and II n which the signs of dissolution were absent or slight, than to the actual

loss of weight of the hemispheres in Groups IV and V, in which these signs were marked.

2 (*b*). *The Convolutional Pattern of the Cerebral Hemispheres.*

Some notes have been made concerning the convolutional pattern in all the cases, and in many instances a very detailed account of the general formation and fissuration of the hemispheres is on record.   In fact, because of its obvious importance, much time and attention have been devoted to this matter. For present purposes, however, it will be sufficient to reduce the description of the convolutional pattern to such terms as "very complex," "above average," "average," "simple," and "very simple."   In the following table will be found the number of hemispheres in each group which have been judged to answer to one or other of these descriptions.   The numbers in one or two of the groups are rather small for reduction to percentages, but for easy appreciation of the results it is convenient to adopt this method.

A glance at the table shows that in Group I, both male and female, the majority of the hemispheres are below the line ——, being either simple or very simple in pattern.   In Group II a greater proportion are above the line—in the case of the males the majority being so.   Groups III, IV, and V agree in that a large proportion of the hemispheres (87 to 91 *per cent.* in the case of the males and 77 to 80 *per cent.* in that of the females) are above the line, being either very complex, above average, or average in pattern.   In fact there is a rather striking similarity in the percentage of hemispheres in each of the Groups III, IV, and V, male and female respectively, which are either of average or above average complexity of pattern.   The hemispheres in Groups I and II are therefore on the whole decidedly more simple in convolutional pattern than are those in Groups III to V.   Moreover, it may be stated in general terms that local areas of under-development, gross anomalies of fissuration, and other defects which may be classed as cerebral stigmata, although found to a certain extent in some of the hemispheres in all the groups, are more frequently met with in those hemispheres placed in the earlier than in those belonging to the later groups. It must be admitted, however, that these stigmata are not uncommon even in large and complex hemispheres, but their

number in such instances is almost always more limited and their prominence much less than it is in the smaller and simpler hemispheres.

TABLE II.—*The Convolutional Pattern of the Cerebral Hemispheres.*

Males.

Pattern.	Group I. No. of cases. / Per cent.	Group II. No. of cases. / Per cent.	Group III. No. of cases. / Per cent.	Group IV. No. of cases. / Per cent.	Group V. No. of cases. / Per cent.
Very complex.	0 ⎫	1 ⎫	3 ⎫	1 ⎫	2 ⎫
Above average	0 ⎬ 35	3 ⎬ 67	7 ⎬ 87	2 ⎬ 87·5	2 ⎬ 91
Average .	7 ⎭	21 ⎭	30 ⎭	18 ⎭	16 ⎭
Simple .	12 ⎫ 65	9 ⎫ 32	6 ⎫ 13	3 ⎫ 12·5	1 ⎫ 9
Very simple .	1 ⎭	3 ⎭	0 ⎭	0 ⎭	1 ⎭
Total cases .	20	37	46	24	22

TABLE II—*continued.*

Females.

Pattern.	Group I. No. of cases. / Per cent.	Group II. No. of cases. / Per cent.	Group III. No. of cases. / Per cent.	Group IV. No. of cases. / Per cent.	Group V. No. of cases. / Per cent.
Very complex.	1 ⎫	0 ⎫	0 ⎫	1 ⎫	0 ⎫
Above average	0 ⎬ 38	2 ⎬ 47	1 ⎬ 80	2 ⎬ 78	1 ⎬ 77
Average .	12 ⎭	20 ⎭	23 ⎭	19 ⎭	9 ⎭
Simple .	8 ⎫ 62	10 ⎫ 53	5 ⎫ 20	6 ⎫ 21	3 ⎫ 23
Very simple .	13 ⎭	15 ⎭	1 ⎭	0 ⎭	0 ⎭
Total cases .	43	47	30	28	13

2 (c). *Mental State of the Patients.*

Bolton was able to show, from personal investigation into the mental state of the patients included in his series, that the groups grade very closely with the degree of dementia present at the time of death. Unfortunately no data are available

which will enable me to make a pathological and clinical correla-
tion of the cases in this series with any degree of accuracy. The
form of insanity from which the patient was supposed to have
suffered at the time of death is stated in the return supplied to
me as a matter of routine practice by the medical officer in
charge of the case, the return being made out in accordance
with the schedule of the Commissoners in Lunacy. According to
this schedule of forms of insanity the medical officer is under
no obligation to state in connection with certain of the chronic
cases whether he considers that any dementia existed or not.
Consequently in the majority of such instances he has expressed
no opinion on this matter, and the returns, therefore, do not
always supply information in the form which is necessary for
the present purpose. At times such a statement as " mania
with mild dementia " occurs ; this case should clinically, accord-
ing to Bolton, come under Group II. Another return may
simply state " chronic melancholia." Inquiry as to this case
may elicit the reply that a moderate degree of dementia existed,
but as the symptoms of melancholia apparently predominated
no mention was made of dementia in the return ; such a case
should clinically be placed in Group III. As personal inquiries
have not been made in every instance, the returns, if any use
were to be made of them, would have to remain as they stand.
This being so, even if the cases were arranged under two head-
ings only—*viz.*, (1) insanity other than dementia, including all
those in which no mention of dementia occurs, and (2) all the
dementias—for the reason just stated a number of cases would
inevitably be classed as insanity other than dementia, which
properly should have been placed under dementia. On the
other hand, some cases would probably be included under
dementia in which no dementia existed at all if by this term is
to be understood " a permanent psychic disability," for there is
no knowing at the present time in what sense the term may
have been employed by a junior medical officer of perhaps only
very limited clinical experience. Apart from this there are the
difficulties of diagnosis to be considered—difficulties which no
doubt diminish as experience increases. Attention has already
been directed to certain bodily conditions, the most important
being tuberculosis, which may modify the ordinary intracranial
appearances, although they do not necessarily do so. The same
bodily conditions may complicate the diagnosis from the

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clinical aspect; indeed, difficulties of this nature are likely to be much greater *ante-mortem* than *post-mortem.* The mental lethargy and confusion exhibited by some patients who suffer from a more or less long-standing illness may be readily mistaken for a permanent psychic disability. It has previously been shown that the percentage of deaths from tuberculosis is highest in Groups I and II and considerably lower in Groups IV and V; it is presumably, therefore, in connection with cases in the first two groups that mistakes in diagnosis—if such mistakes have been made—are the more likely to have occurred. This may explain why such a large proportion of cases included under Group I (*viz.,* 20 *per cent.* of the males and 41 *per cent.* of the females) were considered to have suffered from dementia, although all, *post-mortem,* showed no cerebral wasting nor any other intracranial morbid appearance.

Owing to these various considerations the returns relating to the mental state of the patients are of little or no value for the purpose in view. If, however, the cases are roughly divided into the two classes before indicated, *viz.,* according to the absence or presence of dementia as stated in the returns, it is found that in the majority of the cases in Groups I and II (70 *per cent.* and 54 *per cent.* respectively) no mention is made of dementia, whilst the larger proportion of the cases in Groups III, IV, and V (67 *per cent.,* 77 *per cent.,* and 81 *per cent.* respectively) were regarded as having shown symptoms of dementia. Thus, although the data concerning the mental state of the patients in this series are by no means satisfactory, such general conclusion as can be drawn from them agrees, to some extent, with our previous impressions regarding the close association existing between the intracranial morbid appearances and the presence of dementia.

Conclusions.

The different groups have now been considered from the aspects of the average weight of the cerebral hemispheres, of their convolutional pattern, and, in so far as the data available will allow, of the mental states of the patients included in the series. It has been shown that the hemispheres in Groups III to V—those which had undergone the most wasting, and which, therefore, presumably should have belonged to the patients

who exhibited the most dementia—were, taken as groups, originally the heavier ones as compared with those in Groups I and II. It has also been shown that the hemispheres in Groups III to V possess, on the whole, the better convolutional pattern, and are relatively the more free from cerebral stigmata. If developmental deficiency in weight of the cerebrum, simplicity of convolutional pattern, and the frequent presence of cerebral stigmata—not necessarily any one of these features by themselves, nor in individual instances, but considered as a general average of a large total—are to be looked upon as criteria of amentia, then the majority of the hemispheres included in Groups I and II were derived from cases of amentia. This is as far as a generalisation made from statistics gathered from macroscopic sources will enable us to go. Such a generalisation will not, of course, apply in certain individual instances, for two additional factors of the utmost importance require to be taken into consideration, *viz.*, the depth of the cerebral cortical layers and the degree of development of the neuronic elements in these layers. For example, a comparatively large cerebrum may be found, on microscopic examination and measurement, to possess a poorly developed and relatively shallow cortex, and *vice-versâ*. This, however, does not imply that a generalisation such as the above is without value.

In going over the details from which Table I was compiled, it was found that hemispheres of almost all weights within the ordinary limits occurred in all the groups. The following table shows the number of instances in each group (with the percentages) in which the hemisphere weight was above, and the number in which it was below, that of the average weight of the series of cases. This average weight is, of course, considerably below that of the normal.

Whilst the general result shown by Table III is somewhat similar to that exhibited by Table I, it will be seen that in a large number of instances the hemispheres in Groups I and II weighed more than the average of the series. These groups also, as has been previously shown, contain a fair percentage of cases with hemispheres of at least average convolutional pattern.

It might be argued that the above conclusions are not valid because a certain proportion of cases with hemispheres of good weight and well-developed pattern are to be found in the earlier groups. Groups I and II, however, it may be pointed out,

contain the hemispheres of a number of recent or comparatively recent cases, some of which doubtless would have been discharged recovered had the patients not died of some intercurrent illness, whilst others, it is reasonable to suppose, would in the course of time have passed on to one or other of the later groups. In some instances these cases possessed hemispheres of a weight considerably above that of the average of the series, and the inclusion of these in Groups I and II naturally increases the average weight of the hemispheres in these groups. Conversely, many hemispheres which were originally small (and of poor convolutional pattern) have passed out of the earlier groups into the later, and these reduce the average weight of the hemispheres in the later groups.

TABLE III.—*The Number of Cases in each Group in which the Hemisphere Weight was above, and the Number in which it was below, that of the General Average Weight of the Series. General Average Weight of the Series : Males, 554 grammes ; Females, 500 grammes.*

	Males.					Females.				
	No. of cases.	No. above general average weight.	Per cent.	No. below general average weight.	Per cent.	No. of cases.	No. above general average weight.	Per cent.	No. below general average weight.	Per cent.
Group I .	20	7	35	13	65	34	18	53	16	47
„ II .	37	25	68	12	32	47	21	45	26	55
„ III .	46	28	61	18	39	30	19	63	11	37
„ IV .	24	13	54	11	46	28	15	54	13	46
„ V .	22	9	41	13	59	13	4	31	9	69
Total cases .	149					152				

3. *Factors which may Influence the Passage of the Cases from the Earlier to the Later Groups.*

Some consideration may now be given to the chief of these factors, viz., (a) the age of the patient, (b) the duration of the attack of insanity, (c) the presence or absence of degeneration of the cerebral vessels.

In the following tables the average age at death of the patients in the different groups and the average duration in the asylum are placed side by side.

TABLE IV.—*Average Age at Death.*	Males.	Females.
Group I . .	36	36
„ II . .	42	48
„ III . .	50	59
„ IV . .	58	65
„ V . .	60	66
General average age . . .	49	52

TABLE V.—*Average Duration in Years.*	Males.	Females.
Group I . .	3	4
„ II . .	6	4
„ III . .	9	10
„ IV . .	9	13
„ V . .	8	6
General average duration . .	7	7

(*a*) *Age of the patients.*—Although the average age at death together with the average duration in the asylum increases as one passes from Groups I and II to the later groups, yet included in Groups I and II are to be found patients of almost all ages. Thus, in Group I, male, 4 out of 20 patients (20 *per cent.*) were above the general average age of 49, the oldest being 66 years of age ; in Group I, female, 3 out of 34 (9 *per cent.*) were above the general average age of 52 years, the oldest being 59. In Group II, male, 11 out of 37 (30 *per cent.*) were above the general average age, the oldest being 63 ; Group II, female, contains patients of all ages up to 72 years, and 19 out of 47 (40 *per cent.*) were above the general average age of 52 years.

(*b*) *Duration of the attack of insanity.*—A large proportion of the cases in Group I, both males and females, were recent or fairly recent ones, yet one male was in the asylum for twenty years, one female for eleven years, and many others for periods varying from four to nine years. The patients included under Group II, although only slight wasting of the cerebral hemispheres existed, had been in the asylum for varying periods up to thirty-one years in the case of the males and eighteen years in that of the females, in fact, 25 out of the total 84 cases in this group (*i.e.*, 30 *per cent.*) had been in the asylum for over the general average duration period of seven years.

Thus it would appear that neither the age of the patient nor the duration of the attack of insanity is in itself an im-

portant factor determining the passage of any given case from one of the earlier groups to one of the later.

(c) *Degeneration of the cerebral vessels.*—The following tables (VIa and VIb) show the total amount and the degree of cerebral vascular degeneration found in all the cases, also (VIb) the number of patients with vascular degeneration in each group who were below, and the number of those who were above the general average age for the males and females respectively.

TABLE VIa.—*Number of Cases of Cerebral Vascular Degeneration in each Group.*

Males.

	No. of cases in group.	Average age of group.	Number of cases with vascular degeneration.			Group percentage of vascular degeneration.	Group percentage of moderate and severe vascular degeneration.
			Slight.	Moderate.	Severe.		
Group I .	19	36	2	—	—	11	0
„ II .	37	42	8	1	1	27	5·4
„ III .	46	50	19	8	4	67	26
„ IV .	24	58	6	7	6	79	54
„ V .	22	60	4	3	14	95	77
	148		39	19	25		

TABLE VIa—*continued.*

Females.

	No. of cases in group.	Average age of group.	Number of cases with vascular degeneration.			Group percentage of vascular degeneration.	Group percentage of moderate and severe vascular degeneration.
			Slight.	Moderate.	Severe.		
Group I .	33	36	1	—	—	3	0
„ II .	47	48	12	3	2	36	10·6
„ III .	30	59	5	6	9	66	50
„ IV .	28	65	2	6	18	93	86
„ V .	13	66	—	1	11	92	92
	151		20	16	40		

* One male and one female omitted as insufficient data were recorded in these cases.

TABLE VI*b*.—*Number of Cases with Cerebral Vascular Degeneration above and below the General Average Ages of* 49 *years (Males) and* 52 *years (Females).*

Males.

	No. of cases in group.	Slight.				Moderate.				Severe.			
		Below 49 years.	Average age.	Above 49 years.	Average age.	Below 49 years.	Average age.	Above 49 years.	Average age.	Below 49 years.	Average age.	Above 49 years.	Average age.
Group I	19	1	42	1	51	—	—	—	—	—	—	—	—
„ II	37	2	40	6	59	—	—	1	63	—	—	1	57
„ III	46	6	39	13	58	1	47	7	65	1	36	3	65
„ IV	24	1	22	5	59	—	—	7	62	—	—	6	67
„ V	22	1	48	3	55	1	45	2	52	—	—	14	69
Total	148	11	—	28	—	2	—	17	—	1	—	24	—

TABLE VI*b*—*continued.*

Females.

	No. of cases in group.	Slight.				Moderate.				Severe.			
		Below 52 years.	Average age.	Above 52 years.	Average age.	Below 52 years.	Average age.	Above 52 years.	Average age.	Below 52 years.	Average age.	Above 52 years.	Average age.
Group I	33	1	30	—	—	—	—	—	—	—	—	—	—
„ II	47	4	45	8	60	—	—	3	70	—	—	2	61
„ III	30	3	41	2	61	—	—	6	65	—	—	9	70
„ IV	28	—	—	2	67	—	—	6	61	—	—	18	69
„ V	13	—	—	—	—	—	—	1	69	—	—	11	62
Total	151	8	—	12	—	—	—	16	—	—	—	40	—

When attempting to make any correlation between degeneration of the cerebral vessels and cerebral wasting, it is no doubt advisable to exclude instances of slight vascular degeneration, as it is probable that, even if vascular degeneration is able to initiate or to hasten the progress of cerebral dissolution, it is

only the moderate and severe forms of atheroma which would have any very appreciable effect.   As the number of examples in the above tables of moderate and severe degeneration of the cerebral vessels is rather small in any of the groups, the male and female cases may be considered together.   It will then be seen that no instance of moderate or severe atheroma occurred in Group I.   In Group II there were 7 examples out of 84 cases, or 8 *per cent.*; in Group III 27 out of 76, or 35·5 *per cent.*; in Group IV 37 out of 52, or 71 *per cent.*; and in Group V 29 out of 35, or 83 *per cent.*   Thus decided degeneration of the cerebral vessels and definite cerebral dissolution appear to be associated features.

This correlation can also be shown in another way.   It has been stated that whilst the greater number of the hemispheres in Groups I and II are of less weight than the majority of those in Groups IV and V (and certainly were originally so if the loss of weight due to wasting of those in the two latter groups is considered), yet hemispheres of almost all weights within the usual limits occur in all the groups.   Table III shows the number of hemispheres in each group having a weight above, and the number with a weight below that of the general average of the series of cases.   The 71 cases in Groups I and II, male and female, with either no or only slight cerebral wasting, which possessed a hemisphere weight *above* that of the average of the series, showed no sort of constancy either as regards the age of the patients, which varied from nineteen to seventy years, or in respect to the period of duration in the asylum, which ranged from a few days to twenty years.   All these cases, however, agreed in being free from severe degeneration of the cerebral vessels, and only 4 instances of moderate atheroma (5·6 *per cent.*) occurred in the whole 71 cases.   In Groups IV and V, male and female, there are 46 cases in which the hemisphere weight was *below* that of the average of the series. Whilst the ages of these patients was generally higher, and the duration period usually longer than that of the cases in Groups I and II, the most striking feature exhibited by these cases in Groups IV and V, with marked or severe cerebral wasting, was the prevalence amongst them of moderate or severe degeneration of the cerebral vessels, this being found in 38 cases (6 moderate and 32 severe) or 82 *per cent.* of the whole.

Group III occupies an intermediate position between Groups

II and IV with regard to the prevalence of cerebral vascular degeneration as it does in respect to the degree of cerebral wasting. There is a wide gap between the percentage amount of moderate and severe atheroma in Group III and in Groups IV and V, taken together, particularly with regard to the amount of severe atheroma. This gap—represented in the matter of severe atheroma by 17 *per cent.* on the one hand and 56 *per cent.* on the other—suggests that in the majority of instances cerebral dissolution only reaches a moderate stage in the absence of gross degeneration of the cerebral vessels. In a number of the rarer cases in which cerebral dissolution was marked, although there was no gross naked-eye degeneration of the cerebral vessels, microscopical examination has shown a special affection of the smaller vessels and considerable neuroglial proliferation. These cases, it is of interest to note, have not infrequently been regarded clinically as probably being examples of general paralysis.

Conclusions.

The apparent effect upon cerebral dissolution of age, of duration of the attack of insanity, and of degeneration of the cerebral vessels, may be summarised as follows :

(1) Neither the age of the patient nor the duration of the attack of insanity is in itself an important factor concerned in the production of, or in hastening the progress of, cerebral dissolution.

(2) Atheroma and age may be independent of one another.

(3) It is a matter of general experience that simple senility is not necessarily associated with gross degeneration of the cerebral vessels ; also that cerebral vascular degeneration, even if gross, does not necessarily lead to or hasten the progress of cerebral dissolution, for although no instance happens to be included in this series, very occasionally a case is met with showing severe atheroma but little or no cerebral wasting.

(4) Whilst propositions 2 and 3 are admittedly true, it is evident that cerebral vascular degeneration and cerebral dissolution are commonly concurrent phenomena, and that " the percentage amount and also the severity of naked-eye degeneration of the cerebral vessels vary directly with the degree of" cerebral wasting present.

(5) In the majority of cases cerebral dissolution only reaches a moderate stage in the absence of gross degeneration of the cerebral vessels.

Although the above line of argument in the treatment of this subject is somewhat different to that adopted by Bolton, the general conclusions arrived at are very similar.

PART II.

COMPARISON OF RESULTS OBTAINED AT CLAYBURY ASYLUM AND AT RAINHILL ASYLUM.

1. *The Weights of the Cerebral Hemispheres.*

It has already been stated that there are grounds for believing that the mean weight of the normal brain varies to some extent in different localities. It is therefore of interest, for this and for other reasons, to compare the table of weights of the cerebral hemispheres obtained from Rainhill Asylum with that already published by Bolton concerning the weights of the hemispheres at Claybury Asylum. Although Bolton did not expressly exclude all idiots and imbeciles from his statistics, yet on going through his data it will be found that there are in his series of non-epileptic cases only eight male and female idiots and imbeciles altogether—all in Group I.[4] Reference to the brain weights of these shows that their inclusion makes no appreciable difference to average weight of the whole series of hemispheres in this group, so that the data contained in the subjoined table are for all practical purposes quite comparable.

The sets of figures derived from Claybury and from Rainhill both point to the similar conclusion that the weights of the cerebra in Groups III to V must have been originally greater than that of those in Groups I and II. The Rainhill figures are, however, the more striking of the two, because of the greater weight of the hemispheres—as compared with those from Claybury—in Groups III, IV, and V, particularly of those in the two latter groups.

The general average weight of the hemispheres in all the groups is : for Claybury, males, 538 grm. ; females, 471 grm. ; and for Rainhill, males, 554 grm. ; females, 500 grm. It will be noticed that the Rainhill hemispheres are heavier than the

TABLE VII.—*Comparison of the Weights of the Cerebral Hemi-spheres from Claybury and Rainhill Asylums.*

Males.

	CLAYBURY.			RAINHILL.		
	No. of cases.	*Per cent.* of total cases.	Average weight of hemi-spheres.	No. of cases.	*Per cent.* of total cases.	Average weight of hemi-spheres.
Group I.—No morbid appearances . .	*16*	*15*	**553**	*20*	*13*	**540**
Group II.—Slight morbid appearances .	*14*	*13*	**565**	*37*	*25*	**569**
Group III.—Moderate morbid appearances .	*27*	*25*	**551**	*46*	*31*	**561**
Group IV.—Marked morbid appearances .	*27*	*25*	**509**	*24*	*16*	**557**
Group V.—Gross morbid appearances .	*25*	*23*	**513**	*22*	*15*	**545**
	Total number of cases.		General average weight of hemi-spheres.	Total number of cases.		General average weight of hemi-spheres.
	109		**538**	*149*		**554**

TABLE VII—*continued.*

Females.

	CLAYBURY.			RAINHILL.		
	No. of cases.	*Per cent.* of total cases.	Average weight of hemi-spheres.	No. of cases.	*Per cent.* of total cases.	Average weight of hemi-spheres.
Group I.—No morbid appearances . .	*36*	*14*	**499**	*34*	*22*	**510**
Group II.—Slight morbid appearances .	*66*	*26*	**480**	*47*	*31*	**494**
Group III.—Moderate morbid appearances .	*59*	*23*	**482**	*30*	*19*	**508**
Group IV.—Marked morbid appearances .	*44*	*17*	**455**	*28*	*18*	**506**
Group V.—Gross morbid appearances .	*50*	*19*	**437**	*13*	*8*	**482**
	Total number of cases.		General average weight of hemi-spheres.	Total number of cases.		General average weight of hemi-spheres.
	255		**471**	*152*		**500**

TABLE VIII.—*Average Ages at Death.*

	CLAYBURY.		RAINHILL.	
	Males.	Females.	Males.	Females.
Group I	38	35	36	36
„ II	55	50	42	48
„ III	57	54	50	59
„ IV	68	68	58	65
„ V	70	69	60	66
General average age . . .	57		49	52

Claybury ones in all the groups excepting male Group I, in which the Claybury hemispheres exceed those from Rainhill by 13 grm. ; there is, however, a difference of only 4 grm. in the hemispheres in male Group II derived from the two places. In all the other groups, male and female, there is a more or less decided difference in the weight of the hemispheres obtained from the two institutions—a difference in favour of Rainhill. This difference in Group III is 10 grm. in the case of the males and 26 grm. in that of the females ; in Group IV it amounts to as much as 48 grm. in the males and 49 grm. in the females ; and in Group V to 32 grm. in the males and 45 grm. in the females. It is particularly significant that the difference is greatest, on the whole, in Groups III to V, which groups have been shown to contain, as groups, not only the cerebra which were originally the heavier ones, but also those which possessed the better convolutional pattern. These also are, of course, the cerebra which have suffered most from dissolutive changes.([1])

It might be suggested that the greater mean weight of the Rainhill cerebra can be partly accounted for by the supposed taller stature of the northern people. Marchand (*loc. cit.*), however, states that there is no constant relationship between body-weight and brain-weight, although the mean weight of the brain in males and females of short stature is *rather less* than that of those of average height. Also, that the smaller size of the

([1]) I also have the impression, derived from my own experience at the two asylums, that the Claybury cerebra were of a generally simpler pattern—although naturally with many exceptions—than those at Rainhill, but an impression of this kind is not of any great value, and may indeed be fallacious.

female brain is not dependent on the lower stature of the female, for the mean weight of the brain in women is less than is that of men of equal height. Judging from the older statistics of Marshall (*loc. cit.*) the influence of stature upon brain-weight appears to be rather more marked. If, however, the conjoined cerebellum and pons is allowed for according to Huscke's ratio, the greater weight of each cerebral hemisphere in the taller people is not very considerable, and it is greater in the males than in the females. The matter in any case is of little importance in so far as the present statistics are concerned, for, owing to the kindness of Dr. Robert Jones, I have been able to make a comparison between the average heights of the patients admitted to Claybury and to Rainhill Asylums. Dr. Jones states that the average height of all the admissions to Claybury Asylum during 1909—at least of all the adults whom it was possible to measure—was, for 203 males $66\frac{1}{16}$ in., and for 219 females $61\frac{1}{4}$ in. The average height of the adult patients admitted to Rainhill Asylum during the years 1908 and 1909 was, for 316 males 65 in., and for 264 females $60\frac{1}{2}$ in. These figures are sufficient to indicate that there is no difference in stature between the two asylum populations such as would be likely to appreciably affect the weight of the cerebral hemispheres.

2. *The Percentage of Cases in the Different Groups.* (See Table VII [p. 247].)

With regard to the percentage of cases which have been placed in the respective groups at Claybury and at Rainhill, if the males and females are taken together it will be seen that a greater proportion of cases belonging to Groups I and II occurred at Rainhill than at Claybury, and a lesser proportion belonging to Groups IV and V, especially to the two latter Groups (II and V) in each instance. The former fact may perhaps be accounted for by the non-existence in the County of Lancaster of a body similar to the Metropolitan Asylums' Board. The latter fact is somewhat difficult of explanation excepting on the grounds that, apparently for local administrative reasons, fewer recent, or fairly recent, senile cases were admitted to Rainhill than to Claybury. It will be seen from Table VIII (p. 248) that the average age at death is less in all the groups except one (female

Group I) at Rainhill than at Claybury, and that in Groups IV and V the difference amounts to as much as ten years in each group in the case of the males and to three years in each group in that of the females.   Had there been a greater proportion of elderly people with the commonly concomitant vascular degeneration amongst the Rainhill cases, it is probable that the percentage of cases allotted to Groups IV and V would have been higher. Whatever the explanation may be, I was surprised, some little time after taking up my duties at Rainhill, to find few instances of gross cerebral wasting (exclusive of cases of general paralysis) compared with the number I had been accustomed to see at Claybury, and it is interesting to have this impression confirmed by further experience and by the evidence of statistics.

3. *The Comparative Amount of Degeneration of the Cerebral Vessels.*

Bolton's tables dealing with the question of vascular degeneration in his Claybury cases are compiled somewhat differently to mine, but the two sets of statistics can be readily contrasted. It would appear that not only is degeneration of the cerebral vessels more prevalent at Rainhill that at Claybury, but that it is found at an earlier age in the former institution.   Possibly this can be accounted for by differences in the habits of the general population of the two districts.   With regard to the matter of " drunkenness " and " the comparative prevalence of insanity ascribed to intemperance," the county of Lancaster is, or was, according to the Fifty-ninth Report (1905) of the Commissioners in Lunacy, one of the blackest patches on the map of England.

As it has been stated that vascular degeneration appears to be the chief factor in hastening the progress of cerebral dissolution, it may be thought difficult to reconcile the fact of the relatively greater prevalence of drunkenness in the county of Lancaster with that of the lesser proportion of cases belonging to Groups IV and V at Rainhill as compared with Claybury. It is, however, only reasonable to suppose that vascular degeneration, incited by such an extraneous cause as alcoholic excess, and occurring at a comparatively early age, would have less influence in hastening the progress of cerebral dissolution than would the gross vascular degeneration which is so commonly

associated with senility, and which is only one of the many evidences of wearing out of the whole bodily tissues, including the brain.   As has been shown, it is the class of case with the atheroma of senility which appears to have been admitted with less frequency at Rainhill than at Claybury.

General Conclusion.

Many of the points which have been touched upon in this paper have previously been dealt with by Bolton, from both clinical and pathological aspects, and any reader interested in the subject may be referred to his published work for further details.

Consideration of the weights of the cerebral hemispheres in their respective groups, whether derived from Claybury or from Rainhill, have led to the same conclusion—a conclusion which has been strengthened by the investigation of the convolutional pattern of the Rainhill cerebra.   I wish to especially emphasise the fact that this inference can be drawn very largely from a consideration of intracranial appearances alone.

A general conclusion, the result of a study of the cases in this series—a series from which, it should be remembered, all cases of idiocy, imbecility, epilepsy, general paralysis, and gross cerebral lesion are excluded—is, that all cases of " mental disease" may, on the data furnished by intracranial appearances, be divided into two main classes.   Cases with cerebra which are developmentally deficient in weight and in convolutional complexity, and which are frequently characterised by the presence of an unusual number of other stigmata, but which exhibit no, or only slight, intracranial morbid appearances, and are hence not prone to cerebral dissolution.   These manifestations of cerebral subevolution, therefore, suggest that such cases should be regarded clinically as examples of amentia in contra-distinction to the second class of case, which possessed cerebra of originally greater weight and more highly evolved convolutional pattern ; in the latter class of case the cerebrum has undergone dissolution to a more or less extent, and such cases should presumably therefore be looked upon clinically as cases of dementia.

Lest it should be objected that there is a certain recovery rate amongst the insane, and that cases of recovery do not come

under either of the above described classes, it may be remarked that cases of mental disease which recover may be roughly divided into two clinical types : (1) Cases suffering from a first attack, and liable at any period to a second attack, and cases of relapsing insanity ; (2) cases of obvious cerebral toxæmia—from whatever cause, but often primarily at least, incited by alcoholic excess—in which affection of the cortical neurons has not been sufficiently intense to prevent recovery from taking place. Clinical evidence indicates that numbers of the first type of case, which died from some intercurrent illness, are included in Groups I and II, and to a less extent in the later groups ; and as regards the second type of case, a certain number of recent confusional cases exist in the earlier groups, and numerous examples of a more severe, but otherwise similar type, in which recovery has not taken place, occur in the later groups. The present series of cases may therefore be regarded as being typical of " mental disease " as a whole.

My main object in undertaking this investigation was to determine whether the conclusions arrived at concerning the Claybury Asylum series of cases would find their counterpart in the series obtained from Rainhill. Whilst the conclusions drawn from a study of the material derived from these two institutions are generally identical, it has been found that certain local differences exist, particularly with regard to the weight of the brain, to the proportion of cases which should be assigned to the respective groups and to the prevalence of degeneration of the cerebral vessels. In view of these local differences it is, perhaps, not too much to suggest that statistics similar to those which have just been under consideration, and prepared by independent workers in different asylums, would lead to the acquisition of interesting and valuable information. By some, also, the whole matter may seem in need of further inquiry, for a survey of the text-books and monographs which have been published in recent years on the subject of mental disease would almost lead one to suppose that relatively little importance can be attached to intracranial appearances, and that no special relationship exists between the clinical phenomena of mental disease and the subevolutory manifestations or dissolutory changes found inside the cranium after death.

(1) The references to Bolton's papers dealing with the subject are: (1) *Arch. of Neurol.*, vol. ii, 1903; (2) *Brain*, part cii, 1903; (3) *Journ. of Ment. Sci.*, April,

1905, and April, 1906.—(²) *Journ. of the Scientific Soc. of Saxony*, vol. xxvii, p. 389; abstract in *Centralb. f. die Physiol.*, 1902, p. 294.—(³) The above data are quoted in *Quain's Anatomy*, vol. iii, part i.—(⁴) See *Arch. of Neurol.*, vol. ii, p. 438, and *Journ. of Ment. Sci.*, April, 1905, p. 20.

The Care and Training of the Feeble-minded.(¹)   By Archibald R. Douglas, L.R.C.P., L.R.C.S.Ed., Medical Superintendent, Royal Albert Institution, Lancaster.

FROM the earliest ages in the history of man, we find evidences of the existence of beings stunted in body and defective in mind, whose relations with their fellows varied through the centuries. At one epoch they were exalted almost to the level of a deity, and their symptoms were interpreted as manifestations of Divine will.   At another they were looked upon with loathing and disgust, not unmingled with fear.   Still later, they were either the playthings of kings or the victims of cruel jibe and blow, and their existence at the present day, and the associated conditions of insanity, crime and intemperance, constitute one of the most serious, if not the most serious problem which a civilised community is called upon to solve.

To Itard, of the Bicetre, belongs the honour for all time of being the first to recognise the condition of the imbecile and to take steps for his amelioration.   The first idiot to be scientifically treated was the so-called "Savage of Aveyron" in 1801 ; this story is too familiar to need repetition here.   Guggenbuhl, in Switzerland, began to study cretinism in 1839, and opened a school on the Abendberg in 1842 simultaneously with Saegert, who did the same in Berlin.   In 1846, Kern established a school at Leipzig.   In 1842, the Eastern Counties' Asylum at Colchester was opened.   Scotland followed with her first institution in 1852, and in 1853, the foundation stone of the Earlswood Asylum was laid.   The first American institution for the idiot was opened in 1846.   It is worthy of note that the movement for the amelioration of the condition of the imbecile was solely the result of private charitable enterprise, absolutely unaided by the legislature.   The untiring efforts and the able advocacy of the elder Seguin, first in Paris, and afterwards in America, of Conolly, Andrew Reed, and our own Dr. de Vitré in this country, gave the movement a tremendous impetus.   Institutions at

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