The different aspects of family phthisis : in relation especially to heredity and life assurance / by Reginald E. Thompson.

FAMILY PHTHISIS

THE DIFFERENT ASPECTS OF FAMILY PHTHISIS

IN RELATION ESPECIALLY TO

HEREDITY AND LIFE ASSURANCE

BY

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PREFACE.

THE evidence upon which the arguments advanced in these pages are based is derived from the records of the Hospital for Consumption and Diseases of the Chest at Brompton, and from my experience there.

To my Colleagues on the Medical Staff of the Hospital my sincere thanks are due for the courtesy with which they have placed their case-books at my disposal.

To Mr. Wilfrid A. Bowser I am indebted for his supervision of the chapter on Life Assurance.

The cases extend over a quarter of a century: and the amount of time and labour necessarily

expended upon the work has been great. It has been my object to weigh the evidence without bias; certainly there was little fore-knowledge of the results obtained, and it only remains for me to express an earnest hope that the deductions may prove to be correct.

LONDON: *January* 1884.

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Erratum

Page 82, the heading of Table XI. *should be* Fathers, *Brothers*, and Sisters

all forms of consumption, it assigns no cause, it assumes no theory, for the gregarious disposition of the disease; and no other term would express so fully and so simply the tendency which has to be investigated and traced to its proper source.

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FAMILY PHTHISIS.

CHAPTER I.

THE SIGNIFICANCE OF FAMILY PHTHISIS.

THE term, Family Phthisis, which has been selected for the title of this treatise, sufficiently indicates the basis upon which the grouping of the cases under consideration has been made; the selection being dependent upon historical evidence to the effect that some other member of the patient's family has suffered from phthisis.

While the term is comprehensive enough to cover all forms of consumption, it assigns no cause, it assumes no theory, for the gregarious disposition of the disease; and no other term would express so fully and so simply the tendency which has to be investigated and traced to its proper source.

The advantage of selecting historical evidence as the ground of classification is manifest from the fact

that the investigation of a patient's history is a preliminary retrospect which is made in all cases by the medical examiner, and is dependent in slight degree upon skilled examination. If it can be shown that certain features distinctively characterise special series of cases which differ from each other in the historical record of family implications, as given by the individual whose case is being investigated, then this historical retrospect becomes at once a material help towards the prospective estimate of the probable clinical features of the case, an estimate of value to the physician, as well as to the patient, and of practical importance to the medical examiner concerned in life assurance.

The great significance of the family tendency as regards consumption is apparent from the large number of cases in which a history is obtained showing that some other member of the family has been implicated in the disease; and if we look to the result of experience in regard to those conditions which favour the development of disease generally among families, we might be inclined to surmise that the causes for the family disposition of consumption would be sought among those four agencies which we know prevail for disease generally: one of them is contagion, familiar examples of which influence in

spreading disease among members of a family are to be found in scabies and ringworm; another is infection, a most frequent and generally recognised cause of the distribution of disease; a third cause arises from endemic conditions of soil and of climate, of imperfect sanitary arrangements and peculiar modes of life; while a fourth arises from those universal conditions of inheritance which are known to foster the family disposition to many diseases and are signally instanced in insanity and gout.

With our present knowledge of the laws and conditions of disease it may be admitted that, for most cases, in considering the transmission of a disease from one member of a family to another, the main cause of such family development would be readily recognised; but there is at the same time an inclination to conclude that the main cause is the sole cause, and consequently to put aside the influence of other agencies which co-operate with and aggravate the tendency of the main palpable cause, and it is easy in this way to lose sight of or even neglect a masked though not the less potent cause to which variations in the clinical features of disease may be chiefly due.

The difficulties and complications with which this subject is arrayed may be briefly indicated by some

facts regarding disease which will serve to inculcate caution before too comprehensive and decided conclusions are formed upon insufficient and incomplete grounds.

For example, we cannot be satisfied with the conclusion that because a disease is contagious it may not be developed among a family under other causes, or because a condition is known to be generally hereditary it may not be influenced or caused by endemic agencies. In respect to the first point, the transmission of syphilis from parent to child is too generally known to permit such a conclusion for all diseases, while, as regards small-pox and other epidemic diseases, although we are not yet certain that such diseases influence the conditions of inheritance from parent to offspring, yet observations have been frequently made to the effect that there is a disposition often exhibited in particular families to foster and encourage each and every epidemic as it attacks the district to which the family belongs, while on the other hand some families appear to be endowed with a special power of resisting the attacks of such epidemics.

Sir Henry Holland in his 'Medical Notes and Reflections'[1] has remarked upon the disposition of

[1] p. 39.

the same family and generation to be similarly affected under any given maladies, even such as have no apparent connection with the peculiarity of family habit, and the same point regarding the behaviour of children under various infantile diseases has been urged by Bouchut.[1]

Ricord has made observations to the same effect concerning syphilis; but we do not know whether this disposition, either for or against the disease, is connected with, or derived from, the results of the disease, or whether it be due to some extraneous cause.

Regarding the second point alluded to, peculiarities of form and colour are generally accepted as purely hereditary conditions; but from some facts recently recorded, it appears at least possible that they may be due in some instances to endemic influences. This point has been discussed with much ability by Mr. William Sedgwick in his papers on the 'Hereditary Transmission of Disease,' and he quotes the observations of Livingstone for evidence in favour of the belief that albinoism may be the result of endemic causes.[2]

[1] *Traité Pratique des Maladies des Nouveaux-Nés*, p. 597.

[2] See his papers in the *Brit. and For. Med.-Chir. Review*, 1851, &c.

It is also necessary to bear in mind that acquired forms of disease, malformations, and even accidental maimings may be transmitted under the influence of inheritance from parent to offspring, and Darwin has collected many illustrative examples of such transmission.[1]

Without entering more fully into these points, it will be sufficiently evident that caution should be observed before arriving at definite conclusions, especially when investigations are concerned with reference to a disease which, from the researches already made into its ætiology and character, is known to be protean in form, subject certainly to endemic influences, modified by family conditions, acquired in various ways during different circumstances of life, by different trades and occupations, and even possibly communicated by infection from one individual to another ; for we cannot at the threshold of our investigation shut our eyes to any opinions which from time to time have been urged concerning the propagation of consumption by observers well qualified to form an opinion, and we must not ignore those suspicions which have haunted the minds of some of the acutest physicians the world has known, from the days of Aristotle to the present

[1] *Variation of Aninals and Plants, &c.*, vol. ii. p. 12, &c.

time, regarding such a mode of transmission in respect to this disease.

With all these possible causes in view regarding the family disposition of consumption, we are at the outset of our inquiry face to face with a very complex problem, the more difficult of solution by reason of the multiplicity of the factors concerned, and it is only by dealing with a vast number of instances that we can hope to arrive at any just conclusions upon the question.

It is not intended to enter into a discussion of those endemic causes which are well known to be potent in the ætiology of consumption, nor to investigate the subject of infection: the object in view is to unravel the tangled thread of family disposition to the disease from the investigation of a large number of cases arranged in different series in accordance with the particular family history given in each case, to find out whether there is reason for supposing that inheritance has any influence in this disease, to examine into the nature of the heirloom to see if it be the same in each series, and to form some approximate calculation of the relative value of the heredity; and as it has often been suggested that the frequency of the family manifestation of the disease is due to accidental conditions consequent

upon its national character, it is incumbent upon me to bring forward some conclusive evidence of the hereditary nature of consumption before investigating those different aspects of family phthisis which of themselves form the strongest links in the chain of evidence.

In order to explain the machinery of investigation, a few preliminary words are necessary upon the mode of collection and tabulation of the facts put in evidence: the reliable value of the evidence adduced will be more fully discussed in a subsequent chapter.

The tabulated cases which form the basis of examination are derived from the case books of the Brompton Hospital. The patients whose cases have been carefully investigated, considered, and tabulated were admitted into the hospital during the quarter of the century between 1855 and 1880. The history of each case has been carefully recorded by the clinical assistant, while the examinations of the patients, the physical signs of pulmonary disease, and the diagnosis of the disease have been made by the physician in charge of the case.

It may be fairly said that the cases have been generally under similar conditions, and the majority of the cases—about three-fourths of the total admis-

sions—having come from the metropolitan area, may be considered to have been under similar endemic conditions, at least as regards climate.

The method of arrangement adopted has been the following:—No case has been included unless it was evident that due care had been taken in the investigation of the family history; each case has been carefully considered, the date of attack has been estimated, and the case has been entered under its special quinquennial period. The clinical features have then been investigated, and cases have been entered as improved or worse in which decided evidence as regards weight, general condition, and the disease of the lungs was obtained.

The acute, subacute or chronic character of the disease has been approximately calculated in accordance with a carefully devised scheme arranged to meet the points at issue, and to estimate the progress of disease chiefly as affecting the condition of lungs, but also in its influence upon the general condition; disease tending to cripple one lung in six months, or both lungs in fifteen months, has been reckoned as acute; in thirty months as subacute; and cases which have survived this period have ranked as chronic. The endeavour to enter the cases under their proper headings has been a work of

much difficulty, and has involved much thought and time.

As to the recurrence of hæmoptysis, it appeared advisable to separate cases of copious bleeding from those of moderate amount; copious hæmoptysis indicating a quantity of at least four ounces of blood, moderate bleeding being estimated at from one to four ounces; any amount under one ounce has been reckoned as slight; the frequent repetition of bleeding has also been taken into consideration.

It must be remembered that the object of the present investigation is to obtain some comparative view of the several series of cases, and each case has been subjected to the same mode of handling, so that, as the several series have been sifted through the same mill, the results may be fairly compared.

As regards the errors to which the several series may be liable, it is evident that those cases which have been entered as acquired are most open to error, from the fact that cases occur, although probably few in number, in which a parent may die of the disease long after the death of the child, and such cases undoubtedly ought to be considered as hereditary; but such error only tends to approximate the series of acquired cases to that of the hereditary, the difference between the two being thus diminished

pro tanto, and it would strengthen instead of weaken my position, in so far as my arguments are concerned with the contrast between the two series.

The same kind of error may be attached to some of the hereditary cases, and some of the cases of single heredity may prove from the subsequent death of the other parent to be cases of double heredity. But this can hardly be a widespread error, as the occurrence of double heredity is undoubtedly rare. Fully aware of the probability of errors of this kind, I have endeavoured to meet the difficulty by the collection of a very large number of cases, and the plan which has been adopted for the separate examination of the various series for males and for females has materially helped to check the deductions and corroborate the results which have been obtained.

The complicated nature of the investigation has become the more evident as the examination proceeded, but the more thoroughly such a subject is threshed out the more satisfactory the results which are harvested. Only those who have experienced the wearisome monotony of dealing statistically with a large number of cases can appreciate the encouragement which is attached to the solution of difficult problems, and if it were not for the repeated amplifi-

cation of the horizon which is associated with investigations of this kind, and the keen interest which is kept alive by new results, many a similar voyage of discovery would become barren and end in a disheartened retreat.

CHAPTER II.

EVIDENCE OF THE INHERITANCE OF PHTHISIS.

FROM an early period in the history of medicine, physicians have held the opinion that consumption is hereditary, and this opinion is maintained at the present time generally throughout the civilised world, especially in those countries where the people, from the prevalence of the disease, have daily opportunities of witnessing the frequency with which several members of a family are carried off by it; but those who from painful experience amongst their own family, their friends, or their acquaintances, have accepted this theory as one of the settled doctrines of medical knowledge, would have some difficulty in proving conclusively its truth, and it has even been affirmed by a very competent authority in this country that the arguments hitherto adduced in favour of the theory of inheritance are insufficient to prove the case.

And in this statement, bold as it may appear to many who hold the contrary opinion, there is

undoubtedly much truth, although when we weigh all the considerations which bear upon the subject it is difficult to believe that so many persons who are deeply interested in the theory, and have staked considerable sums of money on its truth, should have allowed themselves to be easily deceived by appearances only. Numerical evidence in favour of this doctrine, derived solely from the frequency with which consumption attacks more than one member of a family, certainly cannot be accepted as proving the inheritance of the disease; but that large sums of money should be risked, and large profits made, on the possible truth of the theory in the matter of life assurance is apparently an argument in its favour.

As Darwin remarks concerning the proof of inheritance with regard to breeding, hard cash paid down is an excellent argument of inheritance, and Spencer, in his 'Principles of Biology,' lays down the maxim that a theory from which large sums of money have been made may be accepted as true.

For many years past the assurance offices have depended and acted upon this theory and they have successfully limited their risks from phthisis, not only by the rejection of applicants who show any actual symptoms of pulmonary disease at the time of examination, but under the assumption of the hereditary

nature of the disease from a consideration of the historical evidence obtained in each case regarding a family disposition to the disease, and by the rejection of such applicants as appear to be specially liable.

But although the principle acted upon in the rejection of such cases has been the inheritance of the disease, we must not lose sight of the fact that the implication of many members of a family, especially when they are of the same generation, might result probably from endemic causes, possibly from infection, and the rejection of such applications by necessarily limiting the liability from consumption invalidates conclusions regarding inheritance solely; but although for this reason the evidence of assurance offices cannot be accepted as conclusively proving the theory of inheritance, it may serve to prove some points in the subject under investigation.

For instance, it has often been urged that the family disposition to consumption is coincident, simply upon the frequency of the disease, and that there is no ground for assuming a special tendency; but this objection, arising from an inconsiderate temerity which assumes a knowledge which it has not acquired, may be overthrown by an appeal to the evidence of life offices; and to put the question in a concise form, I shall proceed to prove the following proposition :—

I. *Individuals who give a history of family phthisis are more liable to phthisis than the community at large.*

This point has been investigated by Mr. Dovey in his interesting treatise on the 'Influence of Selection on the Mortality from Different Classes of Disease among Assured Lives.'[1]

Taking 409 cases of policy holders who had died of consumption, and the same number of those who had died of other diseases, and comparing the family histories of each series, Mr. Dovey found that there were 62, or 15·2 per cent. out of the 409 consumptives who had lost a parent, or a brother or sister from consumption; and out of the same number of non-consumptives, only 44, or 10·8 per cent. gave such a family history of consumption.

It is interesting to note that a similar result has been obtained from the examination of policies in America, and Mr. Dovey quotes from the report by the medical officers of the Mutual Life Assurance Company, of New York, issued in 1877, as follows :—

'Out of 1,031 persons who died of consumption, 18·81 per cent. were individuals who gave a history of family phthisis; while out of the same number of those dying from other diseases, only 9·89 per cent. gave such a history.'

[1] p. 14.

A similar result is also obtained from the medical investigations of the United States Insurance Company, for out of 1,000 fatal cases among the policy holders, 268 were caused by consumption ; but in the case of 720 policy holders, from whom a history of family phthisis was obtained, 19 died of consumption, 31 died of other diseases ; or the proportion of deaths from consumption among the series of policy holders with a family history of consumption was 38 per cent., while the proportion among the policy holders generally was only 26·8 per cent.

It must be remembered that in this kind of evidence we are dealing with selected lives, so that the evidence is by no means the most favourable for the object in view.

But we may go further and show, with Mr. Dovey's assistance, that by the method of selection adopted, British assurance companies have succeeded in reducing their risks below the estimated mortality for the community at large.

Assuming the truth of the observations of medical authorities on the subject, we may accept the average duration of phthisis in this country as not exceeding generally three years, and we must consequently reject from consideration statistics during the first

three years of assurance, inasmuch as cases would have been rejected on personal grounds by the medical examiner, and the liability of the office from consumption would have been *pro tanto* diminished. When the immediate effects of medical examination have passed away, there remains, to quote Mr. Dovey's words,[1] a more permanent, though less strongly marked influence in the reduction of the mortality for a long series of years to about two-thirds of the rate which obtains among the general population of the country. Reference may be made to his pamphlet for actual numbers.

It is necessary to bear in mind that the general public is well aware of the heavy tax which is involved in a history of family consumption, and there is not only no inducement for the applicant to make a parade of his knowledge, but, on the contrary, rather to take refuge in an expressed ignorance when the application is made for assurance.

As family history is a comprehensive term which includes all degrees of relationship, it is necessary for the purpose of proving inheritance to limit the investigation to those cases in which a history of parental phthisis is given ; and for the following proposition, which I shall endeavour to prove, it may be remarked that the evidence is derived from individuals who

[1] p. 12.

have no motive for concealment and are not selected lives. As to the value of this evidence in consequence of being derived from the class of hospital patients, I have discussed this point in another page, but it may be at once stated that there is no reason for supposing that this kind of evidence is not reliable.

The second point I shall endeavour to establish is, that a marked difference between acquired and hereditary causes of phthisis appears upon the investigation of a large number of cases, a difference which quite accords with the known results of general inheritance, and exhibits proof of inheritance.

II. *Consumptives who give a history of parental phthisis are disposed to be attacked by the disease at an earlier period of life than those who have no such history.*

Providing that a large number of cases be examined in which the only special condition which appears to characterise all of them is the fact of one or both parents having suffered from phthisis, we may conclude that an argument in favour of the doctrine of inheritance would result from any special distinction belonging to this series of cases, and the argument would be the stronger in proportion as the

distinction followed in the lines which are known to be traced by inheritance in other instances.

From the results of inheritance for other conditions of disease and peculiarities of structural growth, we know that the development of the heredity is thrown upon an earlier period of life in many cases, and especially with regard to two forms of disease which are signally under the potent influence of heredity, to wit, insanity and gout; and it is fully recognised that for a large number of such cases anticipation of the parental period of development is the rule in the offspring. If inheritance has then any potent influence in the development of phthisis, it would be in accordance with this previous knowledge if we could elicit a similar rule of anticipation from the examination of a large number of hereditary cases of phthisis by comparing them with another series in which the disease appeared to be acquired; but in order to make such an examination fair in all respects, it is of paramount importance that equal numbers of both sexes should be considered, inasmuch as the sexual features of phthisis are peculiar and distinct, as I shall show in a future chapter.

In the present case it seems fair to consider the effect of inheritance generally upon both sexes, and for this purpose 4,000 actual cases have been tabu-

lated and arranged in quinquennial periods, according to the ascertained date of attack. Of these cases 2,000, consisting of 1,000 males and 1,000 females, have been selected in accordance with the history, given in each case, of one or both parents having suffered from consumption ; these constitute the series of hereditary cases, which are compared with an equal number of cases of both sexes in which no family history of phthisis was obtained.

After a careful consideration of the points involved in this comparison, I can see two reasons for believing that the acquired series may approximate unduly towards the hereditary series ; but, as I have already stated, such an approximation tends to strengthen rather than weaken my position, and the two reasons are the following : the acquired series are necessarily open to the objection, that until the deaths of all the relations are known, it cannot be certain that no relation died of phthisis, and consequently it must be allowed that some hereditary cases have been admitted into the series. The other reason is not so evident, and the proof of it depends upon future evidence, and that is the fact that the acquired series contains necessarily only instances of the first member of the family attacked, whereas in the hereditary cases I have included at least 200 cases in

which the patient was not the first of the generation attacked ; but both reasons tend only to diminish the contrast between the hereditary and acquired series of cases, and hence it is evident that my conclusions are not exaggerated.

The subjoined table shows the comparative numbers for the several quinquennial periods of life attacked by the disease, the date of the earliest onset of the attack having been carefully estimated, the comparison being between the 2,000 hereditary cases and the 2,000 acquired cases.

TABLE I.—*Showing the Date of Attack in* 2,000 *cases of Hereditary Phthisis, and* 2,000 *cases of Acquired Phthisis.*

Ages	1	10	15	20	25	30	35	40	45	50	55	60	Total
Hereditary	26	120	436	549	392	217	149	65	27	6	9	4	2,000
Acquired .	17	79	319	456	392	287	221	124	63	30	11	1	2,000

It may perhaps be necessary to point out that these statistics do not deal with the question of infantile liability either to tubercle or to phthisis or early death, inasmuch as our hospital records do not present such statistics for investigation. This part of the subject requires to be dealt with from other records ; but it must not escape our memory that the influence of heredity may be manifest at very early periods of life in other forms than phthisis.

This table shows that the hereditary cases are liable to the onset of the disease in much greater numbers than the acquired cases, during the quinquennial periods before twenty-five years of age. Between the ages of twenty-five and thirty, the two series assume common ground, the two numbers being the same, while the periods after thirty are chiefly favoured by the acquired cases.

If the numbers of the two series be added respectively together for the periods before twenty-five years of age and after thirty, the following result is obtained :—

For the hereditary cases—

1,131	occur	before	25	years	of age.
477	,,	after	30	,,	,,

For the acquired cases—

871	occur	before	25	years	of age.
737	,,	after	30	,,	,,

Or, to put the result in a simple form, whereas for the acquired cases the liability of the period before twenty-five is to that after thirty as 8·7 is to 7·4, the proportion of the liability for the hereditary cases is as 11 to 4·8 ; the liability of the early period for these hereditary cases is thus more than double that for the later period.

This result appears to show conclusively that the

potency of inheritance is exhibited in the early development of the disease. This distinction has been previously recognised by M. Briquet and Dr. C. T. Williams as one of the characteristic features of hereditary disease.[1]

But we may go a step further and adduce other evidence, which appears to be crucial, in favour of the theory of phthisical inheritance. If inheritance from one parent has a certain effect in a particular direction, what is the result of double heredity? I shall proceed to show that, in regard to the anticipation of the attack, the effect of double inheritance is greater than that of single inheritance.

III. *Consumptives who give a history of phthisis in both parents are disposed to be attacked at an earlier period of life than those who have a history of single heredity only.*

The complete consideration of this part of the subject will be found in a subsequent chapter, and I shall there endeavour to show that double heredity is the resultant of the direct and cross heredity; but for establishing the present proposition it will suffice to show that the influence of the double inheritance

[1] See *Recherches Statistiques sur l'Histoire de la Phthisie*, *Revu Médicale*, 1842; and *Pulmonary Consumption*, p. 117.

is much greater than that of either the direct or cross inheritance in the anticipation of the attack.

The actual cases upon which the following statements are based, will be found in the Appendix ; and the calculated tables per mille belong to Chapter IX., to which I must refer.

If the relative numbers for males under the influence of direct, cross, and double heredity be respectively added together for the period between fifteen and twenty-five years of age, it will be found that the comparative liability is proportionate to the following numbers (taking the numbers per mille) :—

Direct	387
Cross	486
Double	555

The liability for this period is evidently very much greater than either direct or cross inheritance.

The same result is obtained from a consideration of the female cases between the ages of 10 and 20 :—

Direct	277
Cross	270
Double	390

The conclusion, therefore, which may be drawn from these numbers is, that the effect of double heredity in the anticipation of liability is greater than that of either single heredity for both cases ; or, in other words, single heredity influences the development of

the disease in regard to the early period at which the attack takes place, and this anticipation of development is further increased under the influence of double heredity.

By such succession of arguments and evidence I have endeavoured to establish the truth of phthisical inheritance—a term which must be understood in a comprehensive sense and freed from the considerations of previous theories which might interfere with an unbiassed review of facts. When the conditions of phthisical inheritance have been minutely investigated and the probable laws of inheritance formulated, we shall then be in a better position to theorise on the subject; but before entering on such an investigation, it will be necessary to appraise the value of the evidence which is brought forward in these pages, for all evidence of this kind has been frequently called in question; and especially it has been argued that the evidence of hospital patients is not trustworthy, although no reason for such doubts has been given. It would, indeed, seem to be assumed that the value of evidence depends upon the social status of the individuals, and that it varies directly in proportion as the class of individuals from whom the evidence is derived is higher or lower in the social scale; but very strong evidence would be requisite before we

could fairly accept these assumptions as true, as they would in great measure make family memories dependent upon money and social distinctions—a conclusion which cannot be said to be self-evident.

CHAPTER III.

THE VALUE OF THE EVIDENCE ADDUCED.

THE success which has followed the elimination of consumptive risks by the historical evidence of family phthisis obtained from the applicants for assurance, after the immediate results of personal examination have passed away, is satisfactory proof that a certain value is to be attached to evidence which depends upon memory, even in cases where no advantage, but rather disadvantage, is reaped from the remembrance; but it has been objected, although no proof has been given for such objection, that the memory of policy holders and of the upper class of society is one thing, but that the memory of hospital patients is quite another thing; confidence may be placed on the evidence obtained from the first, but it must be denied to that derived from the second, and it is necessary to examine into the truth of such objections and discover whether they are founded on facts or not.

The penalty which is imposed by assurance offices,

as already remarked, on those applicants who give a history of family phthisis, amounting in extreme cases to rejection and in minor degrees to the demand of an additional payment, is calculated to induce at least a profession of ignorance under which the applicant may safely shield himself, if not indeed intentional concealment, which, although it would invalidate the policy if proved, might be extremely difficult to prove; and every assurance manager is fully aware of the various subterfuges under which the deaths of parents are concealed, and the terms which are generally used for this purpose. Evidently, therefore, the memory of policy holders is not altogether exempt from a certain suspicion which hangs about a proportion of the cases, a suspicion which is certainly not attached to the evidence of hospital patients, who have no motive for concealment. It might be also remarked, that the status of small policy holders is much the same as that of the patients of Brompton Hospital, and I fail to see *primâ facie* any reasons for believing that the memory of one class of persons is likely to differ in value from that of another class in regard to the condition of near relatives, of parents, and of brothers and sisters, especially in this country, where the family disposition to phthisis is well known.

But it will be said, that inasmuch as the children of poor parents are obliged to go out into the world to earn their bread at a comparatively early age, they may lose sight of their home, their parents, and other relatives, and hence in many cases they cannot know the history of their family.

In some slight measure such an objection might be a valid one, but my answer to that is plain. When the case is being investigated, and the statement is made that the patient does not know the history of the family because he has lost sight of his relatives, the facts are recognised and duly entered, and it is not in the least probable that a tissue of inventions would result from such questioning or be entered in the record of the case. This objection, therefore, does not traverse my evidence, for such cases have not been admitted into the series.

Positive evidence of family implications has been required for the admission of a case into the family series, and any lapses of memory will only affect that series in regard to a diminution of the extent of the implication, and it will only be in rare cases of double heredity where the second parent has died after the admission of the patient into hospital, that such diminution will tend to invalidate results ; but such cases are infinitely rare, so that the effect would be infinitesimal.

But materials are at hand for a precise estimate of the relative value of the memory of the different classes of society; these materials are contained in the statistics collected by Dr. C. T. Williams, from the practice of his father among the upper class in this metropolis, which may be contrasted with those obtained from our hospital records.[1]

General experience would certainly lead to the conclusion, that the memory of women in reference to details of family history is more extensive and accurate than that of men, especially for historical evidence about collateral relations and grandparents; and a reference to the subjoined table, which gives the number of relations implicated, will make it apparent that there is a slight superiority evinced in the memory of the females as regards such remote details; and if this difference may be looked upon as a gauge of the memories of the sexes for such details, we might say that the value of the female memory compared with the male is as 9 to 8. Accepting therefore the memory of the women as slightly better than that of the men, and knowing that the men are more liable to the acquired disease (a point which will be more fully discussed in the next chapter), we

[1] *Pulmonary Consumption, &c.* By C. J. B. Williams, M.D., F.R.S., and C. T. Williams, M.A., M.D.

may institute a comparison of the memory of the women of the two classes by comparing the two sets of statistics.

If we turn to the proportion of family cases among the female patients given by Dr. C. T. Williams, we find that 57 per cent. of this class of women gave a family history of phthisis : the proportion of family cases among the female patients at the hospital, estimated from 2,000 consecutive cases, turns out to be 58 per cent. : the balance being in favour of the hospital class of patients.

Considerations other than mere memory may possibly step in to influence the result ; but taking the evidence as it stands, it appears justifiable to conclude that the memory of the women of the lower class is quite on a par with that of the upper ten thousand.

From the annexed Table of Relationship it will be seen that the numbers of single heredity very closely coincide for the two sexes, and it seems unlikely that chance would have given such a result, and no reason has presented itself for believing that the memory of the males is untrustworthy or even inferior on matters of history concerning near relatives.

The liability of the male sex to the acquired disease is so much greater than that of the female, that the difference in the number of family cases based

TABLE II.—*Showing the proportion in which the several members of families were affected with Consumption in* 1,000 *cases of Males, and* 1,000 *cases of Females.*

	Males		Females	
Father only	168		161	
,, with sons and daughters	50	= 252	53	= 245
,, with sons only	34		...	
,, with daughters only	...		26	
Mother only	158		145	
,, with sons and daughters	58	= 241	69	= 255
,, with sons only	25		...	
,, with daughters only	...		41	
Father and mother only	40		78	
,, with sons and daughters	20	= 68	23	= 115
,, with sons only	8		...	
,, with daughters only	...		14	
Brothers and sisters	152		160	
Brothers only	191		...	
Sisters only	...		112	
Grandparents only	12		16	
Collateral only	84		97	

upon percentage returns cannot be accepted as depending upon memory solely; and the same argument holds good regarding the relative value of the upper and lower classes of society, inasmuch as the lower class is much more exposed to the disease from trade and occupation, from privation and overcrowding, whereas the men of the upper class would have every advantage that riches can give them, and their risk would

be diminished. The percentage which for the upper class of males is 43 per cent., and for our hospital males 36 per cent., cannot therefore be accepted as showing that the memory of the men of the upper class is better than that of the men of the lower class; nor do I quite see how such a comparison can be made; but as the memory of females of the lower class has been shown to be comparable with that of the upper class, we may fairly conclude that the relative memory of the males stands in a similar position.

Those who throw doubts upon the evidence of hospital patients are bound to show cause for their mistrust. My own experience of such evidence has been extremely satisfactory, and induces the belief that attempts are not made to mislead, especially for the disease here considered, and that false statements are rare and accidental, inasmuch as no discredit is attached to the disease. In diseases which implicate the sobriety or morality of the patient, the evidence derived from all classes of patients assumes another character; but I know of no reason for supposing that there is any distinction of class in the matter, unless, perhaps, the reluctance of confession is greater the higher the patient is in the social scale. Certainly the testimony of hospital patients in regard to phthisis

has inspired me with far more confidence than the statements made by applicants for assurance. In the first class of cases there is no motive for concealment, and certainly none for misleading the physician; while in the second class a vivid memory on the part of the applicant for assurance becomes expensive and there is a strong temptation to a general profession of ignorance.

Inasmuch as my evidence is based upon positive statements, I see no reason for thinking that it is anything but true and trustworthy: the results from one series of cases have been checked and counter-checked by other series, and the internal evidence of agreement in the relative numbers of the tabulated cases is, I trust, sufficiently strong to prevent the foundation of facts from being lightly overturned; and inasmuch as I have shown in respect to the women that the memory of the lower class is quite on a par with that of the upper class, statements unsupported by facts cannot be accepted against the worth of the evidence simply because it has been derived from hospital patients.

CHAPTER IV.

THE EXTENT OF FAMILY AND HEREDITARY PHTHISIS.

So much has already been written regarding the relative proportions of family and acquired phthisis and the extent of heredity, the disproportion in the numbers of the sexes affected by inheritance being a point especially insisted upon, that remarks of mine upon these subjects might seem superfluous; but it appears to me necessary to devote some consideration to these points, mainly because all the deductions which have been put forward are based upon percentage calculations, which for many reasons I feel some hesitation in fully accepting.

In dealing with the numbers of acquired and family cases for each sex, we are dealing with two quantities which may vary in different proportions for each sex: both might be variable, or one might be fixed and the other variable. If we know that the liability to the acquisition of the disease is the same

for both sexes, we might fairly make a percentage calculation and estimate the relative numbers with facility and certainty; but if there be any ground for supposing that one sex is more liable to the disease, then it might happen that in simple percentage calculation an increased number of acquired cases would thrust out of the percentage a number of hereditary cases, and the extent of heredity would thus be apparently diminished.

An example will make this clear. Suppose, for the sake of illustration, that we assume the force of heredity to be equal for the sexes, and we find that the males are more liable to the disease than the females, in about the proportion of 270 to 170, and out of these numbers say 100 are cases of inheritance for each sex, so that the two forms of disease stand in the following proportion:—

100	hereditary	+	170	acquired	for the males.
100	,,	+	70	,,	,, females.

If we make these numbers the basis of a percentage calculation, we get the following result:—

100 male cases will be composed of 63 acquired cases,
and 37 hereditary cases.
100 female cases will be composed of 41 acquired cases,
and 59 hereditary cases.

To make the deduction that the hereditary cases are

more frequent for the females, is evidently a fallacy, because we started by assuming the numbers for the sexes to be equal.

Before proceeding then to discuss the comparative proportion of family cases, we ought to find out what is the relative liability of the sexes to the disease, and when we look into the matter we are at once met by the fact that the comparative liability, as shown by the mortality returns for this country, is variable in different localities.

If the mortality returns for the whole of England be examined, say for the year 1880, which conveniently coincides with a portion of the time with which my series of cases is concerned, it will be seen that the deaths of the females exceed those of the males; but in different counties, sometimes the deaths of the males are in excess, and sometimes those of the females.

Upon investigating the addresses of the patients whose cases are here tabulated, I find that nearly three-fourths of them come from the Metropolitan area: in the exact proportion of 66 per cent. of the males, and 77 per cent. of the females. We may presume, then, that, for our cases, the relative liability of the sexes must be estimated on the basis of the Metropolitan returns.

And upon this point it may be remarked that almost all the statistics which have been brought forward have been compiled by physicians practising in London, and most have been derived from cases at the Brompton Hospital.

If we examine the Metropolitan returns of mortality for 1880, we find the actual number of deaths from phthisis are 4,805 for the males, 3,669 for the females; or, in other words, out of every 100 deaths from phthisis in London, 57 are males, and 43 females.

But as it by no means follows that the relative death-rate is an exact measure of the liability to attack, we must look for statistics of liability elsewhere; and these we shall find in the First Medical Report of the Hospital, where it will be found that the liability of the males is rated at 61 per cent., and that of the women at 39 per cent.

This estimate closely coincides with that made by Pollock from a similar set of cases; his estimate being 60·75 for the males, and 39·25 per cent. for the females.

But we can turn to statistics derived from a completely different set of London cases, those given by Dr. C. T. Williams from the practice of his father, which, I presume, we may conclude to have been

largely composed of Metropolitan patients, and we find out of 1,000 cases, 625 were males, 375 were females.

From a careful consideration of the whole subject, and especially of those influences which tend to modify the attendance and admission of the patients at our hospital, influences depending chiefly upon the modes and exigencies of life which need not here be specified, I should accept the numbers given by Dr. Williams, resulting as they do from patients unrestricted by artificial limitations as representing the comparative liability of the sexes for the Metropolitan district; and as the mean of the three estimates is 61·5 per cent. for the males, and 38·5 for the females, we shall not be far out if we take 62 for the males, and 38 for the females.

Now, out of 3,000 cases of males taken in order out of the hospital records, I find that 36 per cent. of the male cases had a history of family phthisis, and 58 per cent. of the female had a similar history, and I should proceed to estimate the actual proportion of family cases for each sex in the following manner:—

For the males 36 × 62 = 2,232 family cases.
For the females 58 × 38 = 2,204 ,,

Although this estimate differs materially from those

hitherto generally accepted, the result appears to be far more consonant with the general results of inheritance; but as I am much impressed with the difficulty of making an exact estimate (and the task appears more complicated by the knowledge of the various influences which affect the calculations), I prefer to state the case in the following manner :—

For 1,000 males in London from whom a history of family phthisis is obtained 1,778 will give no history of the kind ; while for 1,000 females who give such a history of family phthisis, 724 give no history. But I hesitate to accept deductions made from percentages as showing that the disease is more frequently developed among females, or that males suffer less from the hereditary tendency and are enabled to eliminate the effects more readily. For, if the fact be admitted (and of this there appears no doubt) that in London men are more liable to this disease than women, it is very difficult to see why males under such conditions are likely to eliminate the family disposition to the disease; and although the development of phthisis may be held in abeyance and be successfully averted, the hereditary tendency will remain, for it can be transmitted without development.

It is a noteworthy point as regards the table of relations affected with phthisis, that on examining those details of 2,000 cases we find that in respect to family history in which there was limitation to one sex only, 624 males gave such a history and 577 females.

When the attempt is made to deduce from the family cases the comparative extent of heredity, the task appears even more hopeless; for there is a large number of family cases—those for example in which brothers and sisters only are concerned—in which no clue is given as to inheritance, and from the table of relations it will be seen how largely these cases preponderate for the males. The only way in which any approximate estimate can be made is from the life histories of a number of families the parents of which appear to have been effectual in the transmission of the disease. To obtain a full record of a sufficient number of such family histories is a matter of much trouble and difficulty; but I have succeeded in obtaining eighty family histories which are complete up to a late date. No selection has been made in these cases except in regard to completeness of detail, and they are put forward as they came to hand.

These eighty cases are made up of the following sets :—

Paternal inheritance	24
Maternal inheritance	30
Double heredity	14
Atavism	12
Total	80

Full details have been obtained regarding the deaths of the parents and other relations, of the order of succession in the family, their health and causes of death, the number of children who died young, and of those who appear not to have developed phthisis.

As it is important to remember that the effect of phthisical inheritance may be manifest in the early death of the children, I have divided the members of these eighty families, according to their life histories, into three classes : those who developed phthisis, those who died in childhood, and those who showed no symptoms of phthisis.

The total number of children for these eighty families is 385, giving an average of nearly five for each family. Of these 203 were males, and 182 females.

	Males	Females
Phthisis was developed in	98	96
Died in childhood	21	16
Non-phthisical	84	70
Total	203	182

From these cases it will be seen how closely the numbers of the sexes affected with phthisis approximate ; and if the numbers of those who died in early life be added, we find that 119 males and 112 females were affected, the preponderance of heredity being exhibited among the males.

The details of these eighty cases are given in the annexed table, and attention should be directed to the returns for the double heredity, as they seem to suggest a reason for the disproportionate number of such cases for males and females.

Bearing in mind several deductions which appear extremely probable from the facts I have collected, and knowing that the disease is transmitted by inheritance to the third and fourth generations, through intermediary parents who may be the silent carriers of the heredity, and not develop the disease at all, I think it is impossible to estimate with anything approaching accuracy the actual or proportionate extent of inheritance for the sexes, and perhaps some of the doubts which occur to me on this matter may be shared by those who carefully consider the various points discussed in the following pages: at the same time I am impressed with the notion that the discrepancy which has hitherto been accepted as manifesting a greater liability to the heredity, on the

TABLE III.—*Showing the number of Males and Females who developed Phthisis out of* 80 *Families in whom Heredity was suspected.*

Heredity		Phthisical	Died in childhood	Non-phthisical
Paternal 24	Males 39	20	2	17
	Females 54	30	5	19
Maternal 30	Males 102	38	9	55
	Females 78	34	4	40
Double 14	Males 34	17	9	8
	Females 30	17	5	8
Atavism 12	Males 28	23	1	4
	Females 20	15	2	3
Total	Males 203	98	21	84
	Females 182	96	16	70

part of the females is based upon unsatisfactory evidence, and I incline to think that the actual extent of heredity is not very different for males and females.

CHAPTER V.

GENERAL FEATURES OF ACQUIRED PHTHISIS.

THE special effects of inheritance in modifying the general conditions of phthisis can only be ascertained from a comparative study of a large number of acquired and hereditary cases. It must, therefore, be a first task to endeavour to form some estimate of the general features of phthisis in individuals who give no history of the disease in other members of their family, and in whom consequently the acquisition of the disease, as far as can be ascertained, has not been influenced by the heredity resulting from parental consumption.

So much depends upon the careful selection of these cases, that it has been necessary to exhibit much caution as to the admission of proper cases, and the acquired series of cases here tabulated includes only such as bear evidence of thorough investigation as regards the family history. It would be very difficult to collect a sufficiently large number of

cases in which the deaths of the parents were known to have occurred from other diseases than phthisis, and we have to rest satisfied with the statement that no member of the family was known at the time of the patient's admission into hospital to have suffered from consumption; but, as I have before pointed out, the admission of hereditary cases into the acquired series only makes the contrast between the two series less marked; and as it will be seen that a sufficiently marked contrast can be elicited from the series of tables, it is evident that the deduced distinctions are not overstated.

The arrangement which has been adopted seems preferable to the plan of striking averages and percentages, the latter method being open to fallacies and very difficult to handle satisfactorily. It will possibly be argued that the forms of phthisis are so varied that no satisfactory *coup d'œil* embracing all the protean conditions which obtain in this disease can be made; but although conversant with the many-sided aspects of phthisis, I am satisfied that there is a very large number of cases which might be termed ordinary phthisis presenting many common features, and running a similar course; and a general aspect of such cases may be obtained from a consideration of a large number of cases.

Pollock, who has adopted the statistical method of investigation upon a similar understanding remarks as follows:—

'It is understood that no two cases of phthisis, nor, indeed, of any other disease, are precisely alike; but certain broad features are stamped in every instance of disorder sufficient to show that they are akin to others with similar manifestations.'[1]

With regard to the construction of the tables, it may be advisable to point out that the estimate in all the cases is made for the date of attack, and in the different divisions the clinical features of each case are entered in accordance with the date of attack. The first line shows the relative number of individuals attacked by the disease, arranged according to quinquennial periods; the second line shows the number of cases which became worse; the third line shows the number of those which improved under treatment.

The second division refers to the fatal cases dying in the hospital or soon after removal: the first line of this division giving the total number of such deaths; the second line giving the number of cases fatal within six months of the attack, and such as may be termed rapid cases; the third line gives the

[1] *Elements of Prognosis, &c.*, p. 66.

number of cases dying between six and eighteen months.

The third division represents the clinical course of the disease as regards time, and the estimate of the cases, as acute, subacute, or chronic, has been made with much care and labour.

The fourth division refers to the amount of hæmoptysis: *copious* indicating a quantity above four ounces; *moderate*, a quantity from one to four ounces; *slight*, any quantity below one ounce.

Acquired Phthisis among Males.

The subjoined table (p. 52) shows the tabulation of 1,000 actual cases of males, from whom a history of an absence of family phthisis was obtained.

From an examination of the numbers contained under the several divisions in this table, the following deductions are most palpable:—

A glance at the first line shows that an attack of phthisis may begin at any period of life for males; but the periods before fifteen and after fifty are less liable than any of the intervening quinquennial periods.

After the age of fifteen the susceptibility to the disease is very much aggravated, and the acme of susceptibility is exhibited from twenty to thirty-five.

Towards the end of the last mentioned quinquennial period (thirty to thirty-five) there is an apparent tendency towards a diminution of the susceptibility, and after this period there is a rapid decrease in the numbers attacked, until after fifty the members are reduced to very small dimensions.

The liability to acquired phthisis among males is distributed in a remarkably even manner over the active period of man's life.

The susceptibility is largely exhibited during the period between fifteen and thirty-five; and is at its acme between twenty and thirty-five.

The returns of mortality contained in the second division are only relative, but the numbers may be taken as affording a basis for comparison with the other series set forth in other tables, and they give the exact estimate of the duration of the disease for the number of cases.

The number of deaths was 161 per mille, while the number of patients who were decidedly worse (including the above fatal cases) was 333.

Marked improvement, both as regards the general and local conditions, was manifest in 388 cases; so that there is generally a tendency to improve among this series of cases.

The third division of the table devoted to the estimation of the clinical progress of the disease shows

that nearly half the number of all these acquired cases assume the subacute form, while the acute and the chronic forms are nearly equal in number to each other.

Hence the following conclusion, that acquired phthisis, as regards the clinical progress of the case, is prolonged in 71 per cent. of the cases beyond the first year after the date of attack, and only assumes an acute form in 29 per cent. of the cases.

This marked tendency, among the acquired cases, to assume a subacute form is one of the characteristic features of this kind of phthisis.

The occurrence of hæmoptysis is a well-marked feature, the tendency to bleeding being manifested in 424 cases, and nearly three fourths of this number were cases of copious bleeding. It may be stated that in nearly a quarter of the total number no bleeding was recorded.

It is sufficient for my present purpose to rest content with pointing out the marked traits of the disease exhibited in the tables, and we may sum up the special features of acquired phthisis among males in the following terms :—

1. Any period in man's life from birth to advanced age is liable to an attack of non-inherited phthisis ; but the liability to the attack is slight before fifteen, after which period it becomes much intensified.

TABLE IV.

Acquired Phthisis—1,000 (*actual*).

MALES.

AGES	1	10	15	20	25	30	35	40	45	50	55	60	TOTAL
Cases	1	18	131	202	202	180	119	74	42	22	8	1	1,000
Worse . . .	...	18	43	67	62	61	40	21	10	9	2	...	333
Improved . .	1	14	46	77	76	69	46	29	15	10	4	1	388
Deaths . . .	...	1	17	37	26	34	16	18	7	5	...	...	161
In 6 months . .	...	...	...	3	3	1	1	...	...	1	...	...	9
In 18 months . .	...	...	10	15	13	12	10	9	5	2	...	...	76
Acute . . .	...	1	29	52	57	51	47	26	19	4	2	...	288
Subacute . . .	...	2	70	98	92	72	40	34	15	13	5	...	441
Chronic . . .	1	15	32	52	53	57	32	14	8	5	1	1	271
Hæmoptysis : copious .	...	5	35	54	58	52	37	22	11	5	...	...	279
,, moderate	...	3	29	36	22	29	12	5	5	3	2	...	146
,, slight .	...	3	34	65	[illegible]	55	40	28	13	3	3	...	306
,, nil .	1	7	33	47	[illegible]	44	30	19	13	11	3	1	269

TABLE V.

Acquired Phthisis—1,000 (*actual*).

FEMALES.

AGES	1	10	15	20	25	30	35	40	45	50	55	60	TOTAL
Cases	16	61	188	254	190	107	102	50	21	8	3	...	1,000
Worse . . .	3	16	60	104	71	41	34	14	5	1	1	...	350
Improved . .	11	26	77	95	73	28	34	17	12	3	1	...	377
Deaths . . .	...	7	22	51	38	22	16	10	3	1	...	...	170
In 6 months . .	...	...	2	7	3	2	...	1	1	...	...	...	16
In 18 ,, . .	...	3	9	24	20	17	10	6	...	1	...	...	90
Acute . . .	...	22	75	107	80	52	50	24	10	4	1	...	425
Subacute . . .	3	14	60	95	66	33	30	17	5	2	1	...	326
Chronic . . .	13	25	53	52	44	22	22	9	6	2	1	...	249
Hæmoptysis : copious .	1	5	31	38	35	24	18	11	5	2	...	...	170
,, moderate	1	7	17	37	26	11	14	1	2	...	...	...	116
,, slight .	4	15	69	96	70	40	40	19	7	6	2	...	368
,, nil .	10	34	71	83	59	32	30	19	7	...	1	...	346

2. The most susceptible period of life is between twenty and thirty-five, and after forty-five this susceptibility is much diminished.

3. The disease assumes a subacute form in nearly half the cases.

4. The number of acute cases is only 29 per cent.

5. Cases of copious bleeding are frequent.

Acquired Phthisis among Females.

In like manner we proceed to ascertain the special features of acquired phthisis for females, and much interest is attached to the investigation by the contrast between the two sexes: the marked character of this contrast serving to show how important it is to keep the statistics of the two sexes apart and to consider them separately.

An examination of the subjoined table for 1,000 cases of acquired phthisis among females shows that the liability to the attack of the disease is extended over the period of life up to sixty, but not in the same degree as for the males; for it is evident that the liability of early life is greater for the females.

The susceptibility is marked from ten to thirty, and consequently begins to be intensified five years before such intensification occurs for males; the acme of susceptibility is exhibited between twenty

and twenty-five years of age, and this point comes out in a striking manner.

The number of worse cases is larger than for the males, and this tendency to non-resistance is also shown in the larger number of cases dying within eighteen months.

The same point is established by the greater disposition of the disease to assume the acute form, the numbers of acute and subacute cases being almost reversed for the females, and we see that the number of acute cases is not far short of half the total number.

The number of cases of hæmoptysis is considerably smaller ; the reduction being chiefly marked in the cases of copious bleeding. The number of cases in which no bleeding was recorded is also greater.

If all these features be considered and compared with those which characterise the acquired disease for males, they may be summed up in two attributes which appear especially to belong to the female sex, namely, early susceptibility and feebleness of resistance to the disease.

More particularly we may sum up the features of the acquired disease for females in the following terms :—

1. Liability to the disease is intensified after ten years of age.

2. The most susceptible period of life is between twenty and twenty-five years of age.

3. The disease tends to assume the acute form in nearly half the cases.

4. The number of acute cases is 42 per cent.

5. Cases of copious bleeding are not very frequent.

In the male table it will be seen that when the susceptibility begins to diminish, the diminution rapidly and evenly progresses to the end of life; but an examination of the female table shows that an even rate of liability is maintained during two quinquennial periods between thirty and forty. If two curves be described passing through points drawn proportionate in height (from a given base) to the numbers for the several quinquennial periods, it would be at once apparent that the curve for the males showed a rapid decline, while that for the females showed a level shoulder for the years between thirty and forty.

It is sufficiently evident on consideration that this period is coincident with the most active puerperal condition of many women, and it is necessary to examine the numbers of single and married women to see if the level can be attributed to the condition of the female.

The subjoined table shows the proportionate

numbers of single, married, and widowed women attacked by acquired phthisis.

TABLE VI.

AGES	15	20	25	30	35	40	45	50	TOTAL
Single	188	204	105	35	25	10	3	...	570
Married . . .	...	42	77	61	68	32	16	3	299
Widows . . .	...	8	8	11	9	8	4	6	54
Total	188	254	190	107	102	50	23	9	923

From this table it is apparent that the susceptibility of single women is rapidly diminished after thirty years of age, while that of married women maintains its intensity between twenty-five and forty years of age.

It will be convenient to give a brief *résumé* of the sexual distinctions in acquired phthisis.

MALES.	FEMALES.
Susceptibility is intensified after 15 years of age.	Susceptibility is intensified after 10 years of age.
From this time it is increased, and is at its acme between 20 and 35.	It is loaded upon the period between 20 and 25.
The disease has a tendency to assume the subacute form.	The acute form of the disease predominates in nearly half the cases.
Fewer cases fatal within 18 months.	More cases fatal within 18 months.
Copious hæmoptysis frequent.	Copious hæmoptysis less frequent.

It may also be remarked that between the ages of fifteen and thirty-five for males, the number of acute cases never exceeds the number of subacute, and there is a remarkable evenness in the proportion observed between the two ; but for females the number of acute cases is in excess of the subacute for all periods between ten and sixty years of age.

The comparative study of the male and female character of acquired phthisis shows how great the contrast is between the sexes in regard to this disease ; and the following deductions may be made.

Early susceptibility and vulnerability to the disease appear to be the marked attributes of the female sex, which has with reason been denominated the weaker sex ; and it is important to bear this decided difference continually in mind in considering the influence of different forms of inheritance.

If we once grasp the idea that the male has a superior power of resistance to the attacks of phthisis than the female, we shall experience no difficulty in understanding the apparent anomalies in family phthisis.

CHAPTER VI.

GENERAL FEATURES OF HEREDITARY PHTHISIS.

HAVING thus investigated the general aspect of phthisis uninfluenced as far as can be ascertained by the hereditary conditions of family phthisis, we proceed to the examination of those cases which we assume to be under hereditary influence in consequence of the historical evidence obtained of one or both parents having been previously affected with the disease.

For this purpose I have tabulated a series of cases which ought to exhibit the effects of such inheritance, the two series for males and females being each made up of the following sets of actual cases :—

Cases involving the		father only	300
,,	,,	father and other children	100
,,	,,	mother only	300
,,	,,	mother and other children	100
,,	,,	father and mother	200

I must remark that, although these series are sufficient for comparison with the series of acquired

cases, the cases in which a parent and other children are involved are not in the same position as the acquired cases, inasmuch as the acquired cases certainly represent the first, if not the sole attack of phthisis in a family.

The series have been arranged on the same principles as for the acquired cases; they extend over the same period of time, and in all respects have been under similar circumstances in the hospital.

Hereditary Phthisis for Males.

An examination of the subjoined table (p. 62) reveals the following points:—

Liability to the disease extends over all periods of life; susceptibility is exhibited from the age of ten up to forty-five, after which age there is considerable diminution in the numbers; the acme of susceptibility is manifested in a marked manner between the ages of fifteen and twenty-five; while after thirty-five the numbers become practically insignificant.

The fatal cases number 184, an advance upon the numbers for the acquired series; while the cases which proved fatal within eighteen months of the initial attack, 141 in number, form a large proportion of the total deaths.

We have also to note that the number of cases

which showed a marked improvement are nearly the same as the number of those which became worse; the latter showing an increase as compared with the acquired disease.

As regards the character of the attack, it will be seen that the number of the acute cases comes closely up to the subacute, but the subacute tendency is still apparent.

The tendency to copious hæmorrhage does not appear to be generally increased; an increase of no great extent being evident in regard to moderate bleeding.

So much for the general aspect of the table, which under comparison with the acquired series is remarkable for the increased susceptibility of the early periods of life, for the increased weakness of resistance as indicated in the fatal cases, and for the increased tendency of the disease to assume the acute form.

If we compare this table for the males with the acquired series for females, we shall see that these hereditary cases for the males tend to assume in a remarkable manner the condition which naturally belongs to females in regard to consumption.

In respect to the non-resistance to disease, the hereditary males are in a worse position than the

TABLE VII.

Hereditary Phthisis—1,000 (*actual*).

MALES.[1]

AGES	1	10	15	20	25	30	35	40	45	50	55	60	TOTAL
Cases	7	41	222	247	197	126	87	36	18	6	9	4	1,000
Worse . . .	1	14	89	106	79	32	33	9	4	4	2	2	375
Improved . .	5	24	90	84	63	47	21	25	12	1	4	3	379
Deaths . . .	3	7	47	54	44	14	10	2	1	1	...	1	184
In 6 months . .	...	...	12	5	3	...	1	1	...	...	...	1	23
In 18 months . .	1	2	21	34	32	10	6	1	...	1	...	...	108
Acute. . . .	2	9	80	100	64	30	20	7	2	2	2	2	320
Subacute . . .	1	11	88	90	75	52	37	15	7	3	1	2	382
Chronic . . .	4	21	54	57	58	44	30	14	9	1	6	...	298
Hæmoptysis : copious .	1	8	53	60	72	38	22	11	5	...	1	1	272
,, moderate	...	3	35	52	34	22	17	4	4	..	...	...	171
,, slight .	1	12	77	83	45	30	20	7	4	4	2	...	285
,, nil .	5	18	57	52	46	36	28	14	5	2	6	3	272

[1] Fathers, 300; F. B. S., 100; Mothers, 300; M. B. S., 100; D. H., 200.

TABLE VIII.

Hereditary Phthisis – 1,000 (*actual*).

FEMALES.[1]

AGES	1	10	15	20	25	30	35	40	45	50	55	60	TOTAL
Cases	19	79	214	302	195	91	62	29	9	...	...	...	1,000
Worse . . .	4	28	80	101	84	35	21	8	1	...	...	...	362
Improved . .	14	34	80	134	55	34	27	12	4	...	...	...	394
Deaths . . .	...	20	40	52	45	17	12	6	1	...	...	...	193
In 6 months . .	...	1	10	2	5	1	1	3	...	...	...	...	23
In 18 months . .	...	6	33	27	30	11	3	3	...	...	...	...	113
Acute . . .	2	34	118	131	89	33	28	8	2	...	...	...	445
Subacute . . .	4	26	63	96	53	18	18	14	4	...	...	...	296
Chronic . . .	13	19	33	75	53	40	16	7	3	...	...	...	259
Hæmoptysis : copious .	2	16	34	54	33	15	13	8	5	...	...	...	180
,, moderate	4	8	32	41	32	17	3	5	2	...	...	...	144
,, slight .	4	23	75	125	68	20	20	7	2	...	...	...	344
,, nil .	9	32	73	82	62	39	26	9	...	...	...	...	332

[1] F., 400; M., 400; D. H., 200.

acquired females, while as regards the tendency to acute disease the males are in the better position.

But let us examine the results of the tables as regard that portion of a man's life which appears specially affected in the hereditary cases, and compare the liability with that of the woman (unaffected by heredity) for the same period, and we find that the liability of the males is 707, and for the women 693; that is, there is a difference of only 2 per cent. for the hereditary males.

The tendency towards the acute form is still more strongly exhibited by the females even for this period, but the power of resistance is diminished for the males.

Hereditary Phthisis among Females.

Dealing in the same manner with 1,000 cases of heredity among females, a series composed of exactly the same sets as those in the previous table, and comparing this series with the acquired cases for females, we find that liability appears to cease at fifty, but the susceptibility of the early periods of life is shown by increased numbers from ten to thirty, the increment between twenty-five and thirty being very slight.

The worse cases show a slight increase in number,

and the improved cases are also greater; the number of fatal cases is greater, the increase being due to the greater number which proved fatal within eighteen months.

There are more acute cases and fewer subacute ones, and while there is a slight increase in the number of cases of copious hæmoptysis, there is a considerably larger number of cases of moderate bleeding.

Such being the general aspect of the table, we may more closely examine the conditions for the period which appears especially liable, namely from ten to twenty-five years of age; for this period the susceptibility is increased by one half for the hereditary cases; the number of fatal cases is also increased almost in the same measure; while the number of cases dying within eighteen months is very nearly twice as many, in the proportion of 79 for the hereditary and 45 for the acquired cases.

The number of acute cases is increased by almost one half.

Hence we conclude that the hereditary cases exhibit an exaggeration, speaking generally, of the qualities which are specially manifested in the acquired series of cases.

Sexual Distinctions in Hereditary Phthisis.

Having thus determined the main features of hereditary phthisis in the sexes, we may proceed to point out certain sexual characteristics obtained from a comparison of the two series of cases.

It is evident that, as regards both sexes for both acquired and hereditary phthisis, there is a period of life which appears to be common ground as regards liability—that period is between twenty-five and thirty years of age.

	Acquired	Hereditary
Males, twenty-five to thirty . . .	202	197
Females, ,, ,, . . .	190	195

And one effect of heredity is shown for both sexes in the great susceptibility for the period of life before twenty-five.

But on closer examination of the tables we find that the effect of heredity, taking a large number of cases into view, is greater in reducing the constitutional powers of men—if, indeed, we may fairly put the point in this way—than of women.

For instance, if we look at the index of liability for the periods before twenty years of age, we find the difference between the acquired and the heredi-

tary condition much greater for the males than the females :—

	Males	Females
Hereditary, one to twenty . . .	270	312
Acquired, ,, ,, . . .	150	265
	120	47

In this respect, then, the deduction may be made that, as the condition of males attacked by acquired phthisis is more resistant than the condition of females, the effect of heredity, which tends to put both sexes on more level conditions, has a greater apparent influence upon males than upon females ; and that this effect appears to be developed at the time of adult growth is possible from the close similarity which obtains for the males between twenty and twenty-five as compared with the females between fifteen and twenty.

	Acute Cases	Subacute	Deaths within 18 months
Males, twenty to twenty-five	100	90	39
Females, fifteen to twenty .	97	87	43

It is difficult to formulate in terms which preclude any assumption the deductions which seem to follow the consideration of these four series of cases ; but the upshot of the comparison is that the resistance of females liable to acquired phthisis is less than that of the males ; that the tendency of inheritance is to

diminish the powers of resistance in both sexes ; and as a general level of feebleness results from this influence, the effect of inheritance is greater in degree upon the males than upon the females.

As our examination extends, we shall endeavour to find out the explanation of this ; and we must not be too hasty in forming conclusions regarding a general level for all cases. Such an assumption might tend to very erroneous conclusions, the reverse indeed of those which belong to a more patient and accurate investigation.

CHAPTER VII.

INFLUENCE OF THE FATHER.

IN the previous series of hereditary cases we have been considering a set of composite cases, made up of different kinds of inheritance, which require a separate examination; for we have to ascertain whether the influence of inheritance is uniformly the same, whether the paternal heredity is identical with that coming from the mother, or whether any difference can be recognised. We must, therefore, split up the hereditary series into its component parts and examine each part in detail.

As the series of acquired cases is composed of examples in which no member of the family has been previously affected by the disease, it has seemed advisable to separate the hereditary series of cases into sets, in which the individual and the parent only are implicated, and to keep them separate from those sets in which brothers and sisters have been also implicated. By acting in this manner we may

possibly avoid some complications which are at present not evident, and, at least, the comparison is fair in relation to the acquired series.

Effect of Paternal Heredity on Males (Direct Inheritance).

The annexed table is calculated to 1,000 upon the basis of 300 actual cases of males who gave a history of phthisis affecting the father only. The actual numbers will be found in the Appendix; the calculation per mille has been made for the convenience of ready comparison with the other tables.

The following results are obtained from these numbers:—

Liability to the disease extends over all periods of life, as in the acquired forms of the disease, from one to sixty-five, but at an increasing rate up to thirty, after which period it rapidly diminishes.

Susceptibility is marked for the period between fifteen and thirty-five years of age, being chiefly loaded upon the period between twenty and twenty-five.

The number of cases which improved under treatment is 431 per mille, nearly half the total amount; the number of worse being 342.

The fatal cases are 156 per mille, and two-thirds of these cases proved fatal within eighteen months, while 80 per cent. of these occurred before thirty-five.

TABLE IX.

Paternal Influence—(Fathers only).

1,000 MALES—(CALCULATED FROM 300).

AGES	1	10	15	20	25	30	35	40	45	50	55	60	TOTAL
Cases . . .	10	63	187	233	200	137	80	40	23	10	13	4	1,000
Worse . . .	...	23	57	93	63	33	47	3	10	7	3	3	342
Improved . .	10	37	93	77	80	67	17	33	10	...	7	...	431
Deaths . . .	...	17	23	50	33	17	7	...	3	3	...	3	156
In 6 months . .	...	...	3	7	...	...	3	...	...	...	...	3	16
In 18 months . .	...	3	17	27	23	10	...	...	3	3	...	...	86
Acute . . .	3	17	70	113	80	40	30	10	7	3	3	3	379
Subacute . . .	3	13	60	60	57	40	37	17	10	7	3	...	307
Chronic . . .	4	33	57	60	63	57	13	13	7	...	7	...	314
Hæmoptysis, copious .	3	10	30	57	47	40	17	7	...	...	3	4	218
,, moderate	...	3	27	63	30	17	13	10	7	...	...	...	170
,, slight .	...	27	83	66	53	40	17	10	13	7	3	...	319
,, nil . .	7	23	47	47	70	40	33	13	3	3	7	...	293

As regards the progress of disease, the acute cases predominate: the number of subacute and chronic cases being nearly equal. The acute cases exceed the subacute up to thirty years of age.

The number of cases of copious bleeding is only slightly in excess of the number of moderate cases; while in nearly one-third of the total number no bleeding occurred.

Comparison of the Acquired and Paternal Cases for Males.

The period of life between twenty-five and thirty in each series appears to be common ground as regards the degree of susceptibility of that age; but the period before twenty-five is more susceptible under the paternal heredity, and the period after thirty for the acquired cases.

Hence we conclude that the influence of the paternal inheritance is especially developed before twenty-five years of age, being loaded upon the period between ten and twenty-five. The acme of susceptibility is exhibited between twenty and twenty-five, and if we examine the other features of the table we shall find the special influence of this form of inheritance manifested during this period.

For instance, the number of intractable cases pre-

dominate over the tractable : the death rate for cases within eighteen months is high, and the number of acute cases is larger than of the subacute for this quinquennial period.

The disturbance which affects the period between thirty-five and forty, shown by the excess of worse cases, answers to a similar outbreak among the acquired series of cases and is due to a synchronous development of the hereditary condition—that is to say, the tendency which belongs to a particular period of life in the parent may reappear in the son at the same period ; and this is in complete accord with what is known concerning the synchronous development of inheritance for other diseases and conditions of structural growth.

As regards hæmoptysis, the general effect of the paternal inheritance is to reduce the number of cases of copious bleeding for the total period of life, but an excess is observed for the special period between twenty and twenty-five. That the general tendency to bleeding is reduced may possibly be attributed to delicacy of frame and feebleness of muscular strength which is often apparent in hereditary cases ; such conditions would probably reduce the chance of excessive exertion, and the risk from this cause would be proportionately diminished. This surmise receives some

support from the fact that the later periods of life, most subject to this risk in acquired cases, are less liable than the earlier periods under the influence of paternal and other forms of heredity.

The following points may be given as summing up the effects of the paternal inheritance upon males :—

1. Liability to the disease is extended over all periods of life.

2. Susceptibility is marked after ten years of age, and is loaded upon the period between twenty and twenty-five ; and this quinquennial period is remarkable for increased vulnerability and for the number of cases fatal within eighteen months. The period between thirty-five and forty also manifests a special susceptibility.

3. The cases are generally more acute than for the acquired series, and are twice as many for the special period between twenty and twenty-five.

4. The general tendency to marked hæmoptysis is diminished, but the occurrence of bleeding is frequent during the special period.

Influence of the Father on Females (Cross Inheritance).

The subjoined table gives the number per mille derived from a calculation of 300 actual cases of

TABLE X.

Paternal Influence—(Fathers only).

1,000 FEMALES—(CALCULATED FROM 300.)

AGES	1	10	15	20	25	30	35	40	45	50	55	60	TOTAL
Cases	27	73	197	330	163	103	67	30	10	...	...	...	1,000
Worse . . .	4	17	70	93	83	37	27	3	3	...	...	...	337
Improved . .	23	47	83	157	53	43	27	23	10	...	...	...	466
Deaths . . .	...	13	40	40	33	17	10	...	...	...	...	...	153
In 6 months . .	...	3	17	...	...	...	3	...	...	...	...	...	23
In 18 months . .	...	7	23	20	30	17	3	...	...	...	...	...	100
Acute	3	40	117	123	70	33	33	3	3	...	...	...	425
Subacute . . .	7	13	47	97	53	43	24	13	...	...	...	...	297
Chronic . . .	17	20	33	110	40	27	10	14	7	...	...	...	278
Hæmoptysis : copious .	3	26	30	73	33	10	17	7	7	...	...	...	206
,, moderate	3	3	13	33	20	10	...	13	3	...	...	...	98
,, slight .	7	17	54	137	70	37	27	7	...	...	...	...	356
,, nil. .	14	27	100	87	40	46	23	3	...	...	...	...	340

females who gave a history of phthisis implicating the father only. The following results are to be obtained :—

Liability appears to be less extended than for males and is limited to fifty years of age, but extends over all periods of life up to that time.

Susceptibility is loaded in a remarkable manner upon the period between twenty and twenty-five. Nearly half the total amount of cases showed a tendency to improve (466), and the number of worse cases is not large (337).

Although the total number of fatal cases is not large, the number of those dying within eighteen months is considerable, and forms the chief bulk of the fatal cases.

The acute cases are in excess, especially for the periods of life up to thirty years of age.

The subacute are rather more than the chronic.

The number of cases of bleeding is large ; the number of the copious cases being twice as many as the moderate ; the tendency to hæmoptysis is very marked for the period between twenty and twenty-five years of age.

Comparison of the Acquired and Paternal Cases for Females.

To estimate the effect of the father's inheritance on females we must compare the above conclusions with those already obtained for the acquired disease.

As regards liability, no cases recorded in my table having been attacked after fifty years of age, it may be said that the development of the heredity is reduced in extent by anticipation of the period attacked.

Hence susceptibility of early life is much exaggerated and is loaded upon the period between ten and twenty-five.

But notwithstanding this increased susceptibility as regards the earlier period of life, there is a remarkable agreement in the total number of acute cases; the chronic cases being slightly increased, while the number of worse cases is much less and the improved much greater.

Hæmoptysis is more frequent, but the increase is not very great.

The conclusions which appear to be justified from this comparison of the acquired and paternal cases are somewhat remarkable and seem to be of a contradictory character. If it be assumed that the inheritance of phthisis depends upon the transmission

of a special entity of uniform quality and character, it would be extremely puzzling to understand the peculiar modifications which overshadow these cases; but if we consider that inheritance means the impress of peculiar constitutional conditions of a complex nature, we shall find less difficulty in explaining the altered characters of the disease.

The examination of the tables of the acquired series established special features for the male and the female series; and it was shown that, whereas the females manifested a peculiar constitutional susceptibility and a proneness to the acute form of the disease, the males showed less susceptibility at the earlier periods of life and a disposition to the sub-acute form of the disease. Moreover, the number of worse cases is rather less for males, and the number of improved slightly greater.

Hence, although we must expect the paternal inheritance to be to some extent developed upon males and females in a similar manner, we must bear in mind that this will probably include the development in the female of some of the manly characters of the parent.

The susceptibility of the early periods of life from ten to twenty-five is increased by the paternal inheritance developed among females, and in this respect

there is a similarity of effect for the two sexes. But a resistance to disease is also apparently engrafted in a number of cases, exhibited in the increased tendency to improve and the diminished tendency to get worse—the relative numbers before thirty years of age standing thus for the several series of cases—

	Acquired	Paternal
Worse cases before thirty . . .	363	267
Improved ,, ,, . . .	282	363

The total relative number of cases will make no difference in the proportion, inasmuch as there are 799 acquired cases against 790 paternal cases for this period.

The effect of the paternal inheritance upon males is to precipitate the onset of the disease upon an early period of life, or, in other words, inheritance is manifested in the early anticipation of development, and the constitutional power of resistance, which is natural to the male, becomes reduced to the condition natural to the female. The effect upon the female is also manifest in the anticipation of the development; but there is also superadded in many cases some portion of that power of resistance which naturally belongs to the male.

From the results of the following chapter we shall be able to judge whether this theory is confirmed by

the relative effect of the maternal inheritance upon males and females; for we must not lose sight of an old maxim which suggests that what is good for the male ought to be good also for the female; and if it be true that the engrafting of the father's constitution results in some development of manly qualities in the female, the engrafting of the maternal constitution in the boy should have a disastrous effect in the development of the characteristic conditions of the weaker sex.

We come now to the consideration of cases in which not only the father, but brothers and sisters also, have been implicated, and it may help our consideration of the table if we bear in mind that previous deaths of brothers and sisters will probably have already removed those who have shown the earliest tendency to the disease, and we might expect to find a postponement of age and a consequent diminished liability during the early periods of life.

This view of the case is borne out by a comparison of the liability during the different quinquennial periods of life. It is evident that between ten and twenty-five there are fewer cases for the family series or multiple series as compared with the other or single series.

	Single	Multiple
From ten to twenty-five . . .	483	397
,, twenty-five to forty . . .	417	510

Evidently then we may draw the conclusion that when the case of first males with a history of paternal phthisis is considered, the chances are that more will occur between ten and twenty-five; while with regard to the cases of subsequent males of the family more will occur between twenty-five and forty.

If we compare the relative features for these two periods we find that in regard to the tendency to get worse or to improve there is very little difference between the two; only in the point of early deaths is there a marked difference in more being found among the single series.

There is a very close similarity in most points between the two series, but the total number of acute cases is rather smaller and the number of subacute cases rather greater for the second series in which other brothers and sisters are implicated.

The series of female cases in which the father and other children were implicated result, when compared with the paternal series, in similar deductions as for the males.

If we divide the series into two at twenty-five years of age we find the following numbers:

	Single series	Multiple
Before twenty-five	627	520
After twenty-five	373	480

TABLE XI.

Fathers, Mothers, and Sisters.

1,000 MALES—(CALCULATED FROM 300 CASES).

AGES	1	10	15	20	25	30	35	40	45	50	55	60	TOTAL
Cases	13	44	173	180	230	150	130	43	10	10	17	..	1,000
Worse . . .	...	14	44	70	74	40	54	20	10	7	3	...	336
Improved . .	13	30	87	50	87	57	47	16	...	...	6	...	393
Deaths . . .	...	7	20	27	43	20	20	13	...	...	3	...	153
In 6 months . .	...	...	...	...	...	...	...	...	...	...	...	...	...
In 18 months . .	...	...	3	20	17	7	17	...	...	...	3	...	67
Acute . . .	...	7	63	70	77	63	40	6	6	...	10	...	342
Subacute . . .	7	23	60	53	67	63	47	20	4	10	4	...	358
Chronic . . .	6	14	50	57	86	24	43	17	...	...	3	...	300
Hæmoptysis: copious .	...	10	37	27	77	20	23	13	...	...	3	...	210
,, moderate	...	...	43	30	47	17	3	6	...	...	4	...	150
,, slight .	6	...	43	67	33	23	60	7	...	10	10	...	259
,, nil .	7	34	50	56	73	90	44	17	10	...	...	...	381

TABLE XII.

Fathers, Brothers, and Sisters.

1,000 FEMALES—(CALCULATED FROM 100 CASES).

AGES	1	10	15	20	25	30	35	40	45	50	55	60	TOTAL
Cases	20	40	240	220	270	110	60	30	10	...	...	...	1,000
Worse . . .	10	30	50	100	120	40	10	10	...	...	...	...	370
Improved . .	10	10	90	50	70	40	30	10	...	...	...	...	310
Deaths . . .	10	20	...	60	30	10	10	10	...	...	...	...	150
In 6 months . .	...	...	...	...	...	...	...	...	...	...	...	...	...
In 18 months . .	...	10	...	30	10	10	...	...	...	..	...	..	60
Acute . . .	...	20	110	70	80	50	30	10	...	...	...	...	370
Subacute . . .	...	10	60	60	90	30	20	...	10	...	...	...	280
Chronic . . .	20	10	70	90	100	30	10	20	...	...	...	...	350
Hæmoptysis : copious .	...	...	50	60	70	40	...	20	10	...	...	...	250
,, moderate	...	...	40	30	20	50	20	...	...	...	...	...	160
,, slight .	20	...	110	110	80	10	10	...	...	...	...	...	340
,, nil .	...	40	40	20	100	10	30	10	..	...	...	...	250

It appears, therefore, that the previous implication of many children with the fathers' inheritance is equivalent to the general post-dating of the attack for those who ultimately fall victims to the disease; and inasmuch as the rapid progress of the disease is especially exhibited in young individuals, the occurrence of such cases is rare in this series.

The virulence of the heredity is then generally (that is to say in a large number of cases) chiefly developed in the member of the family first attacked, and the subsequent development of the disease in other members takes place later in life and with some diminution in the acuteness of the attack.

CHAPTER VIII.

INFLUENCE OF THE MOTHER.

THE next series of cases for investigation is composed of cases in which the mother only was affected with phthisis ; they are the same in number as the previous series (300), and are in all respects similar, save that the mother instead of the father was diseased.

The examination of the table for males shows the following features :—

1. The liability is shown during the whole period of life, no age being exempt from the attack.

2. Susceptibility is not marked before fifteen, but is especially loaded on the period from fifteen to twenty-five, the acme being reached between twenty and twenty-five.

3. The number of worse cases exceeds the improved and the fatality is 170.

4. The acute cases are much in excess of the subacute, as the subacute are in excess of the chronic.

5. The number of cases of hæmoptysis is large (446), and there are twice as many copious bleedings as moderate.

To compare these results with those previously obtained from the acquired cases, we can see the following general features :—

Liability is not affected as regards the total period of life, but the potency of the mother is exhibited on the periods from fifteen to thirty by the great susceptibility, by the large number of fatal cases for this period, by the excess of acute cases, and by the number of cases of bleeding.

The tendency to become worse is greater, the mortality is slightly increased, but the cases fatal within eighteen months are the same.

The excess of acute cases for these maternal cases is almost as much above the subacute cases as the subacute for the acquired cases are in excess of the acute, the conditions being reversed.

The number of chronic cases is much less. To give the actual numbers for comparison as regards the special period fifteen to thirty.

Worse cases, for the acquired, 172, for maternal, 290, giving the following percentage in proportion to cases.

Maternal	41
Acquired	31

A like comparison brings out the results of maternal influence as regards the fatality of the cases; for though the total number is the same for the whole period, the actual number of deaths for the special period is:

Maternal	132
Acquired	80

and within eighteen months:

Maternal	70
Acquired	44

the percentage proportion to the number of cases being:—

Maternal	19
Acquired	16

A similar comparison with a like result may be made regarding the clinical features of the cases in respect to the acuteness of the attack.

	Maternal	Acquired
Acute cases	308	138
Percentage	44	27

There still remains a feature of much interest, the occurrence of hæmoptysis, and the large number of cases which occur under the potency of the mother is a very interesting point.

As in the previous considerations it is important not to underrate this effect simply by comparing the numbers for the total period of life, although the

increase is on the side of the maternal cases, but we must bear in mind that we have already shown that the maternal influence is especially manifest for a particular period of life, and it is this special period which must be particularly investigated.

On examining this period we find the numbers stand thus :

	Maternal	Acquired
Copious bleeding	224	147
Percentage	32	27
Total bleeding	328	234
Percentage	47	43

It becomes evident that in regard to a large number of male cases, the influence of the mother increases the tendency to bleeding and especially to copious bleeding, and these cases appear to be separated from the ordinary cases of phthisis, inasmuch as the occurrence of bleeding is not exactly synchronous with the occurrence of the greatest susceptibility, but appears at a later period as for acquired phthisis, as will be seen in the following table :

Percentage of Cases of Copious Bleeding to total number of Cases.

AGES	15	20	25	30	35
Maternal	25	30	43	34	25
Acquired	26	27	29	29	30

It remains now to point out the distinctions between the paternal and maternal influence upon males.

The liability of early life before fifteen is greater under the paternal influence, the susceptibility of the period from fifteen to twenty-five being much greater under the mother's potency—the difference being the following:

	Paternal	Maternal
Susceptibility between fifteen and twenty-five .	420	510

the potency of the mother to that of the father in this respect at this period being roughly as 5 to 4.

A similar method may be adopted in estimating the number of acute case for the special period—

	Paternal	Maternal
Acute cases	183	236

In this respect the numbers are nearly as 4 to 3, while the percentage proportion to the number of cases is as follows:

	Per cent
Paternal	43
Maternal	46

Similar calculation regarding the fatal cases shows that the percentage fatality of the maternal in comparison with that of the paternal is as 17 to 14.

So that in all these points the influence of the

mother not only increases the numbers, but augments the virulence of the disease.

It remains to contrast the number of cases of copious hæmoptysis for the period fifteen to twenty-five, and on addition they are as follows :

	Copious	Total
Paternal	134	254
Maternal	231	327

giving a percentage in proportion to the number of cases for the cases of copious bleeding of 45 per cent. for the maternal cases, compared with 32 for the paternal cases.

The tendency to hæmorrhage, which is in a number of cases transmitted by the mother, is analogous to the conditions of hæmophilia, which disease is generally transmitted to the male through the mother. Although hæmophilia must be considered as a distinct disease, its relation to scrofula may lead to a suspicion that some link may in a future time be discovered which may show some connection between *reduced degrees* of this disease and of the hereditary tendency to phthisis.

Maternal Influence on Females.

The examination of a similar series for females will complete the investigation of the influence of the mother.

TABLE XIII.

Mothers only.

1,000 MALES—(CALCULATED FROM 300).

AGES	1	10	15	20	25	30	35	40	45	50	55	60	TOTAL
Cases	7	16	227	283	207	127	77	27	13	3	3	10	1,000
Worse . . .	...	10	90	130	83	33	30	10	...	...	...	...	387
Improved . .	3	6	90	103	53	50	17	13	13	3	3	10	370
Deaths . . .	...	7	33	63	40	13	13	...	...	...	...	...	170
In 6 months . .	...	...	4	...	3	...	3	...	...	...	...	...	10
In 18 months . .	...	3	17	33	10	7	7	...	...	...	...	...	77
Acute . . .	3	7	93	143	83	33	30	20	3	...	3	7	425
Subacute . . .	...	3	73	73	57	57	13	7	...	3	...	3	289
Chronic . . .	4	6	61	67	67	37	34	...	10	...	...	...	286
Hæmoptysis : copious .	...	...	57	77	97	40	17	3	10	...	...	3	304
,, moderate	...	3	33	40	23	17	23	...	3	...	...	...	142
,, slight .	3	...	77	93	53	23	10	7	...	...	...	...	266
,, nil .	4	13	60	73	34	47	27	17	...	3	3	7	288

The following conclusions result from this table :

1. Liability is not manifested after fifty, and it is diminished to very small dimensions after forty-five.

2. Susceptibility is marked during the period between fifteen and thirty, and is at its acme during twenty to twenty-five.

3. The number of worse cases is in excess of the improved : the mortality is great, 257, and the fatality within eighteen months is relatively considerable, 176.

4. The number of acute cases is largely in excess of the subacute, while the number of chronic cases is small.

5. The total number of cases of bleeding is 302, the number of cases of copious bleeding being equal to the moderate cases.

Comparison with the conditions of acquired disease for females shows a very marked similarity in the numbers for the several quinquennial periods, an increase being evident for the most susceptible period twenty to twenty-five ; the other numbers are closely similar.

The excess of worse cases over the improved is manifest after twenty-five, and from what has been shown in a previous page as to the effect of the puerperal state, it may be assumed that this period

represents the danger of child-bearing especially affected under the maternal influence.

It will be seen that the number of acute cases are also in excess above the subacute during this period, but the excess is also evident from ten to twenty-five. The number of acute cases is greater under the maternal influence than for the acquired cases, and the relative potency of the mother is shown by the excess of vulnerability during the period between fifteen and twenty. That is shown by the following numbers:

PERCENTAGE OF ACUTE CASES.

	Acquired	Maternal
Between fifteen and twenty . . .	39	59
,, twenty and twenty-five . .	42	44

The same thing is shown in the mortality returns:

PERCENTAGE OF FATALITY.

	Acquired	Maternal
Between fifteen and twenty . . .	6	20
,, twenty and twenty-five . .	12	13

On examining the cases of bleeding before thirty and comparing the maternal series with the acquired series, we find the following percentages:

	Acquired	Maternal
Copious hæmoptysis	16	16
Moderate ,, ...	13	17
Slight ,, ...	36	34

So that the tendency to copious hæmoptysis is not

TABLE XIV.

Mothers only.

1,000 FEMALES—(CALCULATED FROM 300).

AGES	1	10	15	20	25	30	35	40	45	50	55	60	TOTAL
Cases	20	90	187	327	193	93	60	23	7	...	...	...	1,000
Worse . . .	7	40	70	113	93	43	30	10	...	...	...	...	406
Improved . .	10	40	80	157	53	30	17	...	...	...	...	...	387
Deaths . . .	...	23	47	67	63	27	20	10	...	...	...	...	257
In 6 months . .	...	...	3	3	17	3	7	...	...	...	...	...	33
In 18 months . .	...	10	43	40	33	10	...	7	...	...	...	...	143
Acute	3	37	117	143	113	43	23	10	...	...	...	...	489
Subacute . . .	3	33	57	100	40	17	20	13	7	...	...	...	290
Chronic . . .	14	20	13	84	40	33	17	...	...	...	...	...	221
Hæmoptysis : copious .	...	17	20	33	40	17	17	3	3	...	...	...	150
,, moderate	7	7	30	44	43	16	...	...	...	...	...	...	147
,, slight .	...	26	67	153	53	10	17	10	4	...	...	...	340
,, nil . .	13	40	70	97	57	50	26	10	...	...	...	...	363

increased in the female by the maternal influence, although the tendency to moderate hæmoptysis is slightly increased.

The relative influence of the maternal and paternal potency on females may be estimated from the following comparison :

1. The relative liability is much the same under both influences and stops short at fifty.

2. Susceptibility very closely approximates for both series, and the numbers for the several quinquennial periods are as nearly the same as could be expected in a different set of cases.

3. The number of worse cases is greater for the mother, the mortality being considerally increased as well for the total amount as for the cases fatal within eighteen months.

4. The number of acute cases is also greater under the mother's influence and the number of chronic cases is diminished.

5. The general tendency to hæmoptysis is the same for both series ; the cases showing a marked difference compared with relative effects of the parents on males.

Some estimate may be made of the relative effect of the two parents on the female by the following considerations :

PERCENTAGE OF ACUTE CASES.

	Maternal	Paternal
Between fifteen and twenty . .	59	56
,, twenty and twenty-five .	44	37

PERCENTAGE OF FATALITY.

	Maternal	Paternal
Between fifteen and twenty . .	20	14
,, twenty and twenty-five .	13	7

So that in these respects it is evident that the maternal influence affects the female in an adverse manner to a greater degree than the paternal; but as the inheritance from the father to the daughter includes some of the benefits accruing from the engrafting of male characteristics on to the female, so the inheritance from the mother to the male, as involving female characteristics, is worse than for the female.

The calculated table for males with a history implicating brothers and sisters and mother in the disease shows the following condition of things. The liability is not so great for the period between fifteen and twenty-five, but after this it becomes slightly increased; showing, as in the previous tables, that in many families, the disease has removed the youngest. The general features are very similar, the chief differences observed being in the diminished number of worse cases and of fatal cases.

The general conclusion then in regard to this series of cases is that the previous implication of

TABLE XV.

Mothers, Brothers, and Sisters.

1,000 MALES—(CALCULATED FROM 200 CASES).

AGES	1	10	15	20	25	30	35	40	45	50	55	60	TOTAL
Cases	15	20	200	250	215	135	85	35	35	10	...	...	1,000
Worse	...	...	95	95	80	25	20	5	...	10	...	...	330
Improved	15	15	60	85	75	40	40	25	25	...	...	...	380
Deaths	...	...	35	40	50	10	10	...	...	...	...	...	145
In 6 months	...	...	5	10	...	...	...	...	...	...	...	...	15
In 18 months	...	...	20	15	20	10	...	...	...	...	...	...	65
Acute	...	...	110	95	85	65	25	5	25	5	...	...	415
Subacute	10	5	50	70	65	25	25	25	5	5	...	...	285
Chronic	5	15	40	85	65	45	35	5	5	...	...	...	300
Hæmoptysis: copious	...	...	50	85	80	45	30	10	5	...	...	...	305
,, moderate	...	10	30	40	45	35	5	5	10	...	...	...	180
,, slight	10	...	45	80	40	45	20	5	...	10	...	...	255
,, nil	5	10	75	45	50	10	30	15	20	...	...	...	260

TABLE XVI.

Mothers, Brothers, and Sisters.

1,000 FEMALES—(CALCULATED FROM 150 CASES).

AGES.	1	10	15	20	25	30	35	40	45	50	55	60	TOTAL
Cases	7	33	193	247	247	106	100	60	7	...	...	...	1,000
Worse	...	14	73	126	73	40	20	34	7	...	...	...	387
Improved	7	14	86	100	100	32	60	13	...	...	...	...	412
Deaths	...	...	20	66	27	27	13	26	7	...	...	...	186
In 6 months	...	...	...	...	...	...	...	...	...	...	...	...	...
In 18 months	...	...	14	27	20	13	13	13	...	...	...	...	100
Acute	...	...	80	114	80	33	60	26	...	...	...	...	393
Subacute	...	7	60	73	73	20	7	20	7	...	...	...	267
Chronic	7	28	56	60	92	52	32	13	...	...	...	...	340
Hæmoptysis : copious	...	7	66	53	80	20	20	7	...	..	...	...	253
,, moderate	7	...	20	46	60	13	7	7	7	...	...	...	167
,, slight	...	14	20	100	60	26	40	26	...	...	...	...	286
,, nil	...	12	87	48	47	47	33	20	...	...	...	...	294

members of the family with maternal heredity throws the tendency to the disease later in life, but the effects of the heredity are only slightly diminished by such postponement.

A marked contrast to the corresponding paternal series for males is shown in the occurrence of several rapid cases: none occurring in that paternal series for males or females, and none in that maternal series for females. We have in this point some corroborative evidence of the virulent character of the maternal heredity in regard to the males.

As regards females under similar circumstances the diminution of liability is observed for the period twenty to twenty-five, and after twenty-five there is considerable increase. The number of worse slightly less, and the number of improved slightly greater, but the number of fatal cases, and especially of rapidly fatal cases, is much less.

The acute cases are fewer.

It would seem to follow from this table that the women, by postponing their liability, and being implicated late in order of succession, derive more benefit from this than the males.

CHAPTER IX.

THE EFFECT OF DOUBLE HEREDITY.

HAVING now arrived at some conclusions regarding the influence of single heredity, with reference to direct and cross inheritance for both sexes, we may look with some confidence to the influence of the double heredity for corroborative evidence in favour of the previous conclusions and also of the theory of phthisical inheritance.

Instances of double inheritance are happily not very common ; for males they are particularly rare, and much time has consequently been expended in searching for cases and getting together the 200 which seemed necessary for examination.

It must not, therefore, be expected that a series can be given in which the parents and one child only are implicated, similar to those presented in the foregoing tables ; indeed, it is extremely doubtful whether such a series could be obtained in any number, inas-

much as one characteristic feature of the double inheritance is the extent to which the development is diffused among the members of the family generally.

Out of fourteen families where the father and mother both died of consumption, I find that only one child out of every four escaped the heredity.

That so many more females than males should give a history of double inheritance is a remarkable fact which demands some consideration ; for, knowing that this sexual difference of numbers is out of all proportion to those for single heredity, we cannot suppose that the difference is to be attributed to lapse of memory, for no person would fail to remember a fact of such vital importance as the death of both parents, nor can it be ascribed to elimination of hereditary taint, for the double heredity is extremely potent in its influence. The difference then, which is as much as two to one in favour of the females, must be explained on different grounds, and the explanation rests possibly upon the following causes :

The effect of double heredity is exhibited at a very early period of life, and its potency is very virulent ; and in investigating the life histories of the several members of the fourteen families with double inheritance, I found that while the numbers of males

and females, out of sixty-four persons, attacked with phthisis were identically the same, the number of male children who died from causes other than phthisis was nearly twice as many as the females, and in larger proportion than obtains for other series of family phthisis among males.

But there are other reasons which we know from experience hold good for many cases; the daughters stay at home to nurse their sick parents, and probably fall victims to their repeated devotion. This view is supported by the fact that as many as 85 per cent. of these cases after fifteen years of age were found to be single women, as compared with 60 per cent. for the acquired cases. It is very probable that, from being confined indoors and in the worst of atmospheres, they are much exposed to the risks of the disease, while a serious question which demands careful inquiry arises, whether infection may not have some share in increasing the number of cases.

It must be also borne in mind that many of these women must in great measure have been precluded from obtaining their livelihood by regular occupation, and the orphaned condition of such women would result in excessive privation, from being launched upon the world to seek their daily bread, for which, in many cases, they are ill provided.

Table XVII., p. 106, gives the results derived from 200 cases of double heredity of males, and as in the former tables the calculation has been made per mille.

Effect of Double Heredity upon Males.

Although it is still probable that the influence may be manifested for all periods of life, it is evident that after forty-five years of age liability is reduced to insignificant proportions: susceptibility is especially loaded upon the period from fifteen to twenty.

Throughout the affected period between fifteen and forty, the special vulnerability of the cases is shown in the great excess of worse cases over the number of improved; while the total number of worse cases is not far from being double the total number of improved.

The mortality is excessive, being as much as 290 per mille, while the number of deaths within eighteen months is 210, nearly all of these proving fatal between fifteen and thirty.

The number of acute cases is more than double the subacute, and the subacute are more than the chronic.

The cases of bleeding, especially of copious bleeding, for the period between fifteen and twenty are numerous, and nearly half the total number of cases exhibited a disposition to bleed.

The Comparative Effects of Double, Direct, and Cross Heredity for Males.

The influence of single inheritance in regard to anticipation of the period of attack is found from these cases to be exaggerated under the double inheritance, and the attack is principally manifest for the period between fifteen and twenty.

A comparative estimate for the various forms of inheritance may be conveniently made by a numerical calculation for the period especially susceptible for all the conditions, namely, between fifteen and twenty-five years of age.

The following numbers represent the respective liability of the three forms of inheritance:

Direct	387
Cross	486
Double	555

or, to put these numbers in their simplest proportions, we may represent the comparative potency as regards liability by the following numbers:

Direct	19
Cross	24
Double	28

If a similar method be adopted with regard to the three hereditary series and the acquired cases, we get

the following simple proportions for the period between fifteen and twenty years of age :

Table showing the simple proportions calculated from the numbers of Tables II., III., IV., V.

Period, fifteen to twenty	Acquired	Direct	Cross	Double
Susceptibility . .	11	13	16	19
Copious hæmoptysis .	13	10	15	12

This table appears to point to the conclusion that double heredity is the resultant of the two forces, direct and cross heredity, which (as I have endeavoured to show) act in different ways and cannot be consequently considered as identical, and the double inheritance, therefore, cannot be considered solely as an augmented force acting in one and the same direction, but as the resultant of two forces which have not always the same direction and influence.

The result of double heredity for males may be summed up in the following manner :

1. Liability is diminished to insignificant proportions after forty-five years of age.

2. Susceptibility is loaded upon the period between fifteen and twenty.

3 and 4. The vulnerability of the affected period,

TABLE XVII.

Double Heredity.

1,000 MALES—(CALCULATED FROM 200 CASES).

AGES . . .	1	10	15	20	25	30	35	40	45	50	55	60	TOTAL
Cases . . .	5	40	310	245	155	95	95	40	10	...	5	...	1,000
Worse . . .	5	10	190	140	100	40	45	10	...	...	...	...	540
Improved . .	...	20	115	80	30	10	10	20	10	...	5	...	300
Deaths . . .	5	10	120	70	65	10	5	5	...	...	...	...	290
In 6 months . .	...	...	45	5	5	...	...	...	...	...	...	...	55
In 18 months . .	...	5	30	50	55	10	5	...	...	...	...	...	155
Acute . . .	...	10	170	155	105	30	50	25	5	...	5	...	555
Subacute . . .	...	10	85	55	25	20	30	10	5	...	...	...	240
Chronic . . .	5	20	55	35	25	45	15	5	...	...	...	...	205
Hæmoptysis : copious.	5	15	95	40	65	35	25	25	5	...	...	...	310
,, moderate	...	...	25	60	30	25	30	...	...	...	...	...	170
,, slight .	...	15	100	100	25	20	20	5	...	...	...	...	285
,, nil .	...	10	90	45	35	15	20	10	5	...	5	...	235

Table XVIII.

Double Heredity.

1,000 Females—(calculated from 200 cases).

Ages	1	10	15	20	25	30	35	40	45	50	55	60	Total
Cases	10	115	275	290	185	55	35	25	10	...	...	...	1,000
Worse . . .	5	30	125	85	90	20	5	5	...	...	...	...	365
Improved . .	5	30	100	125	30	30	25	15	10	...	...	...	370
Deaths . . .	...	30	100	35	55	5	5	...	...	...	...	...	230
In 6 months . .	...	...	20	5	...	...	...	...	...	...	...	...	25
In 18 months . .	...	...	55	20	40	5	5	...	...	...	...	...	125
Acute . . .	...	35	140	130	95	20	10	5	5	...	...	...	440
Subacute . . .	...	10	105	100	50	20	10	15	5	...	...	...	315
Chronic . . .	10	70	30	60	40	15	15	5	...	...	...	...	245
Hæmoptysis : copious .	5	15	35	60	25	10	10	15	5	...	...	...	180
,, moderate	...	25	45	55	25	15	5	5	5	...	...	...	180
,, slight .	5	30	135	85	85	15	10	...	...	...	...	...	365
,, nil .	...	45	60	90	50	15	10	5	...	...	...	...	275

as regards the tendency to get worse, the number of acute cases, and of rapid deaths, is excessive.

5. The tendency to bleeding is great.

The evidence of the potent influence of the double inheritance is conclusive as regards the generally increased effect of the combined forces of inheritance, and from this evidence we must conclude that male members of a family where the father and mother have died of consumption are very likely to be generally affected by the disease, and the probability of death during childhood is great. The susceptibility of early youth to the attack should be strongly impressed upon the minds of those concerned in the matter, and the prognosis of the disease if the attack occurs between fifteen and twenty will be in all cases especially grave. Serious as the single heredity appears to be, the double heredity is much more to be dreaded, for it has an effect which is equivalent to the resultant of both direct and cross heredity combined.

The Effect of Double Inheritance upon Females.

The table is calculated upon 200 cases of females who have given a history of both parents being affected with phthisis.

1. An examination of the table shows that the

liability stops short at fifty and is of insignificant dimensions after forty-five years of age.

2. Susceptibility is largely exhibited between ten and thirty, and is especially loaded upon the period between fifteen and twenty-five.

3. As regards the progress of disease the number of total worse is a slight increase upon those for the acquired and hereditary series, the number of improved being also less.

4. The general fatality of the disease is also greater, and also for the period within eighteen months. The rapidity of the disease coincides very closely with the general totals for the two series in the acquired and hereditary tables.

5. As regards bleeding, the chief alteration remarked is an increase in the number of cases of moderate amount.

But if we examine the table more closely we shall find that the period between fifteen and twenty is that which appears to be dominated by the double inheritance.

For this period we find increased susceptibility and vulnerability, and it must also be remarked that this period is influenced in the same manner under this form of inheritance for both sexes.

The following numbers show how this period, fifteen to twenty, is affected in regard to liability:

Acquired	188
Paternal	197
Maternal	187
Double	275

In regard to other points it is necessary to take the percentages, and with this result:

	Acquired	Paternal	Maternal	Double
Worse	32	35	37	45
Improved	41	42	42	36
Deaths within 18 months	6	20	24	27
Hæmoptysis, copious	16	15	10	12

So that in these respects and for this period the double heredity has a disastrous effect; and with regard to copious hæmoptysis and the other points, we appear to obtain a resultant effect.

The comparison of the effects of double heredity upon males and females brings out very strongly the results observed for single heredity.

Knowing that the resistance of the male is greater than that of the female from the deductions made upon the acquired series for the two sexes, it is quite in accordance with such knowledge that some benefit

should accrue to the female in consequence of the paternal heredity, but that the male should be in no way benefited by such inheritance, and that the inheritance from the mother should be more disastrous to the male than the female.

The series of parental heredity have made this clear, and as I have now shown that the double heredity is the resultant of the two single heredities, there is no difficulty in understanding why the double heredity should be more disastrous to the male than to the female. This conclusion is manifest from the examination of the following table, which gives the numbers for the period fifteen to twenty :

Comparative Effect of Double Heredity.

Fifteen to twenty	Liability	Worse	Acute	Copious Hæmoptysis
Males . . .	310	Per cent. 60	Per cent. 54	Per cent. 30
Females . .	275	45	50	12

These results, derived as they are from an independent series of cases, are satisfactory as corroborating the conclusions contained in the previous chapters.

CHAPTER X.

ON ATAVISM.

STILL another link, and a strong one, in the chain of evidence which establishes the theory of inheritance may be derived from the effects of atavism or reversion. Any one cognisant of the results of this influence in the breeding of animals, either from actual observations or from that extraordinary fund of facts recorded by our great Naturalist in his work on the 'Variation of Animals and Plants under Domestication,' will recognise the importance of establishing the effects of atavism in regard to the disease under consideration.

Numerous examples can be brought forward in which consumption has passed from an ancestor to a descendant, from a grandparent to a grandchild, and some even from a great-grandparent to the fourth generation, without the intermediary parents being evidently affected with the disease.

Without such evidence, indeed, a very essential

constituent of the results of nheritance would be lacking, and the arguments for phthisical inheritance would be weakened. But unhappily too many instances are at hand to afford any loophole for doubt on this score; and the strength of this sort of evidence is overwhelming because other possible causes—to wit, infection and similarity of endemic conditions—are out of the question in most cases.

The following cases may be given as evidence of atavism—the implication of collateral branches of the family materially supporting the probability of the intermediary parent transmitting the disease, although without its actual development.

Case 1.—A young woman, aged 19, applied for advice, and on being examined showed evidence of phthisis in the left lung: she had also enlarged glands of the neck. The family history was as follows:—Both parents had been, and were, in sound health, but evidence of the disease was traced back to the maternal great-grandfather, who died of phthisis with copious hæmoptysis. Both maternal grandparents had good health, and lived to the age of 70.

The connection with the ancestor was exhibited in the sisters of the mother—the maternal aunts of the patient, two of whom died of consumption, one of them having had copious hæmoptysis and a disposition to profuse menorrhagia. This tendency to menorrhagia was developed in the patient's mother and in the patient herself, the

period of life at which it was developed being very early and identically the same for both mother and daughter.

In this instance sexual limitation is very pronounced, and would of itself be strong evidence in favour of the hereditary character of the disease.

Case 2.—Out of a family of six children the four sons died of phthisis with copious hæmoptysis, and the two daughters suffered from hæmoptysis. The mother of this family was in good health, and had never suffered from any symptoms of pulmonary disease, but she had lost two sisters from phthisis. Her mother, the maternal grandmother of the children first mentioned, had died from phthisis: no disease could be traced on the father's side.

Here, again, we have an instance of atavic transmission through a female, who is a silent carrier of the disease, with sexual limitation in the collateral branches of the second generation, but with development of the disease among all the members of the third generation, the effect being especially aggravated in the male offspring, all of whom died of the disease. Evidently in this case the disease appears to have gathered strength, and to have acted with accumulation on the third generation.

Case 3.—A young lad, aged 14, was brought to me suffering from enlarged glands of the neck and with a history of occasional epistaxis. The father,

who was 51 years of age, was of robust make and in perfect health; but at the age of 11 he had a severe attack of hæmoptysis and nearly died of it. Subsequently he had an attack of bronchitis at 20 years of age, but completely recovered. The paternal grandfather of the lad had died of phthisis and hæmoptysis at 30 years of age. The paternal grandmother had lived to 70. The father had married twice. By the first wife, who had not suffered from pulmonary disease, he had nine children in the following order:—

1. A daughter who was threatened with phthisis at 16 years of age, but recovered.
2. A son who died, aged 9, of phthisis and hæmoptysis.
3. A son who lived a few days only.
4. A son who died of phthisis at 18.
5. A daughter who died of phthisis at 16.
6. A daughter who died when two weeks old.
7. A daughter who died aged 2 years.
8. A son who suffered from cough at 18, but had recovered, being constantly on board ship.
9. An infant who died soon after the mother.

The second wife was a perfectly healthy and robust woman, and the lad mentioned above was her first child, the tenth of the father's family.

These cases are sufficient to show the possibility of inheritance through an intermediary parent and grandparent; the last case mentioned affords evidence that the development of atavism follows the law of anticipation as regards the period of attack which has been shown to hold good for the parental inheritance. In that case the grandfather died of

phthisis and hæmoptysis at thirty years of age. The father had severe hæmorrhage at the age of eleven, and an attack of bronchitis at twenty, while the third generation developed the disease at earlier periods than the grandfather, one son having died at nine years of age. Here, again, we have evidence of the cumulative effect of atavism, not only in the early development of the disease, but also in the extent of the affection, not one out of a large family having escaped the heredity.

Other cases may be cited to prove the anticipation of the period of attack, and the following instances may be given as individual examples :—

Case 4. A young man was attacked by bronchitis, and was found to have signs of phthisis at the age of 17. He was an only child, and his parents were perfectly healthy. His maternal grandfather died of phthisis at 40 years of age ; and this relation's brother also died of phthisis.

Case 5. A young man was attacked with phthisis accompanied with much hæmorrhage at the age of 20. His parents were alive and healthy, but the maternal grandfather had died of phthisis at 37 years of age.

The subjoined table may also be put in evidence, containing the tabulated results of fifty male and fifty female cases of atavism, one or both grandparents having developed the disease, the parents not having

suffered. The lower half of the table gives the estimated number per mille, to enable a comparison to be made with the foregoing tables for the other series; although the number of cases is not large, there is sufficient regularity in the figures to induce a belief in the accuracy of the facts. As regards liability, this series approximates more closely to the table of double heredity than any other.

TABLE XIX.—*Showing the age of attack in* 50 *Males and* 50 *Females, the Grandparents having died of Phthisis.*

AGE . .	1	10	15	20	25	30	35	40
Males 50 . .	8	4	18	10	5	1	2	2
Females 50 .	2	9	16	12	9	1	1	...
Males 1,000 . .	160	80	360	200	100	20	40	40
Females 1,000 . .	40	180	320	240	180	20	20	...

These numbers show the influence of atavism in precipitating the period of attack; indeed, the liability becomes insignificant after thirty years of age, the main susceptibility being manifested before twenty-five in the proportion of 80 per cent. for the males and 78 per cent. for the females.

As regards limitation by sex, this law of inheritance is not rarely observed in these cases of atavism, and *Case* 1 given above is a remarkable instance of this; but although this limitation is observed, the inheritance sometimes gains not only in strength but in extent by accumulation through a silent generation, and bursts out with virulence attacking all the members of a family, as in *Case* 3.

In regard to this point, there is a bye-law of inheritance, which has been formulated by Darwin, to the effect that disease developed late in life is likely to be transmitted to individuals of the same sex, and there is a case given by Recamier, and quoted by Mr. William Sedgwick in his papers before referred to, which may be an example in favour of this law.

An old lady died of phthisis at eighty years of age, her daughter died of phthisis at fifty, and her granddaughters, two in number, died of the disease before their twenty-second year; a remarkable instance of cumulative anticipation through a succession of generations and of sexual limitation.

But in this country it would be extremely difficult to match this case, as phthisis usually proves fatal at an earlier period of life. I have now collected a good many examples, but have failed in obtaining any instance of inheritance from so advanced an age; and

though phthisis is most unhappily frequent in this country, the occurrence of death in advanced life rather than in extreme old age has the result of inducing extirpation of the heredity in the third generation before marriageable age is attained; of which the following cases are examples:—

Case 6. A lady was under my care for rapid phthisis; she died at the age of 26. Her father died of phthisis at 54, and her child died of pulmonary disease when 1 year old.

Case 7. The paternal grandmother of a girl who died of phthisis at 16 had been attacked with the disease, and died at the age of 45. The father was attacked with phthisis at 27, and died when 32 years of age.

Case 8. Out of a family of six children, one son died at 3 of phthisis, one daughter at 2, and one daughter aged $5\frac{1}{2}$ years was suffering at the time of investigation with pulmonary disease. Two children had also died young, one of measles, the other of croup.

The mother of this family was attacked with phthisis at 36, and died at 40.

The maternal grandmother was attacked at 51, and died of phthisis at 60.

Case 9. Maternal grandmother died of phthisis aged 55.
All other grandparents lived to advanced age.
Father healthy, and aged 67.
Mother died of phthisis, aged 37.
One son died of phthisis, aged 19.
One daughter died of phthisis, aged 17.
One son died of phthisis, aged 27.

It would appear, therefore, that cases of atavism, with one silent generation intervening between grandparent and grandchild, exhibit the influence of inheritance by the early anticipation of the period of attack, equivalent in many instances to the premature manifestation under double heredity; and cases of atavism with the disease developed in the intermediary generation exhibit the cumulative effects of the influence by repeated anticipation.

The evidence here brought forward in support of atavism in consumption points to the conclusion that we have strong corroboration that the general laws of inheritance are observed for this disease; moreover the occurrence of atavism puts the conditions of this disease, as far as inheritance is concerned, into a special category, and, if analogy may be trusted, removes the heredity from the kingdom of animal or other poisons, ranging it with structural alterations, arrested developments and monstrous growths, and with diseases which are under similar conditions, such as insanity and gout. To this point I shall recur in a subsequent chapter.

The heredity of atavism has been shown not to be a diluted condition, as one authority has stated, but one which in many cases is strong in the anticipation of the period of the attack, and in the extent to which

it affects the members of a family. As in insanity, the heredity is intensified by successive inheritance, while syphilis on the contrary is lost in the repetition of inheritance.

The value of evidence derived from the condition of collaterals now becomes evident, for from such knowledge we may learn whether the mother or the father are concerned in the transmission of the disease.

My collection of evidence, as far as it goes, rather points to the frequency with which the mother transmits without developing the disease, but I hesitate to lay this down as a general rule.

Hitherto I have not succeeded in obtaining evidence that more than two generations may be passed over with development of the disease in subsequent generations, nor would it be judicious to make any decided statement as regards the extinction of the heredity; but we may positively conclude that the interposition of two silent generations will not in all cases suffice for such an extinction of taint.

CHAPTER XI.

ON FAMILY IMPLICATIONS.

UP to this point those cases have been investigated which are associated with a history of heredity, and the results have been manifest and conclusive; we now proceed to attack the subject of family phthisis as regards the implication of the children only.

These cases are not associated with a history of heredity, but with the knowledge of the results of atavism and the possibility of inheritance from a remote ancestor, or from ignorance on the part of the individual regarding the state of health of grandparents, we cannot assume that all the cases are free from the heredity, and as we have full knowledge that phthisis is an endemic disease engendered by conditions of climate, soil, position, and construction of house, arrangement of rooms, and the general habits of the individual, we must be in doubt whether we are dealing with cases which can fairly be classed together in one series, either as purely acquired or as purely hereditary.

The question of the general features of family phthisis dissociated from evident history of heredity appeared to demand abundant evidence for its solution, and I have therefore collected not less than 500 cases for each sex, to form the basis of consideration.

This number will be probably sufficient for comparison with the 1,000 actual cases of acquired phthisis on the one hand, and 1,000 cases of heredity on the other; they have been brought up to the 1,000 for convenience of comparison.

It will be well to bear in mind that the liabilities of a particular family to phthisis is not under consideration, the object of the present investigation being to estimate the clinical features of these cases, and to determine whether they resemble the hereditary or the acquired cases most.

The Effects of Implication of the Family—Male Cases.

The examination of this table leads to the following conclusions :—

Liability is extended over all periods of life.

Susceptibility is shown chiefly from fifteen to fifty-five, but is especially manifest from twenty to thirty. The number of worse cases closely approximates to, but is less than, the number of improved.

The mortality is 143, while the number of fatal cases within eighteen months is eighty.

The number of acute cases is less than the number of subacute, and the number of chronic cases is nearly equal to that of the subacute.

The total number of cases of hæmoptysis is 409; the number of copious bleedings being as five to three of the moderate.

The period between twenty and thirty appears to be specially affected from the excess of worse cases over the improved for this period, and also as regards the large proportion of hæmoptysis.

Comparison of these Cases with the Acquired Series.

A careful comparison of these results with those obtained from the acquired cases shows a very remarkable general resemblance of the two series of cases; the main difference being a slight diminution in the number of cases for the period from fifteen to twenty, and an increase in the number from twenty to thirty. This, coupled with the features already recognised regarding the excess of worse cases over improved, shows, as I conclude, that a certain number of cases, although the proportion is small, are included which approximate to the hereditary type.

It has been a matter of surprise to me that this table should so closely, as it does, coincide with the acquired table.

As compared with the hereditary table, it will be seen that there is an approximation only in those points already mentioned, and for the period between twenty and thirty.

On the whole, then, this series of cases points to the conclusion that the family cases of phthisis (with the exception of a small proportion which must be classed as hereditary cases, the inheritance probably being the result of reversion) may rank as acquired cases as regards the general features of liability, susceptibility, and mortality.

But we may investigate the conditions more closely, and subdivide the series of family implications into two sets, one in which the brothers and sisters are implicated, the other in which the brothers only are affected. For this investigation I can produce 300 cases of each set for the males. The two tables coincide in a remarkable manner, the relative liability approximating so closely as to afford no ground for any definite conclusion, but in the excess of the worse cases over the improved, as exhibited in the set for brothers only, we have foreshadowed the suspicion that some at least of these cases approximate to the

TABLE XX.

Brothers and Sisters.

1,000 CASES, MALES (CALCULATED FROM 600).

AGES	1	10	15	20	25	30	35	40	45	50	55	60	TOTAL
Cases . . .	5	15	115	241	223	172	95	78	37	15	2	2	1,000
Worse . .	2	5	42	87	88	50	32	23	18	2	...	2	353
Improved .	2	8	50	78	78	68	43	28	12	8	2	...	377
Deaths . . .	...	3	20	30	35	28	10	12	5	...	...	...	143
In 6 months . .	...	1	2	3	...	3	2	2	...	...	...	...	13
In 18 months . .	...	2	13	12	13	17	2	5	3	...	...	...	67
Acute . . .	...	3	32	63	63	58	17	18	8	5	...	...	267
Subacute . . .	2	5	53	88	82	53	38	32	15	7	2	2	379
Chronic . . .	3	7	30	90	78	61	40	28	14	3	...	...	354
Hæmoptysis : copious .	...	3	29	60	62	49	22	17	7	2	...	...	251
,, moderate	2	2	19	50	33	25	5	22	...	...	...	...	158
,, slight .	2	2	50	67	69	59	37	22	12	10	...	...	330
,, nil .	1	8	17	64	59	39	31	18	18	3	2	2	261

TABLE XXI.

Brothers and Sisters.

1,000 CASES, FEMALES (CALCULATED FROM 500).

AGES	1	10	15	20	25	30	35	40	45	50	55	60	TOTAL
Cases	12	40	214	242	208	130	72	54	20	8	...	...	1,000
Worse . . .	...	8	58	90	64	56	38	18	8	4	...	...	344
Improved . .	6	28	90	94	68	44	14	12	4	2	...	...	362
Deaths . . .	...	6	24	58	30	24	18	8	6	...	...	...	174
In 6 months . .	...	...	6	2	6	4	...	...	...	...	...	...	18
In 18 months . .	...	...	12	24	10	12	14	4	4	...	...	...	80
Acute . . .	...	8	52	60	52	30	30	10	4	4	...	...	250
Subacute . . .	...	14	84	104	82	54	24	20	12	2	...	...	396
Chronic . . .	12	18	78	78	74	46	18	24	4	2	...	...	354
Hæmoptysis : copious .	...	6	46	58	72	32	16	10	6	2	...	...	248
,, moderate	2	4	22	32	24	10	14	4	...	2	...	...	114
,, slight .	6	18	80	76	54	44	16	24	8	2	...	...	328
,, nil .	4	12	66	76	58	44	26	16	6	2	...	...	310

hereditary type. This suspicion is confirmed by the excess of worse over improved for the special period already signalised, namely, from twenty to thirty, and we can therefrom draw this conclusion—that the inclusion of cases in the combined series of family cases which were shown to approximate to the hereditary type may be traced to that set of cases in which there was a history of the brothers only being affected: and although on first blush this result seems contrary to generally accepted views, on further consideration it will be seen that this restriction of disease to one sex is more likely to be due to remote inheritance than to endemic causes, which we may assume would be as likely from conditions of home life to attack the females of the family as the males.

The conclusion, therefore, which appears trustworthy and in accordance with the results of these tables is the following:—

The implication of both sexes of the children (only) results in a series of cases which conform to the type of acquired phthisis.

The implication of the male sex (only) results in cases which for the period between twenty and thirty resemble the hereditary type.

Brothers and Sisters.—Females.

The foregoing table enables us to investigate the results of the family implications for females. The comparison of this table with that for the acquired disease among females shows that as regards the total features there is a general approximation rather to the acquired than the hereditary form of the disease, but that as regards the rapidity of the disease the tendency is rather to assume the chronic form than either the acute or subacute form.

At the same time it is apparent that the tendency to copious hæmoptysis is very considerable, the number being greater than for either the acquired or hereditary cases.

When we come to compare the two tables for sisters only and sisters and brothers combined, we find the same kind of result as for the males, namely, that the conditions for those cases in which sisters only are concerned approximates more nearly to the hereditary character than those in which the sisters and brothers are concerned, and hence we appear to have established this law regarding the family implication—that when the disease is limited by sex, the chances are that the disease is in some measure inherited.

This sexual limitation of disease by inheritance is in accordance with facts already known regarding the transmission of disease by inheritance, and, considering the complex causes probably at work in regard to these family instances, it is remarkable that this law should be thus established for both sexes.

If this solution of the problem be correct, then we might append the following corollary: Family disposition to the disease is not identical with the hereditary condition, a conclusion of importance as showing that hereditary conditions are not simply (so-called) delicacy, but have unique and special characters.

CHAPTER XII.

ON THE DIFFERENT MODES OF INHERITANCE.

THE transmission of disease from parent to child presents several different phases for consideration, and it appears advisable to give a concise synoptical view of the different modes of inheritance, in order to investigate their distinctive characters and compare them with those which prevail in phthisis.

I. The simplest mode of parental transmission is probably that which occurs in cases of zymotic diseases; and striking examples are afforded by small-pox, a zymotic contagious disease of a comparatively gross kind, with an incubation of a short period and with well-marked characters.

The transmission of the disease under conditions of pregnancy occurs through the mother solely, and the disease may be developed in the fœtus or in the child soon after birth. Development follows transmission after a short interval, and, unless the mother has been protected by previous small-pox or by

vaccination, the disease in the child closely follows the disease in the mother.

In the cases collected and published by Kite[1] the interval observed between the first appearance of the eruptive fever and delivery varied from eight to sixty-three days, nine weeks being the longest time recorded.

Jenner's cases, recorded in his paper on the subject,[2] show that the child may develop small-pox without apparent signs in the mother if the mother has been previously protected.

The special features of this mode of parental transmission may be given in the following terms:

1. The transmission is from the mother solely.

2. The disease in the offspring follows closely upon the disease in the mother, unless the mother is protected already.

3. The transmitted disease is protective.

4. Atavism is impossible.

In none of these respects can there be said to be any analogy with the conditions of phthisical inheritance, and I should suggest that this particular form of parental transmission might be designated by the term maternal contagion.

[1] See *Essays and Observations*, by Charles Kite, 1795.

[2] *Med. Chir. Trans.*, vol. i. 1809, p. 272.

II. A far more complex and subtle mode of transmission is that which occurs in syphilis, and the conditions of inheritance have been investigated with much minuteness and accuracy especially by Hutchinson, and inasmuch as it has been repeatedly suggested in recent times that consumption may have some analogy with syphilis it will be necessary to consider the mode of inheritance in detail; but it must be remembered that my arguments throughout this book are concerned with phthisis as a general disease and not with tubercle as a particular poison; and as it is certain that opinions are divided upon the connection between phthisis and tubercle, some holding that the second precedes the first in all cases, others holding that the second (tubercle) is a secondary epiphenomenon of the general disease (phthisis), it is necessary to avoid as far as possible the error of working upon either theory, and treat the question upon general grounds.

It must then be distinctly understood that I am not now taking into consideration the transmission of tubercle (as such) from mother to child, and I proceed to discuss the inheritance of syphilis, not in contrast to the general behaviour of tubercle, but in order that we may contrast syphilis with consumption.

In the following description of the main features

of syphilitic inheritance I have been almost entirely dependent upon the papers of Hutchinson, which will be found in the London Hospital reports.[1]

Either parent may transmit the constitutional disease to the child and at any period within twenty years of the original disease, and this transmission may hold good even though all symptoms are latent in the parent.

In all cases the disease is subsequent to the disease in the parent, and it is not a condition in which a disposition to the disease is transmitted but the actual disease itself.

The inherited taint appears to act generally as a protection against subsequent contagion, although cases are recorded in which the immunity is not complete, but the subjects of inherited disease are probably not liable to contract the indurated form of chancre, so that even in such rare cases some protection is afforded.

The secondary poison is propagated from the fœtus to the mother, and this form of contamination is of frequent occurrence; but it is very doubtful whether inoculation independently of conception is possible, for where there are no children the mother, according to Ricord, does not suffer.

[1] Cf. *London Hospital Reports*, vol ii. 1865, p. 151 *et seq.*

Berkeley Hill is strongly of opinion, as stated in his work on syphilis,[1] that the semen cannot be asserted to be contagious with the knowledge we at present possess.

Mireur's experiments in this direction completely failed, and the cases recorded[2] have no weight in deciding this question. This is a very important point, because it has been supposed by some who have perhaps not investigated the matter so carefully, that spermatic contagion is probable.

As a rule, offspring of parents who are the subjects of the inherited disease do not show symptoms which can be recognised as syphilitic, and no instance has ever been recorded of the inherited disease passing from grandparent to grandchild, and we may therefore conclude that atavism is not known in this disease.

It is also noteworthy that it is common for the first child of a family to suffer severely and the rest not at all.

The special features of this mode of transmission may be briefly described thus :

1. Either parent is effective.

[1] *Syphilis and Local Contagious Disorders*, by Berkeley Hill and A. Cooper, p. 73.

[2] *Annales de Dermatologie*, 1876–7, quoted by Hill.

2. The disease in the offspring follows in all cases the disease in the parent.

3. The inherited disease is protective.

4. The conditions of atavism are not known.

It is very apparent that this mode of transmission differs in all points but the first from the phthisical inheritance, and I would suggest that this mode should be designated parental infection.

III. The third mode of inheritance, properly so called, is the most complicated of all ; it is that form which holds good in respect to structural conditions, peculiarities of form, monstrous growths, arrest of development, as well as for many kinds of disease ; and as the phenomena have been specially studied from numerous instances of insanity, we may consider the features of this form of inheritance as it occurs for that disease.

In hereditary insanity either parent is effective : the disease is seldom developed early in life, but is generally postponed for some years : the inheritance is not only non-protective but predisposing : the disease in the child frequently anticipates the development of the disease in the parent, and it is a matter of common remark that the children are often admitted into asylums before the parents.

The hereditary contamination of the child never

affects the mother, and spermatic contagion is unknown.

The mother is frequently the silent carrier of the disease, and the disease may be transmitted without being developed by the parent.

Atavism is a very important and frequent characteristic of this form of inheritance, and the disease is often developed in increasing degree through as many as four generations.

The following graphic description of the downward tendency and progressive degeneration from inheritance of this disease through four generations is worth quoting [1]:

'It is a fact that a pathological evolution—or, more correctly, a pathological degeneration—of mind does take place through generations.

'The course of events may be represented as something in this wise: In the first generation we perhaps observe only a predominance of the nervous temperament, irritability, a tendency to cerebral congestion, with passionate and violent outbreaks; in the second generation there is an aggravation of the morbid tendencies, displaying itself in cerebral hæmorrhages, ideopathic affections of the brain and in the appearance of such neuroses as epilepsy,

[1] Maudsley, *Responsibility in Mental Diseases*, p. 279.

hysteria, and hypochondria; in the third generation, if no check has been offered to the downward course, we meet with instinctive tendencies of a bad nature, exhibiting themselves in eccentric disorders and dangerous acts, and with attacks of some forms of mental derangement; and finally, in the fourth generation, matters go from bad to worse, we meet with deaf mutism, imbecility, and idiocy, and sterility, the terminus of pathological decline being reached.'

The features of inheritance are these:

1. Either parent is effective.

2. The disease does not in all cases follow—it often precedes—the development of disease in the parent.

3. The disease may be transmitted by the parent without development.

4. Not only is the inheritance non-protective, but it is predisposing.

5. Atavism is a frequent and important characteristic.

Now these features only include in the first point those which are observed in small-pox and syphilis, and we may confidently assert that the features are so different that there is no reason to consider that the conditions belong to the same family or order of things; if it be unsafe to draw

conclusions from analogy, we are at least justified in saying that the characters of these three modes of transmission are so opposite that no argument could be derived from them which would serve to connect the third form with either the first or second, or support the view that the inheritance of insanity is due to a zymotic or animal poison. But it is also very apparent that the inheritance of phthisis is in all respects closely comparable to the inheritance of insanity; and indeed it is difficult to find any point in which they differ.

Either parent, as we know, is effective. The disease may appear in the child before it is developed in the parent, and the effect of inheritance is certainly manifest in the early death of the child from the diseases of childhood. The inheritance of the disease is not protective but predisposing, but the transmission of the disease does not necessarily mean that the disease is developed in the individual who transmits. The offspring contaminated by paternal heredity does not infect the mother, and there is no reason for believing in spermatic contagion in this disease. Atavism is frequently exhibited and is a very important feature of the inheritance. In all these points the inheritance of phthisis and the inheritance of insanity are exactly similar.

But just as the inheritance of insanity is manifested in the development of insanity or of some correlated mental or nervous disorder, so the inheritance of phthisis is manifested in the development of phthisis or of some correlated pulmonary disorder or cognate disease ; and the heredity in the one case is just as much a specially diseased condition as in the other, for disease developed in either case is maintained in well-defined lines. The general application of such terms as delicacy or susceptibility will suffice in neither case, for the heredity is particular ; and although it has been frequently observed that phthisis and insanity are developed in the same individual—and the inmates of lunatic asylums often suffer from phthisis—it is contrary to all our experience at the Brompton Hospital that the development of phthisis is generally associated with insanity.

A similar fact has been observed in lying-in institutions ; for though insanity may burst out in the puerperal woman, it could not be said that child-bearing is generally associated with insanity.

Although, then, it is possible, as Maudsley has suggested, that degeneracy of structure is responsible for conditions of insanity and of phthisis, we must not conclude that the general term degeneracy will suffice to explain the heredity of phthisis any more than the

general term delicacy. Whatever the exact condition be, it must be specially localised, in the brain and nervous system to produce insanity, and in the lungs to produce phthisis; and common as both diseases are in this country, there need be no marvel that the one should be associated with the other.

Those who have opportunities of investigating the association of insanity with phthisis should bear in mind the special disposition to either disease induced by a special inheritance, and, instead of limiting inquiries to the inheritance of insanity, it would be well to consider also the liability to hereditary phthisis probably possessed by lunatics.

The heirloom of phthisis is something more particular and abstruse than general delicacy or degeneracy—it is a special condition, transmitted in a particular manner and developed in definite lines; it appears to be intensified from the acquired condition, and it is concentrated upon special periods of life; its features are peculiar, and they take their colour from the source from which they sprang; and though feebleness of frame and stunted growth are often accompaniments of the heredity, they are not necessarily associated, for beauty of form and vigour of frame, with all the outward and visible signs of health and strength, may be present, and yet the canker of

inheritance may be sapping the vital forces. The shallow, small, and ill-developed chest is undoubtedly a significant character in the disease; but physicians know that even in its acutest form it is frequently manifested in individuals who might serve as types of strength and models of beauty to the artist.

Certainly parental inheritance is not confined to the diseased parent, and the healthy parent may give such strength of frame that the eye may note nothing to raise a suspicion of disease. The peculiarity which comes from the consumptive parent in many cases escapes our view and is beyond our ken.

No doubt those who maintain the pre-phthisical presence of tubercle as necessary for the development of the disease will still hold that the heredity is the result of tubercle, but in the present state of knowledge no support to this theory can be obtained from the close analogy which is observed at all points in the transmission of insanity and phthisis. The transmission of insanity is not attributed to the result of a special poison: to use Dr. Crichton Browne's words, 'it is no new principle instilled into the being affected, it is no foreign growth grafted upon the mind: it must not be supposed that insanity is anything more than a modification of healthy pro-

cesses.'[1] All the evidence which has been here adduced, and all the arguments which may be based upon analogy and the general behaviour of inheritance, have firmly impressed me with the conviction that the phthisical inheritance is a special condition of diseased structure, the causation of which is not dependent upon, however prone the structure may be to, tubercle.

The development of phthisis is another matter, the demonstration of which, now *sub judice*, is rendered probable by the recent brilliant discoveries of Koch.

In one special point the contrast between animal poisons, such as syphilis, and such diseases as phthisis and insanity, is so strong as to form a crucial test between the two classes. In syphilis the poison is so diminished by inheritance that it is completely extinguished in the third generation. In phthisis and insanity, on the contrary, the heredity gathers such strength by the successive inheritance that each generation may suffer more severely than the previous, and the accumulated strength of the heredity at last becomes so fierce that the generation dies out under its virulence, and the family becomes extinguished.

[1] 'The Etiology of Insanity,' *Brit. and For. Med.-Chir. Review*, xl. 1867, p. 169.

CHAPTER XIII.

THE LAWS OF PHTHISICAL INHERITANCE.

THE numerous observations which have been made on animals and men regarding the effects of inheritance have resulted in the formulation of certain laws which appear to predominate in the results obtained, and it is advisable to compare these laws with those which appear to prevail in phthisical inheritance, in accordance with the results which have been observed for this disease.

It would be shortsighted to presume that conditions which have been observed in a small spot on the world's surface represent in all respects the cosmopolitan conditions of inheritance, and a number of accurate observations will be requisite for the whole globe's surface before we can be sure that in dealing with phenomena in a restricted locality we are not dealing with local variations.

It is even now well known that the clinical features of the disease vary in different parts of the world.

From the accounts of the disease given by Laennec and Louis, it is probable that the type is more acute in France than in this country. Pollock, who practised in Rome,[1] says that cases of consumption are commonly acute among the Italians there; and that physicians of Spain, Portugal, and Peru have made a similar report regarding the course of the disease in their respective countries.

From the tables of death-rates for America there appears to be in that country a tendency manifested by the disease to attack persons in advanced life in considerable numbers; so that it is evident, with these differences of features before us, we must not assume that the conditions which prevail in London for this disease will be the same in other places; but as far as our limited evidence goes, we can attempt to arrive at some conclusions which may serve eventually to determine the laws of this form of inheritance.

The law of direct inheritance has been generally insisted upon for all conditions of inheritance, and all writers upon this subject have maintained that this law holds good for phthisis; but although the numbers handled in these pages are large, I find an excess of only 18 in favour of direct heredity, in 2,000 family cases the numbers standing thus: 388 for direct

[1] *Op. cit.* p. 54.

heredity (*i.e.* fathers to sons and mothers to daughters), and 370 for cross heredity.

As the numbers stand we may say that they serve to show that this law apparently holds good as regards the inheritance of disease which is developed in the parent ; but we have no estimate of instances of silent transmission. It must also be observed that this estimate is made upon cases in which one sex only is affected, so that, although this law has been formulated with a good deal of confidence for phthisis, from my cases it has only been proved to hold good in a restricted sense, which may be thus given :

The law of direct inheritance is observed in phthisis for those unisexual cases where the parent has developed phthisis.

It has also been stated that the transmission of phthisis is more common through the mother than the father ; but in this statement transmission is to be understood in its general sense, that is, the transmission of developed disease, and not in the more technical and correct meaning of the word transmission as distinct from, though frequently associated with, development.

To quote Darwin's words on this point : 'Two distinct elements are included in the term inheritance, the transmission and the development of characters ;

but as these generally go together the distinction is often overlooked.'[1] And again: 'Transmission and development are distinct, and they are even antagonised as it were in the individual.'[2]

If we understand by transmission the transmission of developed disease in the parent, my numbers, derived from 2,000 family cases, are, for the fathers, as affecting both sons and daughters, 297, and for the mothers 296, as will be seen from the Table of Relations on p. 33; but if we are to include cases of silent transmission, my experience would certainly point to the mother as being the frequent carrier of the disease, and especially this appears to be true with regard to hæmorrhagic tendencies, the development of the disease being manifested frequently among the males.

The possibility of error from working with a comparatively small number of cases is shown from a reference to Table III., which contains the results observed from eighty families, the maternal cases being more frequent; but when we take into consideration the preponderance of liability and exceeding death-rate of the males of this metropolis, it is *primâ facie* somewhat improbable that more mothers than

[1] *The Descent of Man*, p. 227.
[2] *Animals and Plants, &c.* vol. ii. p. 84.

fathers should transmit the disease, in regard to metropolitan cases.

The next law to be considered concerns the sexual development of the disease; and we shall find the general law to be in accordance with the usual conditions of inheritance, upon which Darwin [1] observes that the equal transmission of characters to both sexes is the commonest form of inheritance, and indeed it might be expected that, in a disease which is so common and which affects an organ which is so closely similar for both sexes, the general characters transmitted would not, in many cases at least, have any sexual limitation; and so, if the Table of Relations be again consulted, it will be found that the numbers of the paternal and maternal heredity, as affecting the sons or daughters, show no very great difference, and the numbers of direct and cross heredity closely approximate.

Sexual limitation sometimes occurs in cases of atavism, and it has been shown from the tabulated series of family disease, without history of heredity, that suspicion of inheritance is attached to those cases in which the disease is limited to a number of males only, or females only, and it would follow that sexual limitation in a family is indicative or suggestive of previous ancestral disease; and such a condition

[1] *The Descent of Man*, p. 230.

should at once suggest a careful examination into collateral histories.

Darwin has insisted,[1] that variations which first appear in either sex at a late period of life tend to be developed in the same sex alone, while variations which appear first early in life in either sex tend to be developed in both sexes. I have carefully gone into this point to the extent of my collected cases, and have been unable to confirm this as holding good for phthisis; but, as already observed, it appears rather to hold good for cases of atavism without relation to age, as far as can be ascertained. The argument which Darwin advances from the analogy of gout, scarcely, as I venture to think, holds good for so general a disease as phthisis, inasmuch as acquired gout is rare among females, and is consequently, speaking generally, a unisexual disease.

The third point is the limitation of age, which, from the deductions obtained from the tables, is evidently generally exhibited in a period of anticipation, that is to say, the period of development in the offspring is at an earlier age than the period of development in the parent.

In order to show this conclusively, the following individual cases may be given from my case-book,

[1] *The Descent of Man*, p. 232.

which prove that in a number of cases anticipation of development varies from ten to twenty-five years:

Case 10.—Father died of consumption at 54 years of age.
Daughter died of the disease at 33.
Daughter „ „ 15.
Daughter „ „ 34.

Case 11.—Father died of consumption, aged 39; ill two years.
Daughter died of consumption, aged 15.

Case 12.—Father died of consumption, aged 60.
Daughter died of consumption, aged 29; ill thirteen months.
Daughter, suffering from phthisis, aged 48.
Son died „ „ „ 40.

Case 13.—Father died of consumption, aged 40
Son, suffering from phthisis, aged 29; ill one year.

Case 14.—Father died of consumption, aged 51.
Son, three years' consumption, aged 27.

Case 15.—Father died of consumption, aged 32.
Daughter died of consumption, aged 19.

Case 16.—Father died of consumption, aged 43.
Daughter died of consumption, aged 19.

Case 17.—Mother died of consumption, aged 42.
Son died of consumption, aged 29.
Son „ „ „ 19.
Son „ „ „ 17.
Son is suffering from consumption, aged 17.

Case 18.—Mother died of consumption, aged 30; ill three years.
Son, aged 25; ill eight years with the disease.

Case 19.—Mother died of consumption, aged 45.
Son „ „ „ 30.
Daughter suffering from phthisis, aged 23.

Case 20.—Mother died of consumption, aged 26.
Son with two years' consumption, aged 14.

Case 21.—Mother died of consumption, aged 34.
Son attacked at 17 with phthisis.

Case 22.—Mother died of rapid consumption at 42.
Daughter „ „ „ „ 12.

Case 23.—Mother died of consumption at 42.
Son, aged 20, suffering from consumption.

Case 24.—Mother died of consumption, aged 41 ; ill five years.
Daughter died of consumption, aged 21 ; ill two years.

Case 25.—Mother died of consumption at 52.
Son, aged 25 ; ill five years with the disease.

Case 26.—Mother died of consumption at 55.
Son, aged 27, with the same disease; nine months.
Daughter died of it at 26 ; ill one year.

Case 27.—Father died of consumption, aged 40.
Mother „ „ „ 50.
Son died of rapid disease, aged 29.

Case 28.—Father died of chronic consumption, aged 60.
Mother died of the disease, aged 56.
Son died of the disease, aged 29.
Daughter died at 17 ; two years ill.
Eight sons also died young } Cause of death un-
One daughter „ „ } known.

Case 29.—Father died of consumption, aged 55.
Mother „ „ „ 56.
Daughter, aged 21, three years' phthisis.

Daughter, aged 19, with cough and hæmoptysis.
No other children.

Case 30.—Father died of consumption, aged 40.
Mother „ „ „ 32.
Daughter died of consumption.
Two daughters died in childhood.
Daughter died of consumption, aged 25; ill five years.
No sons.

These cases show the tendency of the inheritance to precipitate the development of the disease in the offspring at an early period of life.

For the father's inheritance the anticipation was from ten to thirty-nine years—average twenty-one years.

For the mother's, anticipation five to thirty years—average twenty-one years.

For the father and mother, anticipation is from eleven to forty-one years, or an average of twenty-seven years before half the joint age at death.

But also cases occur in which the development of the disease in the offspring is synchronous with the parental period. Such cases are not very frequent, but the following can be put in evidence:—

Case 31.—Father died of consumption at 31.
Mother „ „ „ 28.
Daughter suffering from advanced disease, and examined at the age of 31.

Case 32.—Mother alive and healthy, aged 40.
Father died of phthisis at 23 years of age.
The only son showed signs of phthisis at 22 years of age.

And it may also happen that the attack may be so far postponed as to be subsequent to the parental period. All these conditions are observed, but the law of anticipation is observed in a large majority of cases.

The augmented anticipation by repetition of inheritance in a third generation has been already discussed, and it has been shown to hold good for this disease as it does for cancer, with this difference: that the period of development in the third generation is so early that the child dies in youth or in childhood and before the possibility of marriage, so that in many instances the family becomes extinct at the third generation, or the survivors may evince no hereditary tendency; but it must not be forgotten that the tendency although not developed may still be transmitted, and the mother is frequently in this (as in insanity) the silent carrier of the heredity.

As regards extinction of the taint, it can be said that two silent generations do not necessarily preclude the development of the disease in the fourth generation, but much more evidence is required before we can lay down any rule as to immunity from this heredity.

The next point to be considered relates to the variation in the transmission proportionate to the age of the parent. The attack of phthisis is in many cases of adult age most severe for the earlier periods of life, as all my tables show, although senile cases occur of great rapidity and severity, and it might be expected that some diminution in the strength of transmission might be observed for the later periods of mature age. As this is an important point I have collected the family details regarding 52 families where one or both parents died of phthisis; in twenty-six the deaths of the parent occurred between twenty and forty years of age, and in twenty-six between forty and sixty.

The number of children in these families will of course be smaller for the first series, and it will be seen that the second series has one third more. Each series consists of—

Paternal cases	7
Maternal ,, ...	14
Double ,, ...	5

In estimating the relative strength of transmission it is necessary to remember the curtailment of the numbers of the family, and the estimate must be made on the proportion of those who were affected to those who escaped.

The subjoined tables show, if reliance can be placed on the few instances collected, that the transmission of the developed disease from the parents is stronger before forty than after forty.

TABLE XXII.—*Showing the effects of Heredity, when the death of the parent is before* 40.

Heredity	Number of children	Non-phthisical	Phthisical	Died in childhood	Total affected
Seven paternal families	19	8	6	5	11
Fourteen maternal families	59	26	23	10	33
Five double heredity	14	1	11	2	13
Twenty-six families	92	35	40	17	57

TABLE XXIII.—*Showing the effects of Heredity when the death of the parent is after* 40.

Heredity	Number of children	Non-phthisical	Phthisical	Died in childhood	Total affected
Seven paternal families	31	18	11	2	13
Fourteen maternal families	68	35	27	6	33
Five double heredity	25	7	10	8	18
Twenty-six families	124	60	48	16	64

The percentage proportions for the two periods are as follows:

	Escaped	Phthisical
Before 40	38	43
After 40	48	38

And as regards the total affected, we find the percentage proportion to be 62 for the first series, and 52 for the second; although the more children are affected in the latter series, this is due to the limitation of family by the earlier death of the parent, and the percentage proportion of children affected and non-affected indicate that the greater strength of transmission, as regards extent of development, is on the side of the younger series.

The next point for consideration is:

Development of the Disease in the Family, in relation to the Order of Succession.

So much difference may be observed in the degree of heredity transmitted to the offspring, and in the amount of exposure to causes which predispose to phthisis, that it can hardly be expected that uniformity of development among the members of a family, in regard to the order of succession, is generally manifested; and I have much doubt whether any rule can be laid down which would prove of practical value for the estimate of a large

number of cases; but there are two or three points of interest which are suggested by a review of one hundred cases collected with full details of the family history and the exact order in which the members of the family stand.

In many cases where the disease has been acquired by the parent, there appears to be a disposition for the last born of the family to develop the disease while the others may pass scot free, and the following examples may be put in evidence upon this point.

The cases are incomplete in one particular, because it is almost impossible to obtain a series of family histories in which the history extends to a late period of life for all the members of the family, but they at least show the liability of the last born, which is the point under consideration.

Case 33.—The father died of phthisis, after twelve months' illness, in 1870—the mother being alive and healthy.

The family consisted of the following children in the order in which they are given:

A son, aged 20, in good health.
A son, aged 18, also in good health.
A son, aged 16, also healthy.
A daughter, aged 14, suffering from phthisis, and examined by me in 1883.

In this case the cross inheritance was developed

only on the youngest of the family, and it may be surmised, on calculating the dates, that the father was probably suffering from incipient phthisis at the time the daughter was begotten.

Case 34.—The father had suffered from blood-spitting at 12 years of age, but was alive and in fair health. The mother died of phthisis, aged 34, in 1879. The children were as follows:

A son, aged 24, healthy.
A son, aged 22, healthy.
A son, aged 20, healthy.
A daughter, aged 19, suffering from pulmonary disease.
A daughter, aged 15, ill twelve months, and suffering from phthisis.

In this case the direct inheritance was developed in both daughters, the youngest of the family.

Case 35.—Father, living, suffers from asthma. Mother died at 28 years of age from phthisis. The following were their children:

A son, healthy.
A daughter, healthy.
A daughter, healthy.
A son, aged 28, who died of phthisis.

Case 36.—Father living and healthy, aged 60. Mother died of phthisis in 1860 (age not known). Their children were in the following order:

A son, aged 30, healthy.
A daughter, aged 29, healthy.
A daughter, aged 27, healthy.
A daughter, aged 25, healthy.

A daughter, aged 24, suffering from phthisis.
Son, aged 23, not suffering from pulmonary disease.

Case 37.—Father died by drowning, aged 50. Mother died of phthisis, aged 52, in 1868. Their family were:
A daughter, died of dropsy, aged 28.
A daughter, died in confinement, aged 30.
A son, healthy, aged 30.
A daughter, aged 28, healthy, married.
A daughter, aged 25, suffering from phthisis of five years' duration.

Case 38.—Father living, aged 42, in good health. Mother died of rapid phthisis, aged 42, in 1881. Their children were:
Two daughters, living, in good health.
A daughter, who died, in 1880, of rapid phthisis, aged 10 years.

In these cases it is evident that the transmission of disease affected the offspring who immediately preceded the development of the disease in the parent.

It would also appear probable that the transmission may be possible for a certain period before the development of the parental disease, and the above case appears to be fairly plausible for this view; but, strongly convinced of the permeating and extensive influence of inheritance, I doubt whether it would be possible to obtain a case which could be held to be completely convincing, inasmuch as it is extremely

difficult to obtain absolute proof of the absence of all heredity for a certain number of—say at least four —previous generations.

In the last case I attended both mother and daughter, and was unable to make out any history of inheritance. The mother died of rapid pneumonic phthisis of three months' duration, one year after her child, and the child died of acute phthisis with enlarged glands, a form of disease which would suggest heredity, but although I am strongly inclined to the opinion that transmission may take place during a condition which might be termed the pre-phthisical habitus, it would be very rash to lay down any law as to the duration of this habitus. It is well known that in insanity the transmission of the disease occurs before the actual development of insanity, and it is a matter of common observation that the children are admitted into lunatic asylums before their parents; and the analogy between phthisis and insanity is so strong in all points that I should be inclined to accept the fact for insanity as at least giving colour to a similar theory regarding phthisis.

The case which has been cited by Waldenburg[1] of five out of six children dying with hæmoptysis and

[1] *Die Tuberculose der Lungenschwindsucht, &c.* p. 525.

subsequent phthisis, the mother dying after her children of hæmoptysis and phthisis, is one which probably belongs to that class, of which I have now collected many examples, of the mother transmitting hæmoptysis from a remote ancestor to the children, and I strongly suspect that this case was really one of atavism: it must not at any rate serve as an argument of transmission from a pre-phthisical condition unless several previous generations proved to be completely free from phthisis. The case is also open to suspicion because of the extent of the transmission and the numbers of the family affected.

I say then that the greatest caution should be observed in accepting any cases brought forward to prove the duration of the pre-phthisical habitus in relation to the transmission of disease, and although transmission takes place, not only before development, but even without development at all, it would be almost impossible to bring forward conclusive proof of the duration of the pre-phthisical period of transmission in acquired cases.

When the heredity is transmitted through a parent from a grandparent, then the development of the disease is frequently exhibited in the first born as in the following instances:—

Case 39.—Maternal great-grandmother died at 30, of phthisis. The maternal grandfather died at 37, of phthisis.

Father and mother both healthy. Son, only child, died at 20, of phthisis.

Case 40.—Paternal grandfather died of laryngeal phthisis; maternal grandmother died, aged 32, of phthisis.

Both parents healthy; their family were :—
A son, died, æt. 25, of phthisis.
A daughter, died of phthisis.
A son with cough.
A daughter, aged 14, with rheumatic fever.

Case 41.—Paternal grandfather and his family have not suffered from phthisis.

Maternal grandmother died of phthisis.
Father died, æt. 35, of typhoid.
Mother healthy, aged 54.
One daughter, æt. 29, suffering from phthisis.
One son, æt. 27, healthy.

When the heredity is not only ancestral, but parental, then the development is generally disseminated through the family.

On the whole, it may be concluded that inheritance from a grandparent and a parent is likely to lead to a general development of the disease, which is also true in some cases of pure atavism; but that as regards the inheritance from a parent only, development may be limited, and is sometimes only manifest in the last born.

It has long been known that a connection exists between asthma and phthisis, especially in regard to inheritance, and although each condition may be transmitted separately and specially developed, it also frequently happens that the two conditions are intimately associated, so that one member of a family may have asthma while another develops phthisis; or alternate generations may be attacked severally and separately with asthma and phthisis; consequently when cases come under notice with a parental or family history of asthma, it is very important to investigate other family conditions, and see whether the disease is connected with phthisis.

The following case is an interesting one from this point of view.

Case 42.—The paternal grandfather died of phthisis; the maternal grandmother died of asthma; the mother died of asthma; the father was suffering from asthma.

Their family consisted of:—

A daughter, aged 17, with cough; no asthma.
A son, aged 15, with cough.
A son died, 5 years old, with phthisis and asthma.
A son, aged 5 years, with a bad cough.
A daughter, died at 1 year 9 months of phthisis.

Case 43.—Maternal grandmother died, at 68, of asthma; all the other grandparents lived to a great age.

The mother died of phthisis, aged 42.
Her sister died of phthisis at 41.

The father was alive and healthy.
Their family consisted of four sons, all of whom had phthisis.

The transmission of asthma may, like the transmission of phthisis and hæmoptysis, of insanity and epilepsy, take place through a silent carrier, that is to say, without development in the parent.

Case 44.—Maternal grandfather died of asthma; no history of pulmonary disease was obtained for any other grandparent.

His family consisted of two sons who died of phthisis, and one daughter who was healthy and never suffered from pulmonary disease. She married a perfectly healthy man and they had one (only) son, who at 8 years of age developed asthma.

It may perhaps be mentioned that a connection appears to exist between false croup and asthma, false croup being sometimes associated with a family history of asthma, and the association is made evident occasionally in later life by the development of asthma in the individual.

This alternation of phthisis and asthma in successive generations is quite analogous to the alternation of insanity and epilepsy, and although within recent years a peculiar theory has been broached regarding asthma, asthma is looked upon generally

as a nervous disorder and sometimes occurs with epilepsy in another member of the family.

It has been long known, for it was known to Haller and to Becker, that the peculiarities of a male animal may be transmitted through the female to a progeny which the female may subsequently have by other males, and the particular instance which has received more attention perhaps than any other, is that of Lord Morton's Arabian mare, which was covered but once by a quagga in 1815. In 1817, 1818 and 1821, this mare was covered by an Arabian horse and produced three foals, all of which bore marks of the quagga. This subject has been fully discussed by Darwin, and other instances of the kind have been recorded. Examples of this kind are recognised among mankind, and there is a vulgar observation that the offspring of a second marriage sometimes resemble the first husband. The subject has been most ably investigated also by Dr. Alexander Harvey, who, as regards the special heredity under consideration, gives the following case in point reported by Professor Pirie, which may be quoted *in extenso*.[1]

Case 45.—A woman apparently free from scrofula married a man who died of phthisis; she had one

[1] See *Glasgow Medical Journal*, January, 1859.

child by him which also died of phthisis. She subsequently married a man who was seemingly as healthy as herself, and had two children by him, one of whom died of phthisis, the other of tubercular mesenteric disease, having at the same time scrofulous ulceration of the lower extremities.

This and another case cited by Dr. Harvey are very interesting, but we require more examples before we can completely eliminate all chance of reversionary heredity.

Accepting the case as cited, I would remark that it is important to note that the woman remained free from the disease, and that, if this case can be safely accepted, it would point to a condition analogous to the case of Lord Morton's mare, which involved structural alterations, and not the transmission of an animal poison.

In connection with this branch of the subject, it must be remembered that no cases have been recorded, nor am I aware of any such case having occurred to the effect that the mother has been infected by an infected fœtus from a phthisical father. This absence of maternal infection is in direct opposition to the behaviour of syphilis, for the mother in that disease is frequently infected through the fœtus.

I fail to see any grounds for the suggestion made,

that the disease may be transmitted by spermatic contagion. Such a condition has not been proved even for syphilis, and why this suggestion should have been made for phthisis it is impossible to say. In those cases where more than one wife in succession has died from phthisis, a more generally applicable theory is at hand in infection by inhalation, a theory which has the support of numerous experiments on animals, and would certainly embrace a number of cases of a different relationship; but although I strongly maintain the possibility of infection, the greatest caution should be observed in accepting evidence of infection, for even in regard to the deaths of more than one wife in succession, the curious instance recorded by Portal must not be forgotten, in which three wives died, in succession, from phthisis, but the husband was not phthisical.

When we review the prevalent conditions which are observed to hold good in the transmission of phthisis and in the development of the disease, we cannot fail to see how closely in all respects they tally with the laws of inheritance which have been formulated from observations upon breeding and structural conditions with which no animal poison is concerned; and the conclusion which may be suggested as probable is that, as the laws of trans-

mission and development hold good in both cases, the materials upon which those laws act are of a similar nature.

Those who revere the memory of our great Naturalist, and are deeply convinced of the completeness with which he investigated the vast subject of inheritance in all its aspects, and of his marvellous memory for its facts, will listen to his teaching upon this particular division of the subject and apply his doctrine of Pangenesis also to phthisis.

In considering the reason for the intermission and subsequent development in alternate generations of certain diseases, among which phthisis has its place, he says [1]:—

'A certain amount of gemmules being requisite for the development of each character, as is known to be the case from several spermatozoa or pollen-grains being necessary for fertilisation, and time favouring their multiplication, will together account for the curious cases, insisted on by Mr. Sedgwick, of certain diseases regularly appearing in alternate generations.'

In this view of the subject, and with the many observed facts regarding inheritance before one's view, we can but follow in the lines of Darwin, who remarks that the germ becomes a marvellous object,

[1] *Animals and Plants, &c.* vol. ii. p. 401.

crowded with invisible characters proper to both sexes, characters like those written on paper in invisible ink, all lying ready to be evolved under certain conditions.[1]

The extraordinary potency of inheritance has now been proved by Darwin's researches, but supplemental evidence is still required regarding the inheritance of disease generally. The labours of Galton have already elicited, and will, it may be confidently anticipated, continue to elicit, information upon inheritance, but physicians ought not to continue satisfied with merely finding out the inheritance of a disease; more elaborate and accurate details are requisite, and clinical clerks should be instructed how best to attain this end. The scheme which I have used (and found very convenient) for my cases is given in the Appendix, and it cannot be too strongly urged that some such scheme should be in general use for the investigation of disease in relation to inheritance.

[1] *Animals and Plants*, vol. i. p. 61.

CHAPTER XIV.

FAMILY PHTHISIS IN RELATION TO LIFE ASSURANCE.

THERE is no point upon which assurance offices are so cautious as upon family history in connection with all diseases which are known to be hereditary, and for many years past they have accepted and acted upon the doctrine of inheritance in relation to disease. Guided by this principle with reference to phthisis, in conjunction with other causes, they have successfully diminished their risks from this disease; but that their success depends solely upon their appreciation of inheritance is not here maintained, because other conditions are bound up in the question of family disease.

As regards phthisis there is a pretty general consensus of opinion among the offices, and the broad lines upon which action is generally taken are well understood; but in the working out of details there is some difference observed, and authors have laid down

various rules to meet the difficulties which are frequently presented to the medical examiner.

Pollock, who has had much experience in life assurance, states in his work already quoted, that it is a rule with some offices,[1] that if two members of a family have died of consumption, the life is declined unless the applicant is past forty years of age and free from any suspicion of disease, and an increased premium may even then be charged.

It is also generally held that after forty-five years of age the development of heredity is so far reduced in extent that its significance need not be taken into account.

Brinton in his little work on Life Assurance has some judicious remarks upon the subject,[2] and he shows that he appreciates the increased risk of transmission from the mother; but, for reasons which he does not state, he holds that the influence of a consumptive grandparent, in addition to a father or mother, is less decisive than the influence of the father or mother plus a consumptive brother or sister—an opinion which the evidence brought forward in these pages does not sustain.

Sieveking, in discussing this question, advises an

[1] *Op. cit.* p. 254.

[2] *Medical Selection of Lives for Assurance*, p. 27.

addition of seven years for a consumptive father and ten for a consumptive mother when the applicant has an unexceptionable personal history. Certainly, he says, where two of the same generation have succumbed to the disease, an addition of seven or ten years is necessary.[1] He goes on to remark that if both parents have died consumptive, hazardous rates of twenty or twenty-five years only can be admitted, and it is a question whether such lives ought not to be absolutely rejected.

He is evidently impressed with the great risks attending cases of hæmoptysis, for he says that it does not appear too much to charge fifteen years to the ordinary rate for a single occurrence of hæmoptysis.[2]

If we look across the Atlantic, we shall find very similar regulations observed in the assurance offices of America ; and the recommendations of Dr. Albert Buck of New York are well worthy of attention, although they relate to cases in a different part of the world.[3]

In summing up the result of his experience, Dr.

[1] *The Medical Adviser in Life Assurance*, by E. H. Sieveking, M.D. 2nd edition, 1882, p. 94.

[2] *Op. cit.* p. 156.

[3] *Medical Investigation in Life Insurance*, United States Life Insurance Company, p. 38.

Buck found that there had been an excessive mortality in three of the groups for consumption, viz. spitting blood, both parents, and one parent together with one or more children, although this excess was more than counterbalanced by the small mortality of the others.

His experience of cases of hæmoptysis was such as to lead to the suggestion that all such cases should be totally rejected; no applicant with a history of double heredity should be admitted before forty-five years of age, if, indeed, any such cases should be taken; applicants with a history of single heredity should be at least thirty years of age; applicants with a history of single heredity, together with one or more consumptive brothers or sisters, should be accepted only on condition that they have attained their thirty-fifth year, and that the consumptive brothers or sisters should have died at an earlier age.

Putting aside the three groups for which the regulations of the office proved to be inadequate, we may conclude, in accordance with the evidence adduced by Dr. Buck, that the ordinary rules adopted for the other groups proved satisfactory.

The experience of the Equity and Law Insurance Company in this country (as quoted by Dr. Sieveking), appears to show that the usual additions for con-

sumption were found to be more than requisite, and Dr. Symes Thompson, acting upon the ascertained results, considers that a diminished tax might be demanded, and that an addition of three to five years would suffice if the applicant's health proved satisfactory.[1]

In these times of keen competition, assurance companies are compelled to offer as favourable terms as they can in order to obtain business; moreover, there are two parties interested in the matter of rates —the public who wish to get all the advantage they can, and the offices who wish to obtain a profitable business.

There can be no doubt that risk will be avoided by declining applicants, but if such a rejection be extended to the age of forty, much business would be lost; and a great deal, it must be remembered, centres about thirty years of age, the period at which men are embarked in life, and incline to marriage.

The statement might be made that any life is insurable at a certain rate, although the rate may be such that the applicant might refuse to complete the transaction, and as the assurance of life for the provision of old age and the family is praiseworthy, and should be fostered, rather than discouraged, it

[1] *Medical Adviser, &c.* p. 93.

may be well to consider how far arrangements can be made for applicants with a family history of phthisis which will be of benefit to the public, and avoid risk for the offices.

In order to clear the ground for such considerations, it will be convenient to give a concise summary of the results obtained from the evidence brought forward in these pages so far as they bear upon points of life assurance.

The evidence establishes the truth of the theory that phthisis is hereditary, and shows that the general laws of inheritance, which are known to hold good for other conditions and diseases, especially insanity, are observed in the transmission and development of the phthisical inheritance. It is observed that the possession of a family history of phthisis predisposes the individual to phthisis in greater measure than the community at large: a chief difference between hereditary and acquired phthisis being the early anticipation of the date of attack; and differences of marked importance are observed in the effects of heredity derived from different relations.

As regards the effects of paternal heredity on the males, it has been shown that the liability extends over the whole period of life up to sixty-five, but the greatest susceptibility is exhibited in a marked

manner between ten and thirty, gradually increasing up to twenty-five, and after that period decreasing in numbers, and assuming insignificant proportions after forty-five.

Bearing in mind that the general behaviour of the male towards acquired phthisis shows greater constitutional resistance in all points to that disease, whereas the female exhibits a natural susceptibility to the disease, especially during the adult period of life, and that heredity reduces, speaking generally for all conditions combined, the natural resistance of the male, even to a lower level than it does for the female, the hereditary influence is more potent for evil as regards the male than as regards the female; and this is particularly manifest in the development by males of the maternal heredity, and consequently (as including this influence) of the double heredity.

The maternal heredity shows less extended liability; the numbers after forty being practically insignificant: the susceptibility is very marked for the period between fifteen and thirty, but the susceptibility between fifteen and twenty-five is even greater than under the influence of the father, and the virulence of the disease as regards rapidity and intractability is also greater.

The cases which have been collected show a decided

tendency in the mother to transmit the disease without necessarily developing it, and also according to my experience this is more frequently the case in the transmission of a tendency to hæmoptysis than occurs under the paternal heredity.

It is very necessary, therefore, to bear in mind that either parent may be the silent repository of the heredity, never develop the disease at all, and yet transmit in all virulence the inheritance of the disease; the mother is a frequent intermediary in such silent transmission, and, as in hæmophilia, the tendency to hæmoptysis may be transmitted from the mother and be specially developed in the males.

Similar conclusions hold good regarding asthma, which frequently alternates with, and is associated in the same generation with, phthisis. Consequently, with a family history of asthma or hæmoptysis, strict investigation should be made into the history of the ancestors and of the collateral relations.

Double heredity is in every way worse than any form of single heredity; liability does not assume insignificant proportions until forty-five is attained; the increased anticipation of the attack is shown by the great susceptibility of the period between fifteen and twenty—in all points cases of double heredity appear very dangerous.

Atavism has been shown to be a most important influence, and is not to be considered as diluted inheritance; if it be coupled with parental development the effect is very serious from the extent to which the family is affected; the interposition of two silent generations is not sufficient to eliminate the risk of inheritance.

As regards females, the occurrence of marriage and its consequent risks are so great in all degrees of phthisical relationship, that the probability of such an event makes it extremely dangerous to deal with such lives and upsets calculations upon the subject. The effect of the paternal heredity is however so far the most favourable that cases having such a history might be dealt with, perhaps, after a certain period of life.

We may now proceed to suggest the mode of dealing with applications involving the different degrees of inheritance. In order to simplify, as far as possible, the various complications of individual health, age, and degree of inheritance which, taken together, form an almost endless series of combinations, I would present the following scheme of conditions to form a starting point for our calculations.

The applicant must either have a perfectly clean bill of health in every respect, or he may have had

the zymotic diseases of childhood ; in the first case the applicant might be considered in regard to personal history as first class, in regard to the second as second class. I should decline any applicant who from previous or present ailments ought to rank as third class ; and, in regard to the word ailment, I incline to look with marked suspicion upon cases of so-called colds which require medical treatment ; previous attacks of zymotic diseases of all kinds, of rheumatism and of pleurisy (particularly during adult age), are to be regarded with suspicion, inasmuch as such attacks about the period of growth seldom leave the body in as good a condition as that in which they found it, and moreover specially encourage the attacks of phthisis. Practically, therefore, the applicant should be in good health, and have always enjoyed good health.

The next point to be considered relates to the degrees of relationship, and the number of members involved in the family history of phthisis, and it will be convenient to arrange them in different classes in such manner as to indicate the estimate which should be attached in weighing the probable influence of heredity upon the life of the applicant.

The following classification appears to me warranted by experience and by the evidence adduced in these pages as regards males.

In the first class of least bad cases might be ranked the implication of a sister or one collateral relation solely, or of a brother if the disease was developed at a late period of life, and was distinctly acquired.

In the second class of bad cases might be put the implication of a brother and sister, many collaterals, especially if on the mother's side and if there be evidence of sexual limitation, and the father's heredity alone.

In the third class of very bad cases might be put the implication of grandparents, the father with one other of the children, collateral relations pointing to atavism, the implication of many brothers and sisters, family asthma, hæmoptysis without family implication, and the mother's heredity alone.

In the fourth class of objectionable cases might be put (in most cases for rejection), the father with many members of the family, the mother with other members of the family, the grandparents and parents, double heredity, and hæmoptysis with a history of family implications.

If many members of the family have been implicated, numbers alone would suffice to put any one of them in this fourth class.

But inasmuch as the age of the applicant is an

important point, I would propose to divide the periods of life into four:

1. Before twenty-five years of age.
2. Between twenty-five and thirty-five.
3. Between thirty-five and forty-five.
4. After forty-five.

This arrangement into four classes of heredity and four periods of life will facilitate the consideration of the subject, and help to simplify the estimate to be made in particular cases.

It may be stated at once that as the effects of inheritance are so marked before twenty-five years of age, it appears to me advisable to reject applicants with a distinct family history until they have reached that age; the first proposition I would therefore put forward admits of very few exceptions:

1. No applicant having a distinct family history of phthisis should be accepted until he has reached the age of twenty-five.

2. The next period to consider is that between twenty-five and thirty-five, a period which involves a good deal of business, and presents cases of the greatest difficulty, complexity, and anxiety for the medical examiner.

Again the ground may be cleared by stating that

all cases occurring under the fourth class should be rejected until the second and third periods have been passed, and the applicant has consequently arrived at the age of forty-five.

The first class might be assured by charging a small extra premium, say three years, or at ordinary rates if over thirty.

In regard to the admission of the second and third classes for the second period, from twenty-five to thirty-five, the following arrangement is not only fair to the applicant but devoid of risk to the office, and the principle of the scheme, which was first devised by Mr. Morrice A. Black and has been developed by Mr. Wilfrid A. Bowser, is correct, because as the risks are loaded upon the first years of insurance, the addition of a number of years to the life does not practically meet the requirements of the case.

Instead of charging an additional premium in these cases, the ordinary rates are charged, but a reduction corresponding to the estimated extra risk is made from the sum assured in the event of death happening within a stipulated number of years, corresponding to the expectation of life. The amount of this deduction decreases every year survived, and the policy becomes free when the assured has completed the probationary term.

For example, suppose an application for a policy is made by a young man twenty-nine years of age, with such a family history that the medical examiner considers the addition of seven years advisable.

The expectation of life would be thirty-five years, and the estimated deduction would be 1*l.* 9*s.* per cent. per annum. If the man died in the first year of assurance the deduction to be made from each 100*l.* assured would be 1*l.* 9*s.* × 35 = 50*l.* 15*s.*; if he died in the second year the sum deducted would be 49*l.* 6*s.*, and so on.

If, however, the usual plan of extra premiums be adhered to, then the time had better be extended for the rejection of cases; that is to say, that applicants in the second and third class of inheritance should be rejected until they had attained the age of twenty-eight years.

From this period until thirty-five years of age applicants in the second class might be rated in accordance with an addition of five years, those in the third class being charged for seven years.

From thirty-five to forty-five, the second class applicants might be charged three years, and those in the third five years.

The method generally adopted, of surcharging the life, is unsatisfactory, because it is not so well adapted

to the immediate risks of the first years of assurance, and is often objected to by a healthy man with a doubtful family history. The scheme previously described is therefore to be preferred as avoiding loss to the office, and the payment of too heavy a tax by the applicant.

3. When the applicant has reached the third period of life, between thirty-five and forty-five, the case may be dealt with in the ordinary way by the addition of a certain number of years, and, speaking generally, it would probably suffice to charge extra rates, equivalent to the addition of three to five years for the second class, and five to seven years for the third class.

The first class might be admitted without extra charge.

4. For the fourth period, with the knowledge that the effects of heredity are for this age reduced to insignificant dimensions, almost all cases might be assured without an additional premium as regards the first, second, and third classes; although I should consider that cases of paternal heredity still demanded some addition.

As regards the fourth class, much caution should be exhibited in the selection of cases, especially in reference to numbers implicated, and to cases of double heredity and family hæmoptysis. I doubt whether

it be at all advisable to accept any instances of the two last-mentioned cases.

As regards the assurance of female lives, the risk during the period of child-bearing is so great to a woman who has a history of family phthisis, that it appears to me very unadvisable to accept any such case until the applicant shall have reached the age of forty-eight.

When the chance of child-bearing is over, female applicants might be assured at additional rates, such rates not being heavy, and being especially light in the event of paternal heredity being present.

Cases of maternal heredity would require a greater addition, and no case of double heredity should be accepted.

Although hereditary influence is most frequently looked upon as adding risk to the life, we must not lose sight of the fact that there is another side of the question, and it has been long known that longevity is apt to run in families.

This effect of inheritance, which especially occurs under atavism, has been shown to hold good in cases of cancer by Sir James Paget, and the fact has been discussed by Darwin.

From the results of the Medical Investigations of the United States Insurance Company it would

appear that this holds good also in some cases for phthisis.

I have collected the following cases from that report as showing that the lives of the third generation may be extended, apparently under the influence of atavism, although one of the parents may have died from phthisis.

Case 46.—Grandparents lived from 68 to 75.
Mother died of consumption, 66.
Father died, 84.
Brothers and sisters all died at advanced ages.
Son, 74, alive.

Case 47.—Grandparents, 69, 89, 73, 81.
Mother died of consumption, 55.
Father died, 71.
Brothers and sisters, living, 65 to 77.
Son, living, 72.

Case 48.—Grandparents:—Two grandfathers, 88, 77.
Father died of consumption, 59.
Mother died, 74.
Three brothers alive, eldest 81.
One sister, living, 83.
Two sisters died of cancer.
Son, living, 71.

Case 49.—Grandparents, 79 to 93.
Father died, 28, of consumption.
Mother died, 91.
Brothers, 80 to 82.
Son, living, 78.
One son died of cancer.

Case 50.—Grandparents, 75 to 85.
Father died of consumption (age not stated).

Mother died, 77.
Brothers and sisters, 60 to 90.
Son, 73.

An attempt has been made to arrive at some conclusion regarding the probability of life from the resemblance of the individual to the healthy or diseased parent, but the following case shows that this comparison is not of value for individual cases :

Case 51—A young man, of 29, came into hospital under my care with a history of hæmoptysis.

The family history was as follows : The paternal grandmother was an extremely healthy, robust woman of 85, and frequently visited the patient. The father was a fine, tall, healthy man of 6 feet. The patient himself was a fine, well-made man, 6 feet high, 45 inches round the chest, and 10 st. 11 lbs. in weight, and resembled the father very closely. But, on the mother's side, the grandmother died of asthma at 68 ; the mother died of phthisis at 42, and out of the four sons, who were the only children, the patient had hæmorrhage, aged 29 ; the second son died of phthisis, aged 19 ; the third son died of phthisis, aged 17 ; and the youngest son, aged 17, was suffering from phthisis. Although the patient had all the build of a strong, healthy, and fine young man, he died of hæmoptysis, and was found to have tubercle. The hæmoptysis was traced with probability to a pulmonary apoplexy of the lower lobe of the right lung.

Moreover, the resemblance of the individual has

been observed to vary at different ages, and in early life a person may resemble one parent, while in later life the resemblance may be to the other parent.

Maudsley has a similar observation on the same point; he says that he has noticed in some cases that a likeness to one parent, or to his or her family type, which comes out strongly at one period of life may wane and gradually be replaced by a greater likeness to the other parent, or to his or to her family type, at a later period of life.[1]

Bearing in mind, too, that the parental inheritance is due to both parents, and that every one partakes in some degree of both, it would be unwise to risk any large sums of money upon a theory which is not in accordance with general laws.

In concluding this chapter, I may be excused for insisting upon some points which are perfectly well known to those who are experienced medical examiners, but in regard to which erroneous statements are sometimes made.

Phthisis although acquired in one generation certainly may be transmitted by inheritance to the second generation, just as other conditions and diseases which are purely acquired may be transmitted and developed in the offspring. Transmission does not

[1] *Pathology of Mind*, p. 118.

always include development, and the intermission of even two generations without development will not always prevent the appearance of the disease in the fourth generation.

Underweight, not light weight, is, as Dr. Huntington has remarked,[1] a very serious matter even though no apparent disease be present; the inherited influence is so impressed in the individual that, even if it be successfully kept in abeyance, it persists, probably, through the whole period of life, although its influence may be attenuated by advancing years.

The personal appearance of the applicant must not allow us to underrate the effect of inheritance, and no outward signs of health and vigour should exempt the applicant from that tax which belongs to the particular family history of the case; inheritance, we may depend upon it, is far too subtle, widespread, and potent an influence to be weighed in the balance lightly.

[1] *Annual Report of the United States Life Insurance Company*, p. 62.

CHAPTER XV.

THE PREVENTION OF FAMILY PHTHISIS.

THE evidence which has been discussed in the previous pages will, I trust, convince even the most sceptical that phthisis is an hereditary disease capable of being transmitted from ancestor to descendant, and from parent to child; it is imperative, then, that we should consider what means may be adopted for the future prevention of the spread of this disease, and what advice may be given to those who conscientiously desire to avoid the error and misfortune of bringing children into the world who are probably destined from their earliest days to swell the list of deaths from consumption.

Medical writers who have discussed the question of marriage for those persons who have a family history of the disease have given very decided opinions against such marriages; but, although such advice may be the reasonable result of logical conclusions on the subject, it is evident from the

knowledge we possess as to the great extension of the disease in this country that the promiscuous proscription of marriage for any one whose family is tainted with a suspicion of phthisis would result, if such advice was obeyed, in a considerable limitation of the population, which would in the end lead to the catastrophe of national degeneration, however much in these hard times some diminution in the overcrowding may be earnestly desired by some; and it would also tend to discourage marriage among a class of persons who, from their amiable and intellectual disposition, are especially qualified for marriage and likely to procreate intellectual and amiable offspring.

In his desire to check the manifestation of disease the physician may feel theoretically bound to discountenance and strongly oppose the marriage of the phthisical, but such advice cannot be given practically in all cases without some distinction, for many reasons.

There appears to be little doubt that there are degrees of intensity and extent observed in the transmission of all hereditary diseases, and while some families exhibit a lamentable tendency to suffer from the disease in its most rapid form, others again develop a disposition to the more chronic forms, and many

escape altogether; and though the more knowledge we have on this subject the more impressed we become with the distinct and definite character of the laws of inheritance, yet our ignorance of all the conditions invalidates advice on the subject, the present apparent capriciousness of inheritance making it uncertain to us whether the offspring will necessarily develop the special taint transmitted by the parents.

In his remarks upon the general results of inheritance, Darwin has carried his conclusions to the ultimate logical point in saying that both sexes ought to refrain from marriage if they are in any marked degree inferior in body or mind; but such hopes, he adds, are Utopian, and will never be even partially realised until the laws of inheritance are thoroughly known.[1]

But fortunately in dealing with the hereditary disposition to phthisis we have to do with a disease which may by proper precautions be kept in abeyance. We may not say that the heredity can be eliminated, because we have too strong evidence that it may be still transmitted although all symptoms may be latent, but it is neither dangerous to the community nor does it entail the responsibilities and difficulties which are so often experienced in cases of hereditary

[1] *The Descent of Man*, p. 217.

insanity; but even for this latter disease the same difficulties regarding marriage arise.

Maudsley, in his work on responsibility in mental disease, remarks that 'it would be a hard and unwelcome thing to lay down rules for the prevention and regulation of marriages in accordance with what might seem to be the sober dictates of reason; even if—which is not the case—science had arrived at such a degree of development as to be able to do so with exactness and authority. Moreover we are not sure how great may be the compensating advantages of seemingly unwise marriages.'[1]

If we look back at the number of families in our own cognisance, where one parent has been disposed to phthisis, we must, I think, be struck with the rare promise of intellectual work that has been shown in the offspring of such a parent; how apparent it is that the tendency to disease is counterbalanced by delicacy of feeling, and by intellectual capacity which results in the best moral and scientific work; and how often it happens that only one out of the family may die of consumption, or they may all escape.

Each case should be considered on its own merits, and advice should be given only after a careful personal examination and estimate of the pros and

[1] *Responsibility in Mental Disease*, p. 278.

cons, just as is done in applications for life assurance. Early marriages for both sexes, as likely to lead to the procreation of extensive families, should certainly be discountenanced, and with any suspicion of family taint it would be prudent to postpone the event until thirty-five. But marriage does not induce so much danger to the man as to the woman, and it is for her that care and prudence must be specially inculcated.

The dangers of child-bearing and of lactation are very great, and although it is true that the condition of pregnancy may serve to keep in abeyance the symptoms of the disease if already established, it is a lamentable fact that the consequences of child-bearing are very pernicious, and often lead to rapidly fatal conditions.

All writers on the subject of the treatment of phthisis have entered so fully into particular details that it would be superfluous for me to lay down a code of instructions on the subject, and what should be said might be concisely summed up in three golden precepts: plenty of good food, fresh air, and regular exercise.

In all points the mother must be as careful for herself as for her babe, and that very delicacy of organisation which forms the special heirloom of the

child should make the parent very careful of exposure either to the ordinary risks of weather and of damp, or the extraordinary risks of contagious diseases from which such a child will inevitably suffer more than another free from the heredity; very careful, too, as to the risks of premature education, of which these times afford too many and glaring instances; the child's intellect had better lie fallow, and he had better be taught to labour with his hands, than be forced to early decay, especially by night work, which tends to prevent sleep or procure fitful dreams, and thus interferes with the due regeneration of tissues which have suffered from the day's work.

The effect of properly devised and well regulated gymnastics in developing the feeble frame and expanding the shallow chest and lungs, is extremely remarkable, even when the exercises are only carried out for one hour in the week.[1]

In the selection of proper schools much responsibility rests upon the parents; but the hygienic arrangement of schools is now so much better understood than formerly, and there are so many well conducted and carefully supervised schools in specially healthy localities, and by the seaside, that there is embarrassment in the choice from the number.

[1] See *Physical Education* by A. Maclaren.

Again, in the selection of occupation and pursuits, much may be done, especially in avoiding such as are known to engender phthisis, and recommending those which may be looked upon as prophylactic against the disease.

As regards the experience of the hospital, the influence of trades and occupations has been fully examined in the First Medical Report.

The relative liability of persons following indoor and outdoor occupations was found to be—63 per cent. indoor and 30 per cent. followed outdoor occupations among the males, while all the women followed occupations, and a more detailed investigation of the relative number of different occupations showed that the disease is extremely rife amongst clerks, printers, tailors, milliners, and indoor servants.

This subject has also been examined by Mr. Dovey in his work before alluded to, with regard to a superior class of society; and in comparing the professions and occupations of those dying from consumption and from other diseases, he found that consumption attacked clerks and artisans in preference to farmers and professional men.

The profession of the navy may be followed by all classes with advantage in regard to the prevention of phthisis, and it is perhaps the very best that could be

adopted; the small percentage of deaths which is exhibited in the returns of the merchant service, notwithstanding the many hardships to which the men are exposed, especially in regard to cold and wet, shows how an active life, like the sailor's, with plenty of exercise and fresh air, tends to prevent the attack of this disease.

Without laying down too stringent or absurd rules regarding the avoidance of the development of phthisis, it is quite evident that much may be happily accomplished by a foreknowledge of causes and by due attention to the results of experience; and if it be neither fair nor wise to prohibit the marriage of the phthisical in all cases and under all circumstances, it is imperative that those who are responsible should inculcate the necessity of care in the selection of a fit mate, and in the strict and constant observation of hygienic precautions to avoid the subsequent development of the inherited tendency.

Wise and prudent parents, who have made themselves acquainted with the laws of phthisical inheritance, can undoubtedly help to prevent imprudent marriages; they can in great measure guide the friendships and arrange the propinquity of their children in reference to their neighbours, and they have this power and opportunity especially in the

case of the daughters, whose *rôle* in the transmission of heredity is so important.

The outdoor games and sports, which have of late years proved so attractive and fashionable, may be expected to produce the best results in the development of vigour, and there is to my mind no better promise of the future diminution of phthisis in this country than that which is to be derived from the love of outdoor exercise and that disposition to join in manly games now so generally manifested among the growing generation of women.

Whatever may be said against such exercises on the score of alteration of the female form, the standard of beauty is not fixed, and it will probably undergo change as the eyes of men get accustomed to different lines; the practical advantage to be derived from the expansion of the chest and the healthy and vigorous development of the female frame is too palpable against such trivial objections. The question of marriages of near consanguinity has been much discussed of late years, but there is no reason for concluding that such marriages conduce to phthisis.

Pollock, in discussing this point,[1] states his opinion that this disease is not directly produced under such circumstances, and as far as I am aware there is no

[1] *Elements of Prognosis*, p. 345.

evidence to show that the special evil of these marriages is consumption; whatever arguments may be raised against the desirability of the marriages of near relations upon other scores, all that perhaps may be said upon this point with regard to the disease under consideration is, that any one with a suspicion of family phthisis should avoid marriage with a near relative, as likely to result in the accentuation of the family taint.

Until the truth of the case be fully and generally recognised, that in dealing with inherited phthisis we are confronted with a constitutional defect, a structural disease which cannot be eradicated by the exhibition of drugs, which constantly demands due attention to the laws of health by which the structural growth and development of the body may be improved and the constitutional power of resistance to disease increased, erroneous prognosis will be frequent, drugs which are no remedies will be ever cropping up, the golden harvest of quackery will be abundant, the public will swallow with avidity anything advertised or recommended by their friends, never heeding the source from which such false helps come to them, the ignorance which has devised them, or the condemnatory experience of the experts who have tried them; while, had a better knowledge of

the laws of inheritance prevailed, many might have succeeded, as many before them have done, in warding off the final attack of the disease by due attention to the preservation of health and the improvement of constitutional powers.

In these pages the attempt has been made, from the laborious arrangement of a large number of cases, to show that family phthisis is, in a number of cases, the result of the hereditary transmission of the disease, and that such cases are subservient to stern and unflinching laws. Thoughtful consideration of the results of this inheritance will, I trust, induce some belief in the application of these laws to the ordinary conditions of life.

The physician, in striving to give relief to the sufferings of the consumptive patient, and to arrest the progress of disease when it has once broken out, is like the fireman who does his utmost to extinguish the fire which is destroying some precious edifice, and both are doing their duty with praiseworthy intent; but, as prevention is better than cure, it is preferable to guard against the outburst of a fire by fire-proof construction of the building, and to ward off the onset of the disease by the invigoration of the feeble frame.

From the advance of medical science some knowledge of the laws which govern health and disease

has been attained, and from its further progress more may still be expected; and when the principles of inheritance are more widely known and appreciated, each man and each woman will make use of the knowledge not only to maintain the vigour of their own bodies by the full development of mind and body, but they will also learn to what great degree they are answerable in the condition of their own bodies for the building up of the bodily and mental structure of their offspring; and, from the practical application of this knowledge in matters of daily life, we may confidently look for some diminution of disease and the consequent advancement of the well-being of mankind.

APPENDIX

CONTAINING

THE TABULATION OF ACTUAL CASES.

TABLE A.

Fathers (generally).

MALES, 600.

AGES	1	10	15	20	25	30	35	40	45	50	55	60	TOTAL
Cases	7	32	108	124	129	86	63	25	10	6	9	1	600
Worse . . .	...	11	30	49	42	22	30	7	6	4	2	1	204
Improved . .	7	20	54	38	50	37	19	15	3	...	4	...	247
Deaths . . .	...	7	13	23	23	11	8	4	1	1	1	1	93
In 6 months . .	...	...	1	2	...	...	1	...	...	...	...	1	5
In 18 months . .	...	1	6	14	12	5	5	...	1	1	1	...	46
Acute . . .	1	7	40	55	47	31	21	5	4	1	4	1	217
Subacute . . .	3	11	36	34	37	31	25	11	4	5	2	...	199
Chronic . . .	3	14	32	35	45	24	17	9	2	...	3	...	184
Hæmoptysis : copious .	1	6	20	25	37	18	12	6	...	...	2	1	128
,, moderate	...	1	21	28	23	10	5	5	2	...	1	...	96
,, slight .	2	8	38	40	29	19	23	5	4	5	4	...	177
,, nil .	4	17	29	31	40	39	23	9	4	1	2	...	199

TABLE B.

Fathers (*Fathers only*).

MALES, 300.

AGES	1	10	15	20	25	30	35	40	45	50	55	60	TOTAL
Cases	3	19	56	70	60	41	24	12	7	3	4	1	300
Worse	...	7	17	28	19	10	14	1	3	2	1	1	103
Improved	3	11	28	23	24	20	5	10	3	...	2	...	129
Deaths	...	5	7	15	10	5	2	...	1	1	...	1	47
In 6 months	...	...	1	2	...	...	1	...	...	...	...	1	5
In 18 months	...	1	5	8	7	3	...	...	1	1	...	...	26
Acute	1	5	21	34	24	12	9	3	2	1	1	1	114
Subacute	1	4	18	18	17	12	11	5	3	2	1	...	92
Chronic	1	10	17	18	19	17	4	4	2	...	2	...	94
Hæmoptysis : copious	1	3	9	17	14	12	5	2	...	...	1	1	65
,, moderate	...	1	8	19	9	5	4	3	2	...	...	...	51
,, slight	...	8	25	20	16	12	5	3	4	2	1	...	96
,, nil	2	7	14	14	21	12	10	4	1	1	2	...	88

TABLE C.

Father's Brothers and Sisters.

MALES, 300.

AGES . . .	1	10	15	20	25	30	35	40	45	50	55	60	TOTAL
Cases	4	13	52	54	69	45	39	13	3	3	5	...	300
Worse . .	...	4	13	21	23	12	16	6	3	2	1	...	101
Improved . .	4	9	26	15	26	17	14	5	...	...	2	...	118
Deaths . .	...	2	6	8	13	6	6	4	...	...	1	...	46
In 6 months . .	...	...	...	...	...	...	...	...	...	...	...	...	...
In 18 months . .	...	...	1	6	5	2	5	...	...	...	1	...	20
Acute . .	...	2	19	21	23	19	12	2	2	...	3	...	103
Subacute . .	2	7	18	16	20	19	14	6	1	3	1	...	107
Chronic . . .	2	4	15	17	26	7	13	5	...	...	1	...	90
Hæmoptysis : copious .	...	3	11	8	23	6	7	4	...	...	1	...	63
,, moderate	...	...	13	9	14	5	1	2	...	...	1	...	45
,, slight .	2	...	13	20	13	7	18	2	...	3	3	...	81
,, nil .	2	10	15	17	19	27	13	5	3	...	...	...	111

TABLE D.

Mothers (generally).

MALES, 500.

AGES	1	10	15	20	25	30	35	40	45	50	55	60	TOTAL
Cases	5	9	108	135	105	65	40	15	11	3	1	3	500
Worse . . .	...	3	46	58	41	15	13	4	...	2	...	...	182
Improved . .	4	5	39	48	31	23	13	9	9	1	1	2	186
Deaths . . .	...	2	17	27	22	6	6	...	...	...	...	...	80
In 6 months . .	...	...	2	2	1	...	1	...	...	...	...	...	6
In 18 months . .	...	1	9	13	7	4	2	...	...	...	...	...	36
Acute	1	3	50	62	42	23	14	7	6	1	1	2	212
Subacute . . .	2	2	32	36	30	22	10	7	1	1	...	1	144
Chronic . . .	2	4	26	37	33	20	16	1	4	1	...	...	144
Hæmoptysis : copious .	...	...	27	40	45	21	11	3	4	...	...	1	152
,, moderate	...	3	16	20	16	12	8	1	3	...	...	...	79
,, slight .	3	1	32	44	24	16	7	3	...	2	...	...	132
,, nil .	2	5	33	31	20	16	14	8	4	1	1	2	137

TABLE E.

Mothers (only).

MALES, 300.

AGES	1	10	15	20	25	30	35	40	45	50	55	60	TOTAL
Cases	2	5	68	85	62	38	23	8	4	1	1	3	300
Worse . . .	...	3	27	39	25	10	9	3	...	...	...	...	116
Improved . .	1	2	27	31	16	15	5	4	4	1	1	3	110
Deaths . . .	...	2	10	19	12	4	4	...	...	...	...	...	51
In 6 months . .	...	...	1	...	1	...	1	...	...	...	..	...	3
In 18 months . .	...	1	5	10	3	2	2	...	...	...	...	...	23
Acute . . .	1	3	28	43	25	10	9	6	1	...	1	2	129
Subacute . . .	...	1	22	22	17	17	5	2	...	1	...	1	88
Chronic . . .	1	1	18	20	20	11	9	...	3	...	...	...	83
Hæmoptysis : copious .	...	...	17	23	29	12	5	1	3	...	...	1	91
,, moderate	...	1	10	12	7	5	7	...	1	...	...	...	43
,, slight .	1	1	23	28	16	7	3	2	...	...	...	...	81
,, nil .	1	3	18	22	10	14	8	5	...	1	1	2	85

TABLE F.

Mother's Brothers and Sisters.

MALES, 200.

AGES	1	10	15	20	25	30	35	40	45	50	55	60	TOTAL
Cases	3	4	40	50	43	27	17	7	7	2	...	...	200
Worse . . .	...	...	19	19	16	5	4	1	...	2	...	...	66
Improved . .	3	3	12	17	15	8	8	5	5	...	...	...	76
Deaths . . .	...	...	7	8	10	2	2	...	...	...	...	...	29
In 6 months . .	...	...	1	2	...	...	...	...	...	...	...	...	3
In 18 months . .	...	...	4	3	4	2	...	...	...	...	...	...	13
Acute	...	...	22	19	17	13	5	1	5	1	...	...	83
Subacute . . .	2	1	10	14	13	5	5	5	1	1	...	...	57
Chronic . . .	1	3	8	17	13	9	7	1	1	...	...	...	60
Hæmoptysis : copious .	...	...	10	17	16	9	6	2	1	...	...	...	61
,, moderate	...	2	6	8	9	7	1	1	2	...	...	...	36
,, slight .	2	...	9	16	8	9	4	1	...	2	...	...	51
,, nil .	1	2	15	9	10	2	6	3	4	...	...	...	52

TABLE G.

Fathers (generally).

FEMALES, 400.

AGES	1	10	15	20	25	30	35	40	45	50	55	60	TOTAL
Cases	10	26	83	121	76	42	26	12	4	...	...	...	400
Worse . . .	2	8	26	38	31	15	9	2	...	...	...	...	131
Improved . .	8	15	34	52	23	17	11	8	3	...	...	...	171
Deaths . . .	1	6	12	18	13	6	4	1	...	...	...	...	61
In 6 months . .	...	1	5	...	...	...	1	...	...	..	...	...	7
In 18 months . .	...	3	7	9	10	6	1	...	...	...	...	...	36
Acute . . .	1	14	46	44	29	15	13	2	1	...	...	...	165
Subacute . . .	2	5	20	35	25	16	9	4	1	...	...	...	117
Chronic . . .	7	7	17	42	22	11	4	6	2	...	...	...	118
Hæmoptysis : copious .	1	8	14	28	17	7	5	4	3	...	...	...	87
,, moderate	1	1	8	13	8	8	2	4	1	...	...	...	46
,, slight .	4	7	27	52	29	12	9	2	...	...	...	...	142
,, nil .	4	10	34	28	22	15	10	2	...	...	...	...	125

TABLE H.

Fathers (only).

FEMALES, 300.

AGES	1	10	15	20	25	30	35	40	45	50	55	60	TOTAL
Cases	8	22	59	99	49	31	20	9	3	...	...	...	300
Worse . . .	1	5	21	28	19	11	8	1	...	...	...	...	94
Improved . .	7	14	25	47	16	13	8	7	3	...	...	...	140
Deaths . . .	...	4	12	12	10	5	3	...	...	...	...	...	46
In 6 months . .	...	1	5	...	...	...	1	...	...	...	...	...	7
In 18 months . .	...	2	7	6	9	5	1	...	...	...	...	...	30
Acute	1	12	35	37	21	10	10	1	1	...	...	...	128
Subacute . . .	2	4	14	29	16	13	7	4	...	...	...	...	89
Chronic . . .	5	6	10	33	12	8	3	4	2	...	...	...	83
Hæmoptysis : copious .	1	8	9	22	10	3	5	2	2	...	...	...	62
,, moderate	1	1	4	10	6	3	...	4	1	...	...	...	30
,, slight .	2	7	16	41	21	11	8	2	...	...	...	...	108
,, nil .	4	6	30	26	12	14	7	1	...	...	...	...	100

TABLE I.

Father's Brothers and Sisters.

FEMALES, 100.

AGES	1	10	15	20	25	30	35	40	45	50	55	60	TOTAL
Cases	2	4	24	22	27	11	6	3	1	...	...	...	100
Worse . . .	1	3	5	10	12	4	1	1	...	...	...	...	37
Improved . .	1	1	9	5	7	4	3	1	...	...	...	...	31
Deaths . . .	1	2	...	6	3	1	1	1	...	...	...	...	15
In 6 months . .	...	...	...	...	...	...	...	...	...	...	...	...	...
In 18 months . .	...	1	...	3	1	1	...	...	...	...	...	...	6
Acute . . .	...	2	11	7	8	5	3	1	...	...	...	...	37
Subacute . . .	...	1	6	6	9	3	2	...	1	...	...	...	28
Chronic . . .	2	1	7	9	10	3	1	2	...	...	...	...	35
Hæmoptysis : copious .	...	...	5	6	7	4	...	2	1	...	...	...	25
,, moderate	...	...	4	3	2	5	2	...	...	...	...	...	16
,, slight .	2	...	11	11	8	1	1	...	...	...	...	...	34
,, nil .	...	4	4	2	10	1	3	1	...	...	...	...	25

TABLE J.

Mothers (generally).

FEMALES, 450.

AGES . . .	1	10	15	20	25	30	35	40	45	50	55	60	TOTAL
Cases	7	32	85	135	95	44	33	16	3	...	...	...	450
Worse . . .	2	14	32	53	39	19	12	8	1	...	...	...	180
Improved . .	4	14	37	62	31	14	14	2	...	...	...	...	178
Deaths . . .	...	7	17	30	23	12	8	7	1	...	...	...	105
In 6 months . .	...	...	1	1	5	1	2	...	...	...	...	...	10
In 18 months . .	...	3	15	16	13	5	2	4	...	...	...	...	58
Acute . . .	1	11	47	60	46	18	16	7	...	...	...	...	206
Subacute . . .	1	11	26	41	23	8	7	7	3	...	...	...	127
Chronic . . .	5	10	12	34	26	18	10	2	...	...	...	...	117
Hæmoptysis : copious .	...	6	16	18	24	8	8	2	1	...	...	...	83
,, moderate	3	2	12	20	22	7	1	1	1	...	...	...	69
,, slight .	...	10	23	61	25	7	11	7	1	...	...	...	145
,, nil .	4	14	34	36	24	22	13	6	...	...	...	...	153

TABLE K.

Mothers (only).

FEMALES, 300.

AGES	1	10	15	20	25	30	35	40	45	50	55	60	TOTAL
Cases	6	27	56	98	58	28	18	7	2	...	...	...	300
Worse . . .	2	12	21	34	28	13	9	3	...	...	...	...	122
Improved .	3	12	24	47	16	9	5	...	...	...	...	...	116
Deaths . . .	...	7	14	20	19	8	6	3	...	...	...	...	77
In 6 months . .	...	...	1	1	5	1	2	...	...	...	...	...	10
In 18 months . .	...	3	13	12	10	3	...	2	...	...	..	...	43
Acute . . .	1	11	35	43	34	13	7	3	...	...	...	...	147
Subacute . . .	1	10	17	30	12	5	6	4	2	...	...	...	87
Chronic . . .	4	6	4	25	12	10	5	...	...	...	...	...	66
Hæmoptysis: copious .	...	5	6	10	12	5	5	1	1	...	...	...	45
,, moderate	2	2	9	13	13	5	...	...	...	...	...	...	44
,, slight	...	8	20	46	16	3	5	3	1	...	...	...	102
,, nil	4	12	21	29	17	15	8	3	...	...	...	...	109

TABLE L.

Mother's Brothers and Sisters.

FEMALES, 150.

AGES	1	10	15	20	25	30	35	40	45	50	55	60	TOTAL
Cases	1	5	29	37	37	16	15	9	1	...	...	...	150
Worse . . .	...	2	11	19	11	6	3	5	1	...	...	...	58
Improved . .	1	2	13	15	15	5	9	2	...	...	...	...	62
Deaths . . .	...	...	3	10	4	4	2	4	1	...	...	...	28
In 6 months . .	...	...	...	...	...	...	...	...	...	...	...	...	...
In 18 months . .	...	...	2	4	3	2	2	2	...	...	...	...	15
Acute	...	...	12	17	12	5	9	4	...	...	...	...	59
Subacute . . .	...	1	9	11	11	3	1	3	1	...	...	...	40
Chronic . . .	1	4	8	9	14	8	5	2	...	...	...	...	51
Hæmoptysis: copious .	...	1	10	8	12	3	3	1	...	...	...	...	38
,, moderate	1	...	3	7	9	2	1	1	1	...	...	...	25
,, slight .	...	2	3	15	9	4	6	4	...	...	...	...	43
,, nil .	...	2	13	7	7	7	5	3	...	...	...	...	44

TABLE M.

Brothers and Sisters.

MALES, 600.

AGES	1	10	15	20	25	30	35	40	45	50	55	60	TOTAL
Cases	3	9	69	145	134	103	57	47	22	9	1	1	600
Worse . . .	1	3	25	52	53	31	19	14	11	1	...	1	211
Improved . .	1	5	30	47	47	41	26	17	7	5	1	...	227
Deaths . . .	...	2	12	18	21	17	6	7	3	...	...	...	86
In 6 months . .	...	1	1	2	...	2	1	1	...	...	...	...	8
In 18 months . .	...	1	8	7	8	10	1	3	2	...	...	...	40
Acute	...	2	19	38	38	35	10	11	5	3	...	...	161
Subacute . . .	1	3	32	53	49	32	23	19	9	4	1	1	227
Chronic . . .	2	4	18	54	47	36	24	17	8	2	...	...	212
Hæmoptysis : copious .	...	2	17	36	37	29	13	10	4	1	...	...	149
,, moderate	1	1	11	30	20	15	3	13	...	...	...	...	94
,, slight .	1	2	23	37	41	35	22	13	7	6	...	...	187
,, nil .	1	4	18	42	36	24	19	11	11	2	1	1	170

TABLE N.

Family Phthisis. (Brothers and Sisters.)

MALES, 300.

AGES . . .	1	10	15	20	25	30	35	40	45	50	55	60	TOTAL
Cases	2	3	35	70	68	50	27	28	9	6	1	1	300
Worse . . .	...	1	14	20	26	12	8	10	5	1	...	1	98
Improved . .	1	2	15	26	26	22	15	8	2	3	1	...	121
Deaths . . .	...	1	8	7	11	8	4	5	1	...	...	...	45
In 6 months . .	...	...	...	...	...	1	1	1	...	...	...	...	3
In 18 months . .	...	1	6	3	3	5	...	1	1	...	...	...	20
Acute . . .	...	1	10	16	20	18	5	8	1	2	...	...	81
Subacute . . .	1	...	17	25	28	16	10	11	3	3	1	1	116
Chronic . . .	1	2	8	29	20	16	12	9	5	1	...	...	103
Hæmoptysis : copious .	...	1	12	21	19	16	8	4	1	...	...	...	82
,, moderate	1	...	5	14	11	7	1	6	...	...	...	...	45
,, slight .	1	2	10	17	18	17	7	8	2	4	...	...	86
,, nil .	...	...	8	18	20	10	11	10	6	2	1	1	87

TABLE O.

Family Phthisis. (*Brothers only implicated.*)

MALES, 300.

AGES . .	1	10	15	20	25	30	35	40	45	50	55	60	TOTAL
Cases	1	6	34	75	66	53	30	19	13	3	...	...	300
Worse . . .	1	2	11	32	27	19	11	4	6	...	...	...	113
Improved . .	...	3	15	21	21	19	11	9	5	2	...	...	106
Deaths . . .	...	1	4	11	10	9	2	2	2	...	...	...	41
In 6 months . .	...	1	1	2	...	1	...	...	...	...	...	...	5
In 18 months . .	...	...	2	4	5	5	1	2	1	...	...	...	20
Acute . . .	...	1	9	22	18	17	5	3	4	1	...	...	80
Subacute . . .	...	3	15	28	21	16	13	8	6	1	...	...	111
Chronic . . .	1	2	10	25	27	20	12	8	3	1	...	...	109
Hæmoptysis : copious .	...	1	5	15	18	13	5	6	3	1	...	...	67
,, moderate	...	1	6	16	9	8	2	7	...	...	...	...	49
,, slight .	...	...	13	20	23	18	15	5	5	2	...	...	101
,, nil .	1	4	10	24	16	14	8	1	5	...	...	...	83

TABLE P.

Family Phthisis. Brothers and Sisters (general).

FEMALES, 250 + 250 = 500.

AGES	1	10	15	20	25	30	35	40	45	50	55	60	TOTAL
Cases	6	20	107	121	104	65	36	27	10	4	...	...	500
Worse . , .	...	4	29	45	32	28	19	9	4	2	...	...	172
Improved . .	3	14	45	47	34	22	7	6	2	1	...	...	181
Deaths . . .	...	3	12	29	15	12	9	4	3	...	...	...	87
In 6 months . .	...	...	3	1	3	2	...	...	...	...	...	...	9
In 18 months . .	...	...	6	12	5	6	7	2	2	...	...	...	40
Acute	...	4	26	30	26	15	15	5	2	2	...	...	125
Subacute . . .	..	7	42	52	41	27	12	10	6	1	...	...	198
Chronic . . .	6	9	39	39	37	23	9	12	2	1	...	...	177
Hæmoptysis : copious .	...	3	23	29	36	16	8	5	3	1	...	...	124
,, moderate	1	2	11	16	12	5	7	2	...	1	...	...	57
,, slight .	3	9	40	38	27	22	8	12	4	1	...	...	164
,, nil .	2	6	33	38	29	22	13	8	3	1	...	...	155

TABLE Q.

Sisters (only).

FEMALES, 250.

AGES	1	10	15	20	25	30	35	40	45	50	55	60	TOTAL
Cases	2	12	50	54	57	41	17	11	3	3	...	...	250
Worse . . .	...	2	13	24	18	22	10	2	2	1	...	...	94
Improved . .	...	8	17	19	16	10	2	...	1	1	...	...	74
Deaths . . .	...	1	3	16	8	8	4	1	2	...	...	...	43
In 6 months . .	...	...	...	1	2	...	...	...	...	...	...	...	3
In 18 months . .	...	...	3	8	3	5	4	1	1	...	...	...	25
Acute . . .	...	2	11	14	15	11	7	2	1	2	...	...	65
Subacute . . .	...	2	16	20	26	17	4	6	2	...	...	...	93
Chronic . . .	2	8	23	20	16	13	6	3	...	1	...	...	92
Hæmoptysis : copious .	...	3	12	11	16	8	4	2	...	...	...	...	56
,, moderate	...	2	7	11	5	3	4	...	...	1	...	...	33
,, slight	2	6	20	18	14	14	2	6	1	1	...	...	84
,, nil	...	1	11	14	22	16	7	3	2	1	...	...	77

TABLE R.

Brothers and Sisters.

FEMALES, 250.

AGES	1	10	15	20	25	30	35	40	45	50	55	60	TOTAL
Cases	4	8	57	67	47	24	19	16	7	1	...	...	250
Worse	...	2	16	21	14	6	9	7	2	1	...	...	78
Improved	3	6	28	28	18	12	5	6	1	...	...	...	107
Deaths	...	2	9	13	7	4	5	3	1	...	...	...	44
In 6 months	...	...	3	...	1	2	...	...	...	...	...	...	6
In 18 months	...	...	3	4	2	1	3	1	1	...	...	...	15
Acute	...	2	15	16	11	4	8	3	1	...	...	..	60
Subacute	...	5	26	32	15	10	8	4	4	1	...	...	105
Chronic	4	1	16	19	21	10	3	9	2	...	...	...	85
Hæmoptysis: copious	...	...	11	18	20	8	4	3	3	1	...	...	68
,, moderate	1	...	4	5	7	2	3	2	...	...	...	...	24
,, slight	1	2	20	20	13	8	6	6	3	...	...	...	79
,, nil	2	6	22	24	7	6	6	5	1	...	...	...	79

TABLE S.

Double Heredity.

MALES, 200.

AGES	1	10	15	20	25	30	35	40	45	50	55	60	TOTAL
Cases	1	8	61	49	31	19	19	8	2	...	1	...	200
Worse . . .	1	2	38	28	20	8	9	2	...	...	...	...	108
Improved . .	...	4	23	16	6	2	2	4	2	...	1	...	60
Deaths . . .	1	2	24	14	13	2	1	1	...	...	...	...	58
In 6 months . .	...	...	9	1	1	...	...	...	...	...	...	...	11
In 18 months . .	...	1	6	10	11	2	1	...	...	...	...	...	31
Acute	...	2	34	31	21	6	10	5	1	...	1	...	111
Subacute . . .	...	2	17	11	5	4	6	2	1	...	...	...	48
Chronic . . .	1	4	11	7	5	9	3	1	...	...	...	...	41
Hæmoptysis : copious .	1	3	19	8	13	7	5	5	1	...	...	...	62
,, moderate	...	...	5	12	6	5	6	...	...	...	...	...	34
,, slight .	...	3	20	20	5	4	4	1	...	...	...	...	57
,, nil .	...	2	18	9	7	3	4	2	1	...	1	...	47

TABLE T.

Double Heredity.

FEMALES, 200.

AGES	1	10	15	20	25	30	35	40	45	50	55	60	TOTAL
Cases	2	23	55	58	37	11	7	5	2	...	...	...	200
Worse . . .	1	6	25	17	18	4	1	1	...	...	...	...	73
Improved . .	1	6	20	25	6	6	5	3	2	...	...	...	74
Deaths . . .	...	6	20	7	11	1	1	...	...	...	...	...	46
In 6 months . .	...	...	4	1	...	...	...	...	...	...	...	...	5
In 18 months . .	...	...	11	4	8	1	1	...	...	...	...	...	25
Acute	...	7	28	26	19	4	2	1	1	...	...	...	88
Subacute . . .	...	2	21	20	10	4	2	3	1	...	...	...	63
Chronic . . .	2	14	6	12	8	3	3	1	...	...	...	...	49
Hæmoptysis : copious .	1	3	7	12	5	2	2	3	1	...	...	...	36
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Gr. Father Age . Died of Gr. Mother Age . Died of	Paternal Grand P.		Maternal Grand P.
	Children	Gr. Father Age . Died of Gr. Mother Age . Died of	Children
	1		1
	2		2
	3		3
	4		4
	5		5
	6		6
	7		7
	8		8

Father Age . Died of Mother Age . Died of	Children
	1
	2
	3
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	5
	6
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