The Huxley Lecture

ON HEREDITARY ASPECTS OF NERVOUS AND MENTAL DISEASES.

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MR. CHAIRMAN,—Permit me to thank you and my colleagues of Charing Cross Hospital Medical School most heartily and cordially for the great honour conferred upon me by the request to deliver the Huxley Lecture this year. When I look back on my distinguished predecessors I feel that, with this honour, there is a great responsibility, for it is not an easy task for me to deliver a lecture worthy of the occasion; I felt, therefore, some difficulty in the selection of a subject. I was, however, guided in my selection of the hereditary aspect of nervous and mental diseases by the following facts. Heredity is the subject that the master mind of Huxley illuminated in several of his essays, and it is fundamental in the study of the origin of species and natural selection, which he did so much to forward. Next, recent developments in our knowledge of the subject of heredity, owing to the labours of Galton, Pearson, and their followers in the study of biometrics, and Bateson and his followers in Mendelism, have aroused the keenest interest in the subject of human inheritance, not only in the medical profession, but in the thinking and intellectual portion of the nation. Another reason was that none of the illustrious lecturers in the past have dealt with the subject of heredity in relation to disease. Lastly, it is a subject to which I have recently devoted a large amount of attention in the study of the causation of nervous and mental diseases, and more especially the relation of heredity to various forms of insanity. The wealth of material in the London County Asylums has permitted a biometric investigation in a novel manner. The subject is one of national importance and interest, and it affects many social and legislative questions. The interest taken by the general public in the question of heredity is a sign of social progress. People are recognizing the truth of Thomson's saying, "The present is the child of the past; our start in life is no haphazard affair, but is vigorously determined by our parentage and ancestry; all kinds of inborn characteristics may be transmitted from generation to generation."

Fifty years have elapsed since Huxley wrote an essay on the Origin of Species in the *Westminster Review*, and the doctrine of natural selection which he upheld with such remarkable force remains unshaken and unshakable, but mutations or discontinuous variation has replaced in great measure the continuous accumulation of small differences to which Darwin attributed so much importance in evolution; and it is interesting to note that Huxley in this same essay said, "Mr. Darwin's position might, we think, have been even stronger than it is if he had not embarrassed himself with the aphorism, *Natura non facit saltum*, which turns up so often in its pages." We believe that Nature does make jumps now and then, and a recognition of the fact is of no small importance in disposing of many minor objections to the doctrine of transmission. Huxley cites the case of the Ancon sheep, also an interesting pedigree of polydactylism narrated by Réaumur. I will show a diagram (Fig. 1) illustrating this condition in three generations. Réaumur narrates this case only as far as the third generation, and Huxley remarks:

Certainly it would have been a curious thing if we could have traced this matter any further. Had the cousins intermarried a six-fingered variety of the human race might have been set up.

In the light of the Mendelian law of gametic segregation even this would not be necessary, for a variation is "not swamped out." But sexual selection would tend against the perpetuation of this variation, which does not serve a useful purpose nor is it an ornament. Huxley, in another essay on Hereditary Transmission and Variation,

refers to the different product of crossing a stallion with a she-ass and a male donkey with a mare. "Here, you see, is a most curious thing. You take exactly the same elements, the ass, and horse, but you combine the sexes in a different manner, and the result is modified accordingly. Here, then, is one, and perhaps a necessary, cause of variation." There is in these instances a prepotency of the male in certain physical characters; for, on the one hand, when the donkey is the sire, a mule is produced with the head, ears, and voice resembling that animal; when, on the other hand, the horse is the sire, a hinny is the product, with head, ears, legs, and voice like the horse.

Again quoting Huxley:

A certain amount of variation is the necessary result of sexual propagation itself: for inasmuch as the thing propagated proceeds from two organisms of different sexes and temperaments, and as the offspring has to be either of the one sex or the other, it is quite clear it cannot be a diagonal of the two or it would be no sex at all; it cannot be an exact intermediate form between that of each of its parents; it must deviate either to one side or the other. You will have noticed how very often it may happen that the son shall exhibit the maternal type of character, or the daughter possess the characteristics of the father's family.

The law of ancestral heredity of Galton supposes that every ancestor of a particular individual contributed its quota to the heritable qualities of the individual. The law also states that the average amount of resemblance between an individual and any particular ancestor is capable of definite numerical expression. Thus the mean

Fig. 1.—Polydactylism. The black figures indicate complete polydactylism; the circles normal; the circles with black centre partial polydactylism.

amount of correlation between (1) the two parents and the offspring, (2) the four grandparents and that offspring, (3) the great-grandparents and that offspring, and so on, backwards in the ancestral lineage, is believed to diminish in a geometrical series one half, one quarter, one eighth, which is the same for all organisms and their characters. Pearson represents a more rapidly diminishing series (1) for the two parents 0.6244, for the grandparents 0.1988, for the great-grandparents 0.0630, etc. We thus have a mosaic of ancestral characters.

It is quite possible that the above represents correctly the average total contributions of ancestors when applied to the race as a whole, but it cannot be universally applied to individuals, for according to Mendel's theory of inheritance certain ancestors may contribute nothing to the constitution of certain offspring in respect to certain characters. Moreover, as Maudsley truly says:

It is a conclusion which, however true on the average of such simple characters as height, is manifestly not true of individual cases. Any one selecting for observation different characters, e.g., noses or ears, can see plainly the nose may be like the father's or the mother's or perhaps one of the grandparent's or further back.

This fact was well known to the ancients, and, according to modern ideas of heredity, there is not much to be said against the teaching of Lucretius:

Sometimes too the children may spring up like the grandfathers, and often resemble the forms of their grandfather's fathers, because the parents often keep concealed in their bodies many first beginnings mixed in many ways, which first proceeding from the original stock, one father hands down to the next father, and then proceeding from these, Venus produces forms after a manifold chance, and repeats not only the features but the voice and hair of forefathers; and the female sex equally springs from the father's seed and males go forth equally from the mother's

body; since these distinctions no more proceed from the fixed seed of one or other parent, than our face and bodies and limbs. Again we perceive that the mind is begotten along with the body and grows up together with it and grows old along with it.

The individuality of every human being depends upon the mingled natures of two separate parents, and Goethe poetically refers to his own hereditary endowments in the following lines:

Vom Vater hab ich die Statur,
Des Lebens ernstes Führen,
Vom Mütterchen die Frohnatur
Und Lust zu fabulieren.

According to the Mendelian doctrine of dominant and recessive, the corresponding character of the second parent always exists in the offspring side by side with the character which finds expression, only the former, termed "recessive," is obscured by the latter, the "dominant." This is the explanation of a characteristic feature of a particular grandparent which was not visible in the parent reappearing in the child (see Fig. 1). It also accounts for those heritable diseases and abnormalities which are transmitted by the females in ancestry and appear in the males—for example, haemophilia, Daltonism, pseudo-hypertrophic paralysis. As it passes from a father through a daughter to a grandson, and so on, it must be latent in the germ cells (concealed in the body), though for some obscure reason it has not found expression. In fact, non-expression of a disease does not necessarily imply non-inheritance of a disease, rather a predisposition to disease.

It is well known that a hereditary tendency to nervous disease may have different expressions in successive generations—for example, insanity and epilepsy. The hereditary transmission of nervous or mental disease is rather of the nature of a neuropathic tendency, the character of the disease being largely determined by the exciting cause. I have not time to discuss further the large question of Mendelism in relation to human inheritance, and so far I have not met with cases in entire support thereof in the study of the hereditary aspect of nervous and mental disease, but, as pointed out by Professor Bateson, there are many reasons why it has not been found applicable. Of its enormous importance to biology and heredity there can be no question; even Professor Pearson, its most strenuous opponent, says: "The importance of Mendel's work and his followers lies in the observation of segregation." This great fact holds, whether Mendelism in its simple form remains or not.

THE RARER NERVOUS DISEASES AND HEREDITY.

Among the rarer nervous diseases in which it is generally recognized that heredity plays an important part may be mentioned: Myotonia congenita, pseudo-hypertrophic paralysis, progressive muscular dystrophy, especially the Landouzy-Déjerine facio-scapular type, the neuritic type of progressive muscular atrophy, hereditary ataxia, Huntington's chorea, and family periodic paralysis.

In nearly all the recorded cases of myotonia congenita (Thomsen's disease) the disorder has existed in several relatives of the patient, generally in one of the parents and in the patient's brothers, sisters, and children. More than twenty cases of the kind occurred in the family of Dr. Thomsen in four generations. It is to him that we owe the first accurate description. As in Huntington's chorea (a remarkable pedigree of which I will show you) other neuroses frequently occur in the family tree. Many of Thomsen's relatives were affected mentally.

Sir William Gowers, in the discussion on heredity in relation to disease,* referred to the frequency with which pseudo-hypertrophic paralysis is hereditary; he likewise pointed out that the disease is characterized by sex-limitation—citing a very remarkable case. The disease, although not affecting the females, passed through to the males in several successive generations; there were two families, and probably both originated in the same stock. Again he referred to a remarkable case of facio-scapular humeral atrophy (Landouzy-Déjerine type), which could be traced for six generations.

Family periodic paralysis is a rare disease with a well-marked hereditary tendency; it is characterized by periodic attacks of more or less extensive flaccid motor paralysis with a loss of electrical excitability in the

paralysed muscles and of the reflexes, but without sensory affection or disturbance of consciousness. Between the attacks the patient is well. In a family recorded by E. W. Taylor there were 11 cases in one generation; in the family of a patient of Goldflam there were 11 cases on the maternal side, and Holtzapfel observed 17 cases in four generations. The disease may be transmitted indifferently through the father or the mother, although occasionally there has been limitation of transmission to the same sex. As in other diseases with a similar hereditary character, individual cases may occur in which there is no family history of the disease.

A remarkable case of neuritic progressive muscular atrophy, showing that it might be of an hereditary character, was reported by Herringham; the disease was transmitted by females, but only males were affected. The disease, however, may be transmitted by both males and females, and both sexes are affected.

Friedreich's disease, although called hereditary ataxia, is seldom directly hereditary; it is a familial disease. Several families and several isolated cases have come under my observation, but in the isolated cases no family history of the disease in ascendants was found, nor was it in the two cases affecting a number of members of the family; in one of these there was a history of consanguinity, the parents of this family of hereditary ataxia cases being first cousins. A remarkable pedigree of hereditary ataxia worked out by Sanger Brown, however, shows the disease occurring in five generations of a family. Gordon Holmes states that Schoenborn found a family incidence in 114 of the 200 cases he analysed. Yet in a not inconsiderable number of recorded cases the same disease occurred in the ascendants or in the collateral lines. It may be transmitted through either males or females. Occasionally there is not direct heredity, but the disease occurs in families in which there seems to be a proclivity to spinal disease; for instance, a pedigree which I obtained

Fig. 2.—Huntington's chorea. Four generations. P is the patient insane and in Long Grove Asylum, suffering with chorea. The black figures indicate patients suffering with chorea; several died in asylums or in the infirmary. The black figure with white centre indicates nervous affection, but not chorea. The shaded figure with black centre indicates death at an early age of convulsions.

at Darent Asylum showed this relationship. Moreover, occasionally, as this pedigree showed, it may be associated with idiocy. Nolan and Pritzschke have recorded cases associated with progressive idiocy. I will now pass on to the consideration of a disease which I have met with occasionally in the asylums—namely, Huntington's chorea—in which a direct heredity has been found practically in all the cases studied. The accompanying pedigree (Fig. 2) is a striking one, kindly furnished to me by Dr. Bond, of Long Grove Asylum, under whose care is the

patient of the fourth generation. Huntington, who first gave a complete picture of the disease, remarks:

If one or both of the parents have shown manifestations of a serious nature, one or more of the offspring almost invariably suffer from the disease if they live to adult life; but if by any chance these children get through life without it, the thread is broken, and the grandchildren or great-grandchildren may rest assured that they are free from the disease. Unstable and whimsical as the disease may be in other respects, in this it is firm; it never skips a generation to manifest itself in another; as soon as it has yielded its claims it never regains them.

Huntington also remarks upon the presence of the nervous temperament in all or nearly all of the families in which there is the taint of this disease, and says "that nervous excitement to a marked degree almost invariably attends upon every disease these persons may suffer from, although

* Proceedings of the Royal Society of Medicine.

they may not in health be over-nervous." Heilbronner states that there is a tendency in successive generations for the onset of the disease to be delayed, and Wollenberg has shown—as this pedigree very clearly indicates—that choreic heredity in some cases may be transformed into other neuroses, such as epilepsy, imbecility, paranoia, grave hysteria, etc. This disease is more common in men than women, and Wollenberg's collected statistics of 128 cases in 22 families showed a proportion of 74 men to 54 women. Isolated cases of Huntington's chorea occur in the asylums, and it has been observed that the tendency to insanity, and sometimes that form of insanity which leads to suicide, is marked.

In several cases microscopic examination revealed a marked neuronc atrophy, with some neuroglia hyperplasia of both the frontal lobes, including also the central convolutions. Changes in the Betz cells have been described; these changes, no doubt, would be sufficient to account for the motor disorder manifested during life.

The forms of nervous disease I have briefly described are usually due to characteristic morphological defects, and for the most part are best explained by germinal defects in the specific vitality of groups of muscles or systems of neurones, whereby they waste prematurely. Sir William Gowers has introduced the term "abiotrophy" for this condition. From a practical point of view, on account of their rarity, abiotrophics are of little importance as compared with insanity and epilepsy, to which I shall now direct your attention.

EPILEPSY AND HEREDITY.

With regard to epilepsy, I feel convinced from my own observation and experience that Sir William Gowers is correct when he asserts that there are few diseases in the production of which inheritance has a more marked influence, and the traceable influence is always far less than that which exists. Voisin, Feré, Nothnagel, Dana, Peterson, and Aldren Turner express similar opinions.

In the discussion of the subject of heredity and disease, Sir William Gowers said: "In my own inquiries into the heredity of epilepsy I have limited myself to these two maladies, epilepsy and insanity. Heredity was ascertained in 39 per cent. of 1,193 males and 43 per cent. of 1,207 males. When epilepsy itself occurred in a parent, it was the father who was epileptic in 49 per cent. and the mother in 51 per cent. The cases with insanity in a parent are only one-third the number compared with parental epilepsy. Of the cases with parental insanity the father was insane in 37 per cent. and the mother in 63 per cent. One effect of heredity is to increase the female cases. When it was absent the excess of males amounted to 4 per cent., but in cases of heredity the same excess was presented by females. This is partly due to the fact that inheritance is more frequently from the mother's side by 17 per cent., and that females are in excess by 18 per cent." These facts (obtained by Sir William Gowers) are in many ways in striking conformity with the results obtained by my investigation of insane relatives in the London County Asylums as regards certain types of insanity which I shall shortly relate. Moreover, I have observed that a similar heredity occurs in a considerable number of cases of insane epileptics. Spratling, from his large experience at Craig Colony, gives 16 per cent. of similar heredity.

HEREDITY AND INSANITY.

There are a few alienist physicians who do not have a strong belief in the hereditary causation of insanity, and my esteemed colleague, Dr. Mercier, at the discussion on heredity, said: "When we are confronted with the percentage of persons among whose near relatives insanity is known to exist, we cannot fail to be impressed with two remarkable facts—first, how relatively small their percentage is, and, secondly, that the statistics, even if taken at their face value, do not purport to be anything but an *enumeratio simplex*, and cannot be made the basis of any valid conclusion until they are compared with similar statistics of the percentage of insane relatives among the sane." He also stated that the published statistics are of no value at all, for any practical or scientific purpose. With this I would entirely agree, but in taking statistics among the same population we should find that insanity and epilepsy would often occur in families where there were neuroses, eccentricity, and even genius, all of which

are variations from the normal average of the species. I have endeavoured to ascertain what is the proportion of insane, feeble-minded, and epileptic members occurring in the pedigrees of my hospital patients; and I am greatly indebted to my house physician, Dr. Thomas, for the careful and painstaking way in which he has obtained information from the friends. In 32 pedigrees, which would include about 1,000 living representatives and 250 dead individuals, there were 8 who had been in asylums, and in 8 others fits were chronicled. In no case was either parent of the patient insane or epileptic. Two of the pedigrees furnished most of the cases. One was a patient suffering from neurasthenia, in which there were, besides insanity and epilepsy, migraine, hysteria, deaf-mutism, and imbecility, and the other a patient with exophthalmic goitre with several neuropathic members in the stock (Fig. 3). I must confess that, had I to prove my

Key to all figures except Figs. 1 and 2.

Fig. 3.—The pedigree of a neuropathic patient, P., suffering with neurasthenia and slight mental symptoms. It will be observed that she comes from neuropathic stocks on both sides, maternal and paternal.

case by comparing the pedigrees thus obtained with some pedigrees obtained at the London County Asylums and Imbecile Asylum at Leavesden [25 non-selected pedigrees were kindly taken for me by Dr. Elkins and his medical officers], I should not have a very strong case; for in a very considerable proportion of the cases admitted to these asylums interrogation of the friends elicits no evidence of insanity on either side. Yet most alienist physicians would not agree with Dr. Mercier in casting doubt upon the importance of heredity in the production of insanity. I would rather say certain types of insanity. Many of the inmates of asylums are suffering with congenital or post-natal organic brain disease; these conditions are certainly not due to inheritance. General paralysis of the insane, syphilitic brain disease, and softening from vascular disease are acquired conditions and should not be classed among the inherited insanities, nor should Korsakoff's psychosis and chronic alcoholism. In all attempts, however, to ascertain what forms of insanity are especially due to inheritance there is always the difficulty of finding out by inquiry of the friends what was the nature of the insanity, not only because the friends do not know, but also because different opinions may be held by the medical men who have had charge of the cases and different systems of classification and terminology have been used. Therefore any statistical inquiry formed upon pedigrees the data of which are based solely upon information which has been obtained of friends of the patient may have several radical faults. The lack of statistical evidence of heredity in relation to

feeble-mindedness was noticed by Sir Francis Galton in his comments upon the Report of the Commission on the Feeble-minded, and yet the opinion of experts was unanimous in favour of the importance of heredity as a causal factor.

Two years ago an experienced biometrician and scientist, Mr. Edgar Schuster, kindly undertook to co-operate with me in the study of the convolutional pattern of the brains of relatives dying in the asylums, with a view of seeing whether there is a similarity in the convolutional pattern in the members of the same family, just as there is a similarity of physiognomy. An inquiry was initiated concerning relatives at the various asylums, and a request was made that brains of relatives should be kept for examination after the autopsies had been made. Isolated instances of two or more members of the same family were known to exist by me in the various asylums; but it soon became evident that a properly co-ordinated card system would reveal the fact that a *very large number* of parents and offspring and brothers and sisters, besides collateral relatives, were resident in the London County Asylums, or had been recently. In June the numbers had risen from a few hundred known instances to 1,834 (763 males, and 1,071 females); and since then, owing to a newly opened asylum not having furnished full reports, and owing to the fact that fresh cases are continually turning up at other asylums, the numbers have now reached 2,000. These instances have been afforded by the records of patients under observation during the last two years, and include their relatives who have died in, or who have been discharged from, the London County Asylums previously. A large number of cases of recurrent insanity are included in these instances—for example, one case has a record of twenty-three admissions, and during the time taken for the collection of the above cases several of them have been discharged and readmitted; but at the present time it is computed that over 60 per cent. of the relative cases are still resident in the London County Asylums. And this list does not include patients with relatives in the asylums of the Metropolitan Asylums Board, nor patients with relatives in other asylums in Great Britain and Ireland.

Before proceeding to give further details of the inquiry, I wish to express my indebtedness to the Clerk of the Asylums Committee and the superintendents and assistant medical officers of the asylums for the valuable assistance they have afforded me in obtaining information.

The total 1,834 cases living, discharged, and dead in June are made up from 854 families, as follows:

2 instances of 6 of a family.	
3 " 5 "	
12 " 4 "	
85 " 3 "	
752 " 2 "	

Of the 752 instances of two of a family, making in all 1,504 cases, it will be observed that the vast majority are directly and not collaterally related. Another fact stands out prominently in an analysis of the 752 instances of two of a family, and that is, the much greater incidence of transmission from parents to offspring through the female side, as the following figures show:

Parental Heredity.

	Instances.	Males.	Females.
Father and son	44	88	—
Mother and son	51	51	51
Father and daughter	58	58	58
Mother and daughter	104	—	208
	297	197	317

It will be observed that the mother transmits to the offspring in the proportion of 60.7 per cent., the father 39.3 per cent. This is not accounted for wholly by the fact that there are more females in the asylums insane than males, for the ratio of females to males in the asylums is rather less than 11 to 9. Sir William Gowers, in his

statistics regarding insanity in the parents and epilepsy in the offspring, observed that in cases with parental insanity the father was insane in 37 per cent., and the mother in 63 per cent. This, he says, is partly due to the fact that inheritance is more frequently from the mother's side by 17 per cent., and that the females are in excess by 18 per cent. It will be observed that these figures of mine *closely* correspond with his on the transmission of insanity from mother and father to offspring.

Co-fraternal Heredity in Two of a Family.

	Instances.	Males.	Females.
Two sisters	130	—	260
Two brothers	87	174	—
Brother and sister	136	136	136
		310	396

The above table shows when pairs of offspring of the two sexes are affected, the proportion of males to females is 43.9 per cent. to 56.1 per cent., a difference of 12.2 per cent. But the percentage in which the mother transmits insanity to the offspring as compared with the father is as 67.7 per cent. to 39.3 per cent., a difference of 28.4 per cent., and this increase of 14.2 per cent. is mainly due to the fact that she transmits to the daughter nearly twice as often as the father does. It may well be asked whether this may not partly be due to the fact that the daughter, at the time of life when insanity is manifested, is more at home than the son, and therefore has more to do with her insane mother.

Grandparents' Heredity.

Female with insane grandfather ...	1 instance.
Male " " " "	1 "
Females with insane grandmother...	6 instances.
Males " " " "	5 "

This is undoubtedly very much below the proper ratio; it is due to the fact that there is far more difficulty in obtaining records. The hereditary transmission from females, however, markedly preponderates.

Collateral Insanity.

	Instances.		Instances.
Female with uncle ... 12		Male with uncle ... 11	
Female with aunt ... 33		Male with aunt ... 11	
	45		22

There is here a more marked preponderance of females affected than males than in direct heredity, but the numbers are too few to draw any very decided conclusions, except the fact that the females with aunt affected are as numerous as all the rest combined.

The proportion of collateral relatives discovered in the London County Asylums is comparatively small for several reasons; the information is not so readily obtainable, and they are less likely to come into the same asylum as their residence is not nearly so likely to be in the same district as that of parent and offspring.

I have analysed the above figures, only taking into account near blood relations (parents and offspring, brothers, sisters, or brothers and sisters), where two or more representatives of the family *are now* resident in the London County asylums. The following figures show that of an average insane population of approximately 20,000, 717 cases are thus related, representing 342 families. We may ask the question, Should we find in 20,000 adults, living in the county of London, which some random non-inheritable cause had collected together, this proportion of direct relationship? I think not.

The figures, to my mind, are in a broad way eloquent in favour of the importance of heredity as a cause of insanity; and the numbers being great, the data indisputable facts, independent of the personal equation of the inquirer, enable satisfactory statistics to be made and inferences to be drawn in regard to certain points relating to the hereditary aspects of mental disease.

Analysis of Instances where Two of a Family (Near Blood Relations) are now Resident in the London County Asylums.

Father and son	...	...	...	34
Father and daughter	...	...	...	58
Mother and son	...	...	...	44
Mother and daughter	...	...	...	102
Two sisters	...	...	...	144
Two brothers	...	...	...	80
Brother and sister	...	...	...	160
				622

Total, 622 cases, representing 311 families.

In addition to the above there are 95 cases in which three (and in two instances four) members of the same family are now insane residents in the London County asylums—31 families.

Grand total, 717 cases, representing 342 families.

A mother, two daughters and a son have been sent to an asylum since this table was compiled.

When taking part in the discussion at the Royal Society of Medicine on heredity and disease, I expressed the opinion that, without being then able to give any precise data, the investigation I was conducting had led me to conclude that we should find among these relatives in the asylums certain types of insanity exhibiting a more marked tendency to inheritance than others, and I enumerated recurrent or manic depressive insanity, delusional insanity and the insanity of adolescence (*dementia praecox*), and imbecility as having this tendency most marked. Moreover, I observed that cases of general paralysis were relatively few in number. In the light of modern views as regards the causation of general paralysis being due to syphilitic infection I was not surprised to find my inference was correct. Again, in the evidence which I gave before the Royal Commission on the Feeble-minded I pointed out that during the eight years ending December 31st, 1902, there were 8,933 patients discharged from the London County Asylums as recovered, the percentage of readmissions was 25.59, and one half of these cases were readmitted within twelve months of their discharge. The clinical records showed that a considerable number of these readmissions were cases of recurrent insanity termed "recurrent mania" and "recurrent melancholia"; the more modern term for this periodic insanity is "manic depressive insanity." But whatever term it is called there is one feature, namely, periodicity. When I inquired into the family histories of these cases, I found insanity in other members of the family in 55 per cent., even though I did not eliminate those cases which were not visited by friends, and there was no record regarding inheritance; moreover, I found particulars of many relatives of patients being in the asylum at the time or who had previously been in there or died there. These observations were made at Colney Hatch Asylum, where the Superintendent, Dr. W. J. Seward, had for a long time been in the habit of taking the history himself from the friends who visited. I may add that this asylum has afforded valuable information in this research, partly because it is an old asylum, with records often of three generations, and partly because, containing, as it does, all the Jews, one has the opportunity of comparing the incidence of inheritance of this race with the non-Jewish population. I am indebted to Dr. Seward for the following statistics relating to the percentage of relatives among the Jewish and non-Jewish population: The number of cards belonging to Jews is 80; the number belonging to non-Jewish inmates is 254. The total number of inmates is 2,450, and of these 459 are Jews, so that rather less than one-fifth of the total population is Jewish. A little more than one-fourth of the relative cards belong to Jews, so that the incidence of ascertained relationship among the Jewish inmates is considerably more than among the non-Jewish. No doubt the temperament of the Jews renders them, as a race, more liable to the neuropathic tendency, but the greater incidence of ascertained relationship among the Jews is partly due to the following facts: They are more often visited by their friends; they have more pride of family, know more about their family, and, as a general rule, are more intelligent and anxious to afford information.

Statistics are often distrusted when an inquirer sets out to find something. I was, therefore, fortunate in having the co-operation of such an unbiassed statistician, skilled in biometrics, like Mr. Edgar Schuster. The cards were all sent to him for an independent and unbiassed investiga-

tion. His valuable report is published in the forthcoming annual report of the Asylums Committee. But I will summarize his results in great part in his own words:

There were 319 pairs of parents and children; of these, the children in 69 cases suffered from periodic insanity. Of the 69 so afflicted, 28, or 40.6 per cent., had parents similarly affected, while in 59.4 per cent. the nature of the parents' disease was different. Of the remaining 250 children, only 41, or 16.4 per cent., had parents suffering from periodic insanity. Bratz, working at Wuhlgarten Asylum, Berlin, on similar lines, has obtained similar results, but as yet has not published any statistics. He speaks of this similarity of insane inheritance as a *Vererbungskreis*.

There was even greater similarity of insane inheritance between brother and brother, between sister and sister, or between brother and sister when suffering from this form of insanity than between father and mother and son and daughter. Thus there were 200 pairs in which the first brother or sister was periodically insane, and in 92, or 46 per cent., of these pairs the second member also suffered with manic-depressive insanity, while in the remaining 108, or 54 per cent., the two members differed in the nature of their disease.

Where the first brother and sister suffered from some other form of insanity, in only 13.8 per cent., as compared with 46 per cent., was the other member afflicted with periodic insanity, while in 86.2 per cent. were other forms associated together. This indicates similar co-familial inheritance more than three times as frequent in recurrent insanity as in other forms. Allowing that the term "recurrent" may have been used sometimes for a second attack of mania or melancholia which was not truly a manic depressive insanity—still it would not account for this vast difference when dealing with such a number of cases.

Delusional Insanity—Although the numbers dealt with are many fewer, yet Mr. Schuster's statistics show that the tendency of this disease to run in families is more strongly marked than between parents and offspring. The tables he gives show that delusional insanity occurs with almost four times as great a frequency (33.3 per cent. instead of 9 per cent.) than among the insane parents of other insane people, while among the brothers and sisters the frequency is just six times as great (43.2 per cent. instead of 7.2 per cent.). There is a decided tendency for the brothers and sisters of imbeciles to be also imbecile.

In *dementia praecox* there is a strong correlation between members of the same co-familiality (*vide* Fig. 5); seeing, however, that quite 80 per cent. of the cases of this form of insanity occur before the age of 25, it is not surprising to find Schuster "had no available material for statistics on parents and offspring." Perhaps the term "insanity of adolescence" is a better one than "*dementia praecox*." The report also shows a strong correlation between brothers and sisters when affected with chronic mania or melancholia, but the numbers are perhaps too small to draw any very definite conclusions.

With regard to general paralysis, he found no indication of this disease running in families. The brothers and sisters of general paralytics seem no more likely than anybody else to be themselves general paralytics, and the same may be said about their children. Of the very few cases of juvenile general paralysis recorded, only one is the son of a general paralytic.

The second problem enunciated was, "Is there any tendency for members of the same family (as in some hereditary nervous diseases) to become insane at similar periods of their lives?" Seeing that adolescence is the period in which stress is likely to affect the individual with an insane inheritance, it is not surprising that Schuster in his report states that "a strong tendency exists for brothers and sisters of the same family to become insane at similar periods in their lives, and only a slight one between parents and children."

Since certain forms of insanity exhibit a much greater tendency to similarity of type in parents and offspring and brothers and sisters, it may be concluded that these are the types in which an inheritance of a tendency to insanity is three or four times as great as in other forms. Now we may ask ourselves the question: "Is there any correlation between the macroscopic and microscopic appearances of brains of persons suffering from manic

depressive insanity, delusional insanity, epilepsy, and insanity of adolescence where there is no terminal dementia?"

It would be difficult in the vast majority of cases to discover any abnormal morphological change, nor would microscopic investigation afford much (if any) help in the elucidation of these psychoses. Indeed, I know of only one form of insanity that is really (as I have already said), an acquired organic disease, namely, general paralysis, which, on macroscopic and microscopic investigation of the brain *post mortem*, shows such change in the organ of mind as to justify a diagnosis of the form of insanity which had affected the individual during life. I do not mean to say that these psychoses may not eventuate in a dementia, and then changes may be found in the brain.

There is a disease affecting Jewish infants which is quite specific in the changes observed in the brain and nervous system; I refer to so-called "Amaurotic Idiocy," four cases of which I have investigated. Why it should affect only Jewish children, and occasionally occur in several members of the same family, is not known; nor is it explicable unless it be by an abiotrophy due to some racial hereditary condition. This disease shows a pathological change quite unlike any other disease of the nervous system that I have seen; the Nissl substance disappears from without inwards towards the nucleus, and eventually the nucleus itself dies and the whole cell undergoes a true fatty degeneration; the neurones which were the last developed are the first to go—thus the pyramidal layer of the cerebral cortex shows this fatty degeneration much more markedly than the subcortical neurones.

PEDIGREES ILLUSTRATING INSANE INHERITANCE.

Every insane patient should be considered as a biological study. To say, merely, that one of his ancestors was

Fig. 4.—The pedigree of an insane family with homicide and suicide. The patient, P., was insane and committed a murder; a brother committed suicide; two sisters were insane. The insane inheritance was obviously from the maternal side.

insane, and therefore he has a bad heredity, and to label him thus, as is the common custom, is absurd. What we wish to know is what he was born with, and what has happened to him since birth. I have found that a conversation with the mother will very much help in understanding the causes which have led up to the mental breakdown, and she is often able, and generally very willing, to tell all she knows about the family. I am speaking only of the poorer classes.

The causes of insanity are seldom simple; they are in varied degrees inborn tendencies combined with some form of mental or bodily stress. I use the word "stress" in its widest sense as implying a strain on the important organs and functions of the body. But it is not within the province of this lecture to deal with these causes of insanity, for my object is to dwell upon the elucidation of what were probably the inborn tendencies. The construction of a pedigree will often answer the question, Did the patient come from a good stock on both sides, or was there physical or mental defect, or both, on maternal or paternal or on both sides? The fact that a cousin was insane, or even several members of a large stock, does not show a bad heredity; often, indeed, with several insane members there will be found men of genius and men and women of great civic worth (Fig. 6). A bad stock is where we find degeneracy, insanity, drunkenness, and criminality in the pedigree (Fig. 4), or a general low standard, mental and physical, in both stem and branches

of the family tree. The general tendency is for insanity not to proceed beyond three generations, and I have only three such records. As a rule, there is either a regression to the normal or the stock dies out (Fig. 4). Not infrequently the stock dies out by the inborn tendency to insanity manifesting itself in the form of congenital imbecility or insanity of adolescence—dementia praecox. Such patients are especially prone to die of tuberculosis. Thus rotten twigs are continually breaking off the tree of life, and I will now illustrate these facts by some examples of pedigrees (*vide* Fig. 5).

Fig. 5.—The pedigree of two sisters and a brother now in an asylum suffering with dementia praecox. It will be observed that two other members of the same generation have healthy children. Both the parents were sane, total abstainers, but there is abundant evidence of insanity in collaterals on both sides.

Consanguinity does not appear to produce insanity or nervous disease provided both stocks are free from taint; but if there is insanity or epilepsy (not necessarily in the first ascendants, but even in the collaterals), then intermarriage of first cousins from these two stocks with collateral insanity will tend to insanity or epilepsy in some cases in the offspring of the two sane related parents.

Fig. 6.—This pedigree shows the marriage of cousins; there are two members of the stock showing brilliant talents, but there is also insanity and suicide in two members. The regression to the normal is shown in the youngest generation.

I have observed in many of these pedigrees, but have not as yet compiled precise data, that manic depressive insanity in a stock is frequently associated with suicide in the members so affected, and even in others not affected. The tendency to suicide often runs in families, and some remarkable pedigrees have been published in which members of families in successive generations have taken their lives in a particular way, and sometimes even at a particular age; there is a suicidal obsession. Morel mentions an instance where seven brothers destroyed themselves, though in good positions and suffering no misfortune. Mudge, in the first number of the Mendel journal, has published a remarkable pedigree of two families that were united by marriage. In one the members committed suicide by drowning, the other by shooting. I would explain this by initiative suggestion acting on a neuropathic stock. A member of a family of four generations of suicides of which two were inmates of

London County asylums—namely, Colney Hatch and Cane Hill—and the pedigree of which I will now show you (Fig. 7), affords a striking example of suicide and insanity in successive generations. It will be observed that in three successive generations suicide was attempted or committed by cutting the left arm.

Another interesting case of a suicidal family in which a member developed impulsive obsessions of suicide and auto-mutilation occurred at Cane Hill Asylum, and was published by Dr. Devine, accompanied by interesting observations on the subject. The development of the obsessions in the patient dated from the aunt's suicide, which is a proof that suggestion was the cause, acting in conjunction with insane inheritance.

The vexed question of transmission of acquired characters, specially in relation to alcoholism, is one of great importance and interest. The assumption that the germ cells are sequestered in the body and not of the body, therefore do not participate in the biochemical changes which occur therein, and that in prolonged toxic conditions are uninfluenced in their nutrition and their specific vital energy, is contrary to reason. It may therefore be asked, how it is, as so often happens, a chronic

Fig. 7.—Pedigree of four generations of suicide and insanity. The stock dies out.

alcoholic may have offspring mentally and physically sound. The question is wrapped up in the causes which lead a man to drink, and my observations seem to show that a man who can drink continually for numbers of years and keep out of a lunatic asylum, a prison, or a hospital, must have possessed an inherent stable physical and mental organization, and he transmits this, the virility of the stock remaining potent in spite of the vicious habit, although it is undeniable that his offspring in all probability would have been stronger and better had he been a temperate man. Drunkenness in successive generations would indubitably lower the virility, and mental and physical degeneracy would result. Dr. Archdall Reid has expounded the tendency of the uncontrolled alcoholic type to work itself out, and the same is true of other types.

I have often noticed in the pedigrees that the children of chronic drunkards (especially when the father drank and the mother was temperate) are total abstainers. There can be no question that chronic alcoholism does figure largely in the pedigrees of patients admitted to asylums; but the same occurs—though, I think, not with such frequency—in the pedigrees of hospital patients. The accompanying pedigree was always regarded as a proof that alcoholism is productive of insanity in the offspring. The institution of the card system led to the disclosure of collateral insanity (Fig. 8). Further un-

biased inquiries on these lines are very necessary. Occasionally I have met with a pedigree (Fig. 9), such as the one I show you, in which a woman has had two husbands. By her first husband (a temperate man) she had a family of healthy children and numerous grandchildren; by her second husband (a chronic drunkard and one of a family of drunkards of several generations) she had three children, one with a muscular dystrophy, another an epileptic imbecile, and another apparently

Fig. 8.—This pedigree shows three insane patients, the progeny of a drunken insane father, who, with two brothers, was in an asylum. They were, as the figures show, the offspring of a drunken mother; it was not until the card system of relatives was established that it was discovered that her sister had been an inmate of this asylum, and had died there; also it was discovered that she had had one child, who was an imbecile. Seeing that the maternal side is free from any taint in the second generation and the paternal in the first, it was regarded as evidence in favour of a drunken mother being the exclusive cause of the insane children and grandchildren. But, in the light of the doctrine of heredity, the collateral insanity must be taken into consideration.

healthy. A few instances such as this may be mere coincidence; but multiplied, seeing that they are almost of the nature of an experiment, they would form a convincing argument in support of the injurious effects of alcohol on the germ cells. It has long been the opinion that chronic drunkenness of the parents leads to mental degeneracy in the offspring in the form of feeble-mindedness and epilepsy. With this I should agree, but that the desire for alcohol is transmitted from

Fig. 9.—This pedigree is almost of the nature of an experiment in regard to the effects of alcohol. A woman has two husbands. By the first she has healthy children and grandchildren; by her second husband, a drunkard, one of a family of drunkards, descended from a drunkard, who died of Bright's disease, she has three children—one fairly healthy, one suffering with a muscular dystrophy, and another an epileptic imbecile.

parent to offspring, in the form of like begetting like, instead of like begetting a tendency to like, is without foundation. What may be transmitted is the temperament that induces alcoholism, namely, a lack of will power and moral sense. The transmission of an acquired character, such as the desire for alcohol, is contrary to the doctrine of heredity. In twenty-five pedigrees obtained from an imbecile asylum (Leavesden)—for which I am indebted to Dr. Elkins, the Superintendent—I observe (though the numbers are not sufficient yet to give any precise data) that the families are prolific, quite as prolific as those of

the pedigrees of hospital cases, but there is relatively a larger number of deaths from various diseases, especially tuberculosis. Some pedigrees show a large number of miscarriages and stillbirths associated with imbecility and epilepsy, and occasionally juvenile general paralysis

Fig. 10.—This is a pedigree of a woman who had two husbands; by the first she had one living and one dead child; by the second she had two dead children, then a juvenile paralytic, and lastly a feeble-minded epileptic. The stock of the second husband is unsound, and he was syphilitic.

(Fig. 10); the cause of such is syphilis. The mental defect in a considerable number of the cases in imbecile asylums is undoubtedly due to organic brain disease and injuries at birth, and after.

I have still another pedigree to show; it illustrates the transmission of a similar character and life in two generations, and possibly three. The grandfather was a most distinguished man who lived to a great age, much respected. He had a daughter, concerning whose mother no particulars were obtained. This daughter was a drunkard, and of a defective moral character. She had a daughter, whose conduct was similar; she has married twice, and is at present in an asylum. By her first husband she had two stillborn children; by her second husband no children; fortunately this stock has died out (*vide* Fig. 11).

Fig. 11.—Pedigree of a drunken, insane woman, married twice, but no children living. She was the grand-daughter of a distinguished man.

A study of pedigrees teaches us the truth of the conclusions which Maudsley in *Pathology of Mind* emphasizes: "First, that a person does not inherit insanity, but a tendency or predisposition to it; and, secondly, that the tendency is inherited from the stock." . . . "Nor need the unsound strain in the stock show itself in any form of actual insanity; it may appear in some allied nervous disorder, in hypochondriasis, in suicide, in epilepsy, in dipsomania, in weakness of mind, in neuralgias, in chorea, in stammering, in spasmodic asthma, in some periodical nerve storm of abnormal character; and conversely these disorders of one generation may in their turn forebode some form of insanity in the next generation" (*vide* Figs. 6 and 12).

With the spread of the knowledge of heredity and the interest shown among the intellectual and thinking classes by the study of such works as Whetham's *The Family and the Nation*, more care will doubtless be taken in marriage selection; moreover, the cult of eugenics—literally good breeding—a term employed by Sir Francis Galton to denote the science and art of the improvement of the human race by the double process of multiplying the fit and eliminating the unfit, is daily gaining ground. Again, the study of heredity teaches that the measure of the physical, mental, and moral capacity of the individual for civic worth and usefulness depends largely upon inborn characters; you do not gather grapes of thorns or figs of thistles. Bateson has truly said, education, sanitation, and the rest are but the giving or withholding of opportunity. The diminishing birth-rate of the professional and middle classes with the high birth-rate and diminished infant mortality of the lower classes is now agitating the minds of many, but the fact nevertheless remains that Nature cares little about individuals or societies: it is mindful only of the species, and the

instinct to propagate is so rooted in our animal natures that in the process of the mental evolution of man it has become the root and stem of the tree of life, upon which has been grafted the moral virtues and altruistic sentiments which are most nobly personified in maternity.

An intellectual development, whether of the individual, or community, or race, that starves the natural instincts of love, marriage, parentage, and pride of family—these the noblest of all human aspirations—will pay the penalty, and one way in which the penalty for the starvation of this instinct will be paid for by advanced civilization is the increase of the neurotic, self-regarding type of temperament, the forerunner of neurosis and insanity.

We are constantly reminded of the fact that insanity is on the increase; in the last fifteen years the London County Council have opened four new asylums and an epileptic colony, and are now building another huge asylum, and loud is the cry of national degeneracy; but when people are feeling most pessimistic of a *natural* decay of the race, it would be well if they would remember this passage from a lecture by Huxley on Harvey and the discovery of the circulation of the blood:

"I myself am of opinion that the memory of the great men of a nation is one of its most precious possessions, not because we have any right to plume ourselves upon their having existed, as a matter of national vanity, but because we have a just and rational ground of expectations that the race which has brought forth products as these

Fig. 12.—This pedigree of four generations is interesting from its completeness, and the number and variety of the mental and bodily diseases afflicting both the maternal and paternal stocks. There is insanity, epilepsy, suicide, nervous disease, eccentricity, and physical unsoundness; but there was not one drunkard in the four generations.

may, and in good time, under fortunate circumstances, will produce the like again. I am one of those people who do not believe in the *natural* decay of nations; I believe, to speak frankly, that the whole theory is a speculation invented by cowards to excuse knaves. My belief is, that so far as this old English stock is concerned, it has as much sap and vitality and power as it had two centuries ago; and that with due pruning of rotten branches, and due hoeing up of weeds, which will grow about the roots, the like products will be yielded again. The weeds to which I refer are mainly three: the first of them is dishonesty, the second is sentimentality, and the third is luxury."

CREMATION does not appear to be making much progress in Victoria, although both that State and South Australia are ahead of New South Wales in having a public crematorium. The crematorium in Victoria is at the Spring Vale Cemetery, and although it has now been established for four years, it has averaged only six cremations a year.

It would appear from steps which are being taken in some of the Australian States that the old method of taking the oath by kissing the Bible will shortly be a thing of the past. The new form of swearing under the Evidence Act (1906), W. A., is for the witness to hold up his hand and declare: "I swear by Almighty God to tell the truth, the whole truth, and nothing but the truth." The matter is also receiving attention in Tasmania, and we learn that the Evidence Bill, which is before the Assembly, contains a provision that kissing the Bible for oath-taking be discontinued, and that the utterance of the words "I swear" should be sufficient.