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THE SOCALLED LAW OF ANTICIPATION IN MENTAL DISEASE.

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THE purpose of the present study is to examine and criticize a supposed law which has been given great prominence by some writers on the heredity of mental disease. It has been said that there is a tendency for an inherited disease to occur in the child at an earlier age than that at which it occurs in the parent. This may be expressed otherwise by saying that in the child the age of onset anticipates the age of onset in the parent. The law, which was postulated to account for the apparent earlier onset of the disease in the offspring, was therefore called the 'law of anticipation.' The mere fact of earlier onset in the child has also been called antedating, anteposition, and, in France, précession.

DEVELOPMENT OF THE CONCEPTION OF EARLIER ONSET IN THE OFFSPRING AS EXPRESSING A NATURAL LAW.

Observations on this subject were originally made outside the sphere of mental disease. Darwin¹ himself stated in his *Animals and Plants under Domestication* that there existed a strong tendency for disease to appear in the offspring at the same period of life as in the parent, but where this rule failed, the disease could occur at an earlier age than in the parent, whereas it was exceptional for the opposite to occur.

The French psychiatrist Morel², in his book *Traité des dégénérescences de l'espèce humaine*, was the first to lay great stress on the age of onset of mental disease in successive generations. He believed that there was to be found in some pedigrees what he called a 'progressive degeneration' in virtue of which the affected stock became extinct in the course of a few generations. He believed that the degeneracy in the first generation took the form of mild nervous disorders which appeared late in life. The

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predisposition to disease became more accentuated in the second and third generation, appearing at an earlier age and in a more intense form, until the members of the degenerate stock, being unable to propagate further, became finally extinct.*

It will be seen then that Morel believed that this 'progressive degeneration' was of very frequent occurrence, even the rule, in mental disease.

Henry Maudsley⁵, treating of the same subject, wrote: 'There appears to be at work a silent tendency in Nature to restore an insane stock to a sound type, if regeneration be possible, or to end itself, if degeneration is too bad to mend.' It will be noticed that this writer does not say that insane stocks die out by progressive degeneration, but merely that in many cases insanity goes hand in hand with sterility.

An English writer who examined particularly the age of onset of inherited disease was Nettleship, who did valuable work in collecting pedigrees relating to diseases of the eye. In a paper published with E. J. Lidbetter in *Brain*, 1913, he⁴ described antedating as occurring in a stock whose members suffered from a complicated eye disease and different forms of mental disease. Nettleship stressed this apparent earlier onset in successive generations and believed it to be the expression of a natural law. He also referred to the fact that inherited disease appeared to occur at an earlier age in younger siblings than in older siblings. This he called 'fraternal anticipation,' a phenomenon which will be discussed later in this paper.

At Nettleship's instigation, the late Sir Frederick Mott started an enquiry into the inheritance of mental disease with a view to ascertaining whether it was the rule for mental disease to occur at an earlier age and in a more intense form in successive generations. If this were found to be so, then it might appear that there was a 'law of anticipation' in virtue of which Nature finally brought a tainted stock to an end in the manner described. Mott accordingly instituted a card index system, in which the name of each patient in the London County Council Mental Hospitals, who had either a parent, child or other relative in one of these hospitals, was

* *Traité des dégénérescences de l'espèce humaine*, Paris, 1857, p. 565. 'Les médecins aliénistes . . . savent qu'un simple état névropathique des parents peut créer chez les enfants une disposition organique qui se résume dans la manie et la mélancholie, affections nerveuses qui, à leur tour, peuvent faire naître des états dégénératifs plus graves et se résumer dans l'idiotie ou l'imbécillité de ceux qui forment les derniers anneaux de la chaîne des transmissions héréditaires. J'ai constamment observé, pour ma part, que les enfants d'un père ou d'une mère aliénés présentaient, dès l'âge le plus tendre, des anomalies du côté des fonctions nerveuses qui étaient les signes les plus certains d'une dégénérescence ultérieure, lorsque rien n'était fait pour combattre un danger aussi redoutable. Le peril est plus imminent, et pour ainsi dire inevitable, lorsque l'hérédité est double.'

recorded, together with the date of admission, age of onset, and type of psychosis of both relatives. Mott then compiled statistics which appeared to show that not only was the age at which the psychosis started much earlier in the children than in the parents, but also earlier in nephews and nieces than in uncles and aunts.

It is this work of Mott's which is especially considered in the present study. Other writers both in this and other countries have quoted their findings in support of the theory that tainted families become extinct in virtue of this hereditary law. It has seemed the best course, however, to direct the criticisms contained in this article against the work of Mott, because he was the most eminent English writer to support this theory, and was the first to give statistical backing to Morel's theory.

Mott⁷ summed up his results in *Brain*, 1911. From his statistics one finds that insane children of insane parents appeared to become affected on the average some 24 years earlier than their parents. In view of this fact, Mott wrote: 'I noticed there was a general tendency for the insanity not to proceed beyond three generations. There is frequently a regression to normal type, or else the stock dies out.' Not infrequently the stock dies out by the inborn tendency of insanity manifesting itself in the form of congenital imbecility, or the insanity of adolescence.' He⁸ wrote further in the *British Medical Journal* that 'this signal tendency of insane offspring to suffer with a more intense form of the disease, and at an earlier age, is of great importance for the following reasons: first, it is one of nature's methods for ending or mending a degenerate stock; secondly, it is of importance to the physician, for he can say that there is a diminishing risk of the child becoming insane after he has passed twenty-five, a matter of great importance in the question of marriage; thirdly, it is of importance in connexion with the subject of social surgery of the insane, for when the first attack of insanity occurs in the parent, the children have for the most part all been born.'

SCOPE OF PRESENT ENQUIRY.

The material upon which Mott based these conclusions has continued to accumulate during the 20 years following 1911. The bulk of the material was taken from Colney Hatch, which is the largest London County Mental Hospital. Through the courtesy of the Superintendent, Dr. Brander, I have been able to go through over 4,000 cases, and compare the material which Mott used in 1911 with that which obtains at the present day. In what follows, then, I shall call attention to certain statistical fallacies which accounted for Mott's results. Some of these, indeed, were pointed out by Prof. K. Pearson⁹ and Dr. D. Heron² soon after the publication of Mott's work. I shall try to show that much of the apparent anticipation was due to the fact that Mott's material ranged over a comparatively short period of time, a fact which, as we shall see, favours the appearance of a spurious antedating

in the children's generation. This is borne out by examination of cases during the 20 years following the publication of Mott's work. Finally, I shall attempt to show by analysis of Mott's own data that anticipation is only the rule where the parents become affected late in life.

EXAMINATION OF MOTT'S MATERIAL.

The accompanying diagram (fig. 1), reprinted by permission from *Biometrika*, Vol. X, 1914, p. 368; 'The Inheritance Factor in Insanity,' by D. Heron, embodies the data on which Mott chiefly relied to substantiate his

Diagram to illustrate the Distribution of Age at Onset of Insanity among:

- (1) The Insane Offspring of Insane Parents.
- (2) The Insane Parents of Insane Offspring.
- (3) All Admissions to L.C.C. Asylums.

FIG. 1.

theory. The unshaded columns represent the percentage of all cases to be admitted at the various age periods. In the left-hand figure the shaded columns show the insane children of insane parents, and the percentage admitted at each period, while the shaded columns on the right indicate the same for insane parents of insane children,

If we consider first the right-hand figure, it is not difficult to understand why the parents do not constitute a fair sample of the general admissions, that is, why the parents' columns do not correspond to those of all admissions. The reason lies in the very fact of parenthood. If he is to be a parent at all, an individual must in all probability reach the age of 25 or 30 before falling a victim of mental disease. We therefore find very few parents affected before the age of 30. Since a relatively low percentage are first affected in early life, a relatively high percentage are affected in later life, and so there too the curve for parents, being much higher, differs from that for all cases admitted.

Mott at first compared the average age of onset of mental disease in the children with that in the parents, not with that in all cases admitted. Here then we see the first fallacy. He is comparing the children who may be affected from birth onwards with the parents who are only likely to be affected after becoming parents, that is, after the age of 25 or 30.

This fallacy can be best exemplified, as Professor Pearson pointed out, by considering cases of persons who have met with a violent death. In this case we should find that since about half of violent deaths in females occur before the age of 20, and about a quarter in males before that age, and since almost none of the present generation, in virtue of their parenthood, could meet their death before the age of 20, there would be a marked anticipation of the age of death in the offspring. This antedating, however, of the age of accidental death in the children, which is comparable to the antedating of the age of onset of mental disease, can have nothing to do with any law of inheritance, but only with the fact of parenthood.

This objection relating to parenthood applies particularly to the sphere of mental disease, for if we consider the commonest form of mental disease, schizophrenia, we find that according to Kraepelin two-thirds of the cases occur before the age of 30. It is therefore only to be expected that this common form of mental disease, whose onset is early, will be much less common in those who are already parents.

With regard to Mott's conclusion that the disease occurs in a more intense form in the offspring, the explanation again depends on the fact of parenthood. Since the members of the older generation must be parents, they are unlikely ipso facto to suffer from the severe kinds of mental disease which occur in the first three decades of life, such as congenital imbecility, and the more malignant forms of dementia præcox. If they do suffer from dementia præcox it will not be so rapidly progressive or lead to such a profound dementia. It is clear then that to say that the disease occurs in a more intense form is merely to say that it occurs at an earlier age.

If reference is made again to fig. 1, it will be seen that the percentage of cases of mental disease which occur in the first two decades of life is apparently much higher among children of the insane than among the

general run of those admitted to mental hospitals. This phenomenon cannot be explained by the fallacy of parenthood described above, as Mott urged in defending himself against Pearson's criticism. A brief consideration, however, of the method in which the material was collected will show how there was a selection of material which gave chiefly those children who became affected at an early age.

In the first place, an enquiry regarding relatives belonging to different generations who are both admitted to mental hospitals will lead to a selection of those cases which are admitted about the same time or within a decade of each other. As parents are on the average 30 years older than their children, those who are admitted to hospital in the same year as their children will show an anticipation averaging 30 years. Those cases, on the other hand, in which the child becomes insane at an age 30 years older than that at which the parent became insane will almost certainly not be included, because the child is admitted to hospital on an average 60 years later than the parent, and so will not be noticed.

Mott himself, in trying to meet another objection to be described later, stated that the bulk of his cases of parent and child were admitted within 15 years of each other, and I find that the average interval between admissions for the Colney Hatch material is 13·7 years.

If we now consider three hypothetical cases, we can see how Mott's selection of material favours his theory (Table 1). In the first example,

TABLE 1.—HYPOTHETICAL FAMILIES SHOWING HOW THE SHORT TIME BETWEEN ADMISSIONS OF PARENT AND CHILD LEADS TO A SELECTION OF CASES SHOWING GREAT ANTICIPATION.

Parent						A	B	C
Born	...	...	...	...	...	1830	1830	1830
Year of onset	...	...	...	...	...	1890	1890	1860
Age at onset	...	...	...	...	...	60	60	30
Child								
Born	...	...	...	...	...	1860	1860	1860
Year of onset	...	...	...	...	...	1890	1920	1920
Age at onset	...	...	...	...	...	30	60	60
No. of years between two admissions						0	30	60
Amount of anticipation						30	0	—30

parent and child are admitted in the same year and there is anticipation of 30 years; in the second the child is admitted 30 years after the parent, and there is no anticipation; in the third the child is admitted 60 years after the parent, and there is postdating of 30 years. If all three cases were recorded, there would on an average be no anticipation, but since on an average Mott

only records those cases admitted within 14 years of each other, the probability is that only the first case will be recorded, namely, that which shows marked anticipation. The accompanying Table (Table 2) shows how many of the children were admitted either before or in the same year as their parents, and how many within 10, 20, and 30 years. The children who were admitted 30 years after their parents were on the average admitted at an age greater than that of their parents when admitted, and so there is on the average postdating. There is no need to suppose that the scarcity of those admitted 30 years after their parents depends on anything else than the method of collecting the material, for, as Mott himself states, the bulk of the cases were admitted within 15 years of each other.

TABLE 2.—SHOWING RELATION OF INTERVAL BETWEEN ADMISSIONS OF PARENT AND CHILD TO AMOUNT OF ANTICIPATION.

No. of years that child was admitted after parent	No. of cases	No. of cases of postdating	Per cent. of cases of post-dating	Anticipation in years
Less than 1	108	0	0	35.1
1-10	113	0	0	23.3
11-20	102	1	1	13.3
21-30	89	13	15	4.9
31-40	40	23	58	- 1.1
Over 40	30	30	100	- 16.6

As we have seen, Mott has given preference for inclusion in his material to those children who became insane about the same time as their parents. Now, in the matter of age, new patients whose parents have recently been admitted to a mental hospital cannot be said to constitute a fair sample of the general admissions. They will be much younger, just as those who are parents will be much older, than the general run of admissions.

In thus selecting his material Mott was neglecting all those members of the second generation who, though sane at the time of the investigation, became insane later; yet it was just those cases, as we have seen, which became insane long after their parents, that told against the theory of anticipation. Now, some of the insane children of insane parents recorded by Mott in 1911 had younger brothers and sisters who were sane in 1911, but who have since become insane. If we include these children, the amount of apparent anticipation will be much less. I have found 20 families in the records at Colney Hatch in which psychotic parents had had one or more psychotic children by 1911, these being included in Mott's material, and in

which one or more children have since become affected. Taking only the children recorded by Mott, there is anticipation of 25 years, but taking only the younger members of these families, who have been admitted since 1911, there is an anticipation of only 13 years (Table 3). These figures, then, show how this fallacy alone contributes largely to the apparent anticipation.

TABLE 3.—SHOWING FAMILIES IN WHICH SOME SIBLINGS WERE AFFECTED BEFORE 1911 AND SOME SINCE 1911. THE AMOUNT OF ANTICIPATION HAS DECREASED WHEN THE LATTER ARE TAKEN INTO ACCOUNT.

Number of parents	...	...	...	...	...	...	20
Number of offspring	...	...	...	...	...	...	53
Anticipation in 1911	...	...	...	...	...	...	25 years
Anticipation in offspring alone who have become psychotic since 1911							13 years

It follows, therefore, that if we are to compare the age at which members of an older generation become insane with that at which members of a younger generation become insane, we must wait till all the members of the latter are past the danger zone for insanity. Only in this way shall we be certain that we are not counting as sane those who will later become insane. If we take as our younger generation those who were born on an average in 1860, we shall largely avoid this pitfall, for to say that a man of 72 is free from all possibility of insanity has quite a different significance from saying that a man of 32 is free. The importance of this point was apparently not fully appreciated by Mott, for the average age of his younger generation was 26.

This particular fallacy can very easily deceive one when examining a pedigree into thinking that evidence of anticipation is presented in it. In the *Archives of Neurology and Psychiatry* (London), vol. VI, two of Mott's pupils, H. W. White¹¹ and J. C. Wooton¹², together published 35 pedigrees in which anticipation was for the most part apparently demonstrated. In nearly every case the investigator took as his starting point (propositus) an insane patient of about 25, in the preceding generation of whose family was a fair sprinkling of mental disease. Now if we include, as Mott did, the acquired forms of mental disease, such as general paralysis and alcoholic psychoses, four times as many cases of mental disease occur after the age of 25 as before it. About four out of every five members of the preceding generation will therefore have become insane after that age. In the younger generation, however, the average age is about 25, and so this is impossible. If insanity occurs in the younger generation, this is said to be a case of marked anticipation, and if it does not, this is said to be a case where the stock is mending. The real truth, however, is that, if one waited till the patient's generation had all become extinct, one would no doubt find that the same number had become insane in later life as in the previous generations.

This is shown clearly by reference to these very pedigrees. In Table 4, I have taken as the younger generation that which preceded the propositus, and compared it where possible with the preceding generations. It will be seen that there are five cases of antedating and four of postdating, and that the balance in years is on the side of the latter.

TABLE 4.—SHOWING AVERAGE AGES AT WHICH MEMBERS OF PARENTS', GRANDPARENTS' AND GREAT GRANDPARENTS' GENERATION BECAME PSYCHOTIC IN PEDIGREES CITED IN SUPPORT OF ANTICIPATION BY H. W. WHITE AND J. C. WOOTON.

(Numbers in brackets refer to number of persons psychotic in each generation.)

		Great grand- parents' generation	Grand- parents' generation	Parents' generation	Average antici- pation
White	Pedigree No. 4	50 (1)	40 (1)	52 (1)	- 2
	" " 6	42 (1)	50 (5)	25 (7)	17
	" " 10	0 (1)	68 (2)		- 68
	" " 11		55 (1)	54 (1)	1
Wooton	" " 16	60 (1)	72 (1)		- 12
	" " 2		44 (1)	38 (4)	6
	" " 3		28 (1)	35 (5)	- 7
	" " 4		25 (2)	20 (3)	5
	" " 7		20 (1)	11 (2)	9

There are thus—

5 cases of anticipation, average 7.6 years.

4 " " postdating, " 20.2 years.

One of the authors, H. W. White, remarked at the conclusion of his paper that the amount of anticipation was smaller in the earlier generations. He did not, however, realize that the apparent anticipation in the last generation was on this explanation spurious.

CASES OF INDIRECT HEREDITY.

In addition to examining the amount of the difference in age of onset as between parent and child, Mott examined the cases of all those related as nephew or niece to uncle or aunt. Here he found anticipation, but to a lesser degree (in the Colney Hatch material it is 13.4 as against 16.0 years); and this he attributed to the fact that the relationship was less close. That there was some anticipation, however, he attributed again to the fact that those related collaterally belonged to a stock in which there had set in a degenerative process, in virtue of which the members of each succeeding

generation became affected at an earlier age, until propagation was no longer possible.

A much simpler explanation, however, presents itself. The fallacy created by comparing those who must be parents with those who need not be parents holds only partially for uncles and aunts. The apparent anticipation is therefore less. Incidentally, examination of the material in this piece of work shows a regrettable oversight, for included among the uncles and aunts were those who were no blood relations, but related only by marriage. At first sight it might be thought that to include persons who were no relation would decrease the amount of anticipation, but the contrary holds. In order to be an uncle or aunt by marriage, it is necessary to be at least in the neighbourhood of 20 years of age, and so the same exclusion of members of the older generation from the early forms of mental disease obtains in this case too.

Table 5 shows how the selection of material has influenced Mott's results in relation to uncles and aunts. The Table shows the amount of anticipation

TABLE 5.—SHOWING RELATION OF INTERVAL BETWEEN ADMISSIONS OF UNCLES OR AUNTS AND NEPHEWS OR NIECES TO AMOUNT OF ANTICIPATION.

No. of years that nephew or niece was admitted after uncle or aunt	No. of cases	No. of cases of postdating	Per cent. of cases of post-dating	Anticipation in years
Less than 1	38	6	16	17.9
1-10	66	0	0	19.1
11-20	63	9	14	11.8
21-30	46	12	24	5.3
31-40	32	20	60	0
Over 40	22	21	96	-14.1

in relation to the length of time between admissions. It will be noticed that in contrast to the parent-and-child Table, very few nephews or nieces apparently became insane before their uncles or aunts. Thus only 38 were admitted previously or in the same year, as against 66 who were admitted in the decade following the admission of uncle or aunt. The obvious reason for this is that relatives are much less likely to record that a patient has an insane nephew than that he has an insane uncle. Where, therefore, the uncle is admitted first, the case is not likely to be noticed. This omission of cases where very young nephews and nieces became insane partly accounts for the fact that apparent anticipation between uncles or aunts and nephews or nieces is not as great as between parents and children.

OTHER FACTORS FAVOURING SPURIOUS ANTICIPATION.

There are other fallacies which help to increase the amount of apparent anticipation. For instance, Mott counted, as the year of onset of the disease, the year in which the patient was first admitted to an L.C.C. mental hospital. Now in the parents' generation patients were for the most part only admitted when they were dangerous to the community or quite helpless. As Mott himself pointed out, between 1890 and 1910 the accommodation for the insane in the L.C.C. asylums was almost doubled, in order to contain the large proportion of insane who were either roaming at large, or else, being helpless, were nursed in ordinary hospitals.

In going over the records of the older generation, I repeatedly found notes stating that the patient had been previously insane, but as he had not been admitted to an L.C.C. asylum, the later attack was counted as being the first.

This greater accommodation of the insane in L.C.C. asylums (which amounted to 27,000 in 1910 compared with 16,000 in 1890) made possible the admission of patients at an earlier age. Not only was there more room for the mentally diseased in asylums, but the asylums became more like hospitals. Relatives have therefore shown less reluctance in sending the patients in for treatment, and so they have come to be admitted at an earlier age.

It was to meet this objection that Mott stated that the parents and children in his material were admitted for the most part within 15 years of each other. He appears, however, to have overlooked the fact that such a selection of material could only lead to an apparent antedating in the children which was spurious. Parents are on the average 30 years older than their children. If the children included are admitted on an average 14 years after their parents, they must be 16 years younger at the time of their admission. As we have seen, children who are admitted at a later age than their parents, are admitted, on an average, more than 30 years after their parents. These, however, were extremely unlikely to be included in Mott's material.

Even if all the objections to Mott's theory which have so far been put forward were invalid, it could still be shown from analysis of his own material that he failed to prove any law of anticipation such as he described. If his theory were correct, we should find that the amount of anticipation would have no relation to the age of the parent, but would remain the same whatever the parent's age. Thus, if the average amount of anticipation were 20 years, parents admitted first at 70 would, on the average, have a child who became affected at 50, the parents who became psychotic at 50 would have on the average a child who became insane at 30, and if the parents first admitted at 30 had children, these would, on his theory, be mostly feeble-minded. If, however, the material has been so selected as to include chiefly cases admitted about the same time and where, therefore, the onset of insanity

was late in the parents and early in the children, we shall find a different result. The amount of anticipation will not always be the same, whether the parent became insane at 70 or 60 or 50 or 40. We shall find on the other hand, that as the age at which the parent became insane decreases, so also will the amount of anticipation decrease, so that the children of parents who became insane in early life will show not antedating but postdating. This is in fact what we do find.

TABLE 6A.—AMOUNT OF ANTICIPATION IN RELATION TO PARENTS' AGE.

Age of parent	No. of cases	Average age of parent	Average age of child	Anticipation in years	No. of cases of post-dating	Per cent. of cases of post-dating
Over 70	41	74.6	40.6	34.0	0	0
60-69	101	68.6	37.2	26.4	2	2
50-59	105	53.8	31.5	22.3	5	19
40-49	99	44.9	33.4	10.5	21	21
30-39	95	34.2	29.1	5.1	27	27
20-29	33	27.9	30.6	-2.7	12	36
0-19	8	16.0	26.8	-10.8	5	63

If reference is made to Table 6A it is seen that the amount of anticipation decreases from 34.0 years for parents admitted over 70, to 5.1 years for parents admitted between 30 and 40, and where parents become insane below the age of 30, it is actually more usual for their children to show postdating, not antedating.

TABLE 6B.—AMOUNT OF ANTICIPATION IN RELATION TO AGE OF CHILDREN.

Age of children on admission	No. of cases	Average age	Average age of parent on admission	No. of cases of post-dating	Per cent. of cases of post-dating	Average anticipation
Under 20	65	16.8	47.4	3	5	30.6
20-30	143	24.3	50.0	7	5	25.7
30-40	115	34.3	50.6	43	37	16.3
40-50	81	44.2	53.0	23	28	8.8
50-60	39	53.6	55.5	23	60	1.9
60-70	14	64.6	55.7	7	50	-10.9
Over 70	5	70.4	50.0	5	100	-20.4

Similarly, Table 6B shows that where we do find children who became insane as late as 50, 60 per cent. of their parents became insane at an earlier age, i.e., postdating is again the rule,

Tables 6c and 6d show similar findings for indirect heredity.

TABLE 6c.—AMOUNT OF ANTICIPATION IN RELATION TO UNCLES' AND AUNTS' AGE.

Age of uncle or aunt	No. of cases	Average age of uncle or aunt	Average age of child	Anticipation in years	No. of cases of post-dating	Per cent. of cases of post-dating
Over 70	6	76.5	24.2	52.8	0	0
60-69	27	62.1	32.9	29.2	1	4
50-59	47	53.2	33.1	20.1	3	6
40-49	50	43.4	30.3	13.1	8	16
30-39	72	34.0	28.0	6.0	20	28
20-29	50	24.5	26.7	- 2.2	23	46
0-19	18	17.4	23.2	- 5.8	13	72

TABLE 6d.—AMOUNT OF ANTICIPATION IN RELATION TO AGE OF NEPHEWS AND NIECES.

Age of nephews or nieces	No. of cases	Average age for 10-year period	Average age of uncle or aunt	No. of cases of post-dating	Per cent. of cases of post-dating	Average anticipation
Under 20	48	16	33.5	1	2	17.5
20-30	99	24.4	38.7	14	14	14.3
30-40	71	33.6	44.4	20	30	10.8
40-50	28	43.5	39.7	18	64	- 3.8
50-60	15	54.1	44.4	10	67	- 10.0
60-70	0					
Over 70	2	70.5	62.0	2	100	- 8.5

Figure 2 shows the age-incidence of children on admission when the parents were aged over 70 on admission, aged 60 to 70, 50 to 60 and so on.

FIG. 2.

It will be noticed that the mean age of children on admission when the parents were aged 60 to 70 was 30 to 40, that is, 30 years younger. Similarly for parents of 50 to 60, there is a mean anticipation of 30 years. This, however, is the result of the selection of cases of parent and child admitted about the same year, for in such cases the parent will be 30 years older than the child. Similarly, in the case of uncles and aunts, those who were over 60, over 50 and over 40 on admission show a mean anticipation of 20 years. This again is caused by the selection of material, but the amount of the anticipation is less, because many uncles and aunts become mentally diseased before the age of 20, whereas parents as we have seen can scarcely do so.

FRATERNAL ANTICIPATION.

With regard to so-called fraternal anticipation, although Mott collected material, he did not, so far as I am aware, publish any results. In the present material I examined the records of 425 pairs of siblings, and found that the older sibling became insane at an age 4.1 years greater than the younger sibling. By way of control, however, I examined 41 pairs of cousins and second cousins and found that the older cousin became insane at an age 4.0 years older than the younger cousin. The difference is therefore almost identical in the control series.

The apparent anticipation again results from the way in which the material is collected. Let us take a case where one sibling is four years older than the other. If both are admitted in the same year, then this case which shows fraternal anticipation of four years is certain to be noticed. If, however, there is a case where the younger is 4 years older at the time of admission than the older sibling was at the time of his admission, then there will be a lapse of eight years between the two admissions and this case is not so likely to be noticed. There is therefore a selection of material which favours apparent anticipation.

Another factor which favours apparent anticipation is that relatives put off as long as possible the admission of the older sibling who becomes insane, but if an older brother is already in a mental hospital, the second is likely to be admitted when the first symptoms appear. Thus where two siblings really both become affected at 20, the probability is that the older will be admitted when he is 21 or 22, whereas the younger will be admitted at 20.

From the above material, an attempt was made to separate the cases of schizophrenia from those of the manic-depressive group. It was difficult to be sure of diagnosis, as this was in many cases made soon after admission, and schizophrenics in the earlier records might be labelled mania, stupor, delusional or confusional insanity, or melancholia, while manic-depressives were often diagnosed as cases of stupor, confusion, or delusional insanity. Taking, however, the cases where the diagnosis was pretty clear, the following figures were obtained.

Of 153 pairs of manic-depressive siblings, 102 showed average fraternal antedating of 10·4 years, while 51 showed average postdating of 7·5 years. The average antedating for the 153 was 4·4 years.

Of 36 pairs of schizophrenic siblings, 24 cases showed average antedating of 6·0 years, while 12 cases showed postdating of 5·8 years. The average antedating for the 36 was 2·1 years.

Little importance, however, can be attached to these figures, since in the control series there was an anticipation of 4·0 years.

If we consider those families where three, four, or five siblings were insane, we find that there is a fairly marked apparent anticipation between the first and second but much less between any other two. This probably results from the fact mentioned above that after one sibling is admitted there is no hesitation on the part of relatives about admitting others. Thus in 35 cases where three or more siblings became insane, there was an average anticipation of 2·7 years of the second over the first, but only of 1·4 years of the third over the second.

If we examine the few families where four or five siblings become affected we find much less evidence of anticipation because the chief statistical fallacies described do not hold. We are not counting as sane those who will later become insane.

The following Table shows four cases of families where four siblings became insane and two where five siblings became insane.

The roman numerals indicate order of birth, the arabic numerals the age at onset. The diagnosis in each case is also given. At the bottom are given the average ages at onset.

TABLE 7.—CASES OF FAMILIES IN WHICH SIBLINGS BECAME INSANE.

Order of birth	I	II	III	IV	V
Age at onset and diagnosis	39 melancholia 15 mania 31 melancholia 0 imbecile 29 schizophrenia 15 melancholia	36 schizophrenia 13 mania 0 imbecile 23 mania 20 melancholia 23 mania	28 melancholia 15 mania 34 paranoia 38 melancholia 21 schizophrenia 17 schizophrenia	24 melancholia 23 mania 23 mania 22 paranoia 20 melancholia 29 schizophrenia	37 schizophrenia 16 mania
Total age	129	115	153	141	53
Average age at onset	21·6	19·2	25·5	23·5	26·5

It should be mentioned here that Rüdin¹⁰ examined 72 cases of schizophrenic siblings and found that the older sibling was affected on an average at the age of 25·86 years while the younger's age at onset was 24·68.

There was therefore a difference of only 1·18 years between the ages at onset and Rüdin himself considers the anticipation to be spurious for the reasons mentioned above. Two English text-books, however, quote Rüdin as believing these figures to support the theory of anticipation.

CRITICISM OF MOTT'S CONCLUSIONS.

It now falls to examine the conclusions which Mott drew from his statistical data. He believed that the apparent earlier date of onset of mental disease in the younger generation was of great importance, and that the disease was more intense in form. He believed that this was one of nature's methods for ending or mending a degenerate stock. We have seen, however, that there is no evidence that nature eliminates a stock by the gruesome method of causing the disease to appear at an earlier age in each succeeding generation. Nor has Mott brought forward evidence that insanity and sterility go hand in hand and that therefore it is superfluous for the eugenicist to dissuade the insane from marriage. The literature contains numerous pedigrees which show that tainted stocks can be exceedingly prolific.

Mott also believed that his figures 'were of great importance to the physician, because he can say there is a diminishing risk of the child becoming insane after the age of 25, a matter of great importance in the question of marriage.'

We have seen, however, that there is nothing in Mott's material which would lead us to suppose that the children of insane parents differ from the general run of mental patients in regard to age at onset. Now, in the latter case, if we include the types of psychosis which are caused almost entirely by exogenous factors, such as general paralysis and alcoholism, we find that for every one person who becomes insane before 25, about four become insane after that age. These figures of 4 to 1 were quoted by Dr. D. Heron in his criticism of Mott. If Dr. Heron were a psychiatrist and not a statistician, he would have excluded the acquired psychoses, and said that as far as heredity goes, the chance of becoming insane after 25, is only about twice what it is before that age. His figures 4 to 1, however, were justified as an argumentum ad hominem, for Mott, when he wrote, included general paralysis in his material.

The question of the age at which mental disease comes on in members of a tainted family no longer influences the psychiatrist in giving advice about marriage so much as the question of what type of psychosis is found in that family. During recent years valuable work has been done to show the probability of mental disease occurring in the direct and indirect descendents of psychotics in comparison with those of healthy individuals.

We can say for instance that whereas an individual whose parents are healthy has only a 0.68 per cent. chance of becoming schizophrenic, the child of a schizophrenic parent has an 8.4 per cent. chance. Similarly for manic-depressives, the figures are 0.38 per cent. for those with normal parents but 31.4 per cent. for those with manic-depressive parents. The psychiatrist can merely state what the prognosis is and leave it to the patient to make the decision. The figures (Table 8) quoted are taken from Hoffmann³ and they are being substantiated by further work in Germany and elsewhere.

TABLE 8.—SHOWING PROBABILITY OF MENTAL DISEASE IN CHILDREN, ONE OF WHOSE PARENTS SUFFERS FROM ITS THREE CHIEF FORMS, COMPARED WITH AVERAGE POPULATION (HOFFMANN, 1928).

			Psychotic child of psychotic parent Per cent. affected	Average population Per cent. affected	Greater probability of these diseases in the former
Schizophrenia	...	...	8.4	0.68	12.3 times
Manic-depressive	psychosis		31.4	0.38	82.6 times
Epilepsy	...	...	9	0.29	3.1 times

Lastly, Mott says that his figures are of importance in connexion with the subject of social surgery of the insane, for when the first attack of insanity occurs in the parent, the children for the most part have all been born. In this connexion, it may be pointed out that the form of mental disease which is most strongly inherited is the manic-depressive psychosis, which in virtue of its recurrent nature allows the patient to become a parent during the intermissions. There is nothing in Mott's results which should prevent a psychiatrist from discouraging a patient suffering from, say, attacks of recurrent mania from becoming a parent.

In conclusion, it would seem then that the onset of mental disease in each succeeding generation of a tainted stock at an earlier age and in a more intense form, so far from being the rule, is exceeding difficult to demonstrate in any pedigree, and that where it does occur, it probably depends on a combination of Mendelian factors, the exact nature of which is still a matter for investigation. The results obtained by Mott do not make it necessary to postulate any law in virtue of which nature ends or mends a degenerate stock. The facts are capable of being explained more simply in the way described above. It rests with those who believe in the law to adopt a different method of approach to prove their case.

SUMMARY.

Many writers have remarked that in cases of hereditary disease the disease appears to occur at an earlier age in each succeeding generation. This has been supposed to be the expression of a hereditary law, in virtue of which a tainted stock comes to an end. This law was described by Morel as occurring in mental disease. Sir Frederick Mott sought to prove its existence by examination of material in the London County Mental Hospitals. In the present study, a great deal of this material has been brought up to date and examined. Arguments are brought forward to show that the apparent antedating of mental disease in the children is merely the result of the way in which the material was collected. Similar arguments explain the apparent antedating of mental disease in younger siblings compared to older ones. Conclusions based on the supposed law of anticipation have been applied by Mott and others to the sphere of eugenics. These conclusions are criticized.

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