The causes and prevention of deafness. : Four lectures delivered under the auspices of the National bureau for promoting the general welfare of the deaf / by J. Kerr Love.

THE CAUSES AND PREVENTION OF DEAFNESS.

FOUR LECTURES

DELIVERED UNDER THE AUSPICES OF

The National Bureau for Promoting the General Welfare of the Deaf

BY

J. KERR LOVE, M.D.

(Aural Surgeon, Glasgow Royal Infirmary; Aurist to Glasgow Institution for the Deaf and Dumb, Lecturer in Aural Surgery, St. Mungo's College, Glasgow, etc.).

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PREFACE

Dr. Kerr Love, in giving the following Lectures, has responded in a most helpful and generous way to the invitation of the National Bureau for Promoting the General Welfare of the Deaf. The Four Lectures were given during the winter of 1912–3, and now that they are issued in pamphlet form, they become accessible to all those who are in sympathy with this great movement for the prevention of deafness.

In formulating a correct classification of the various types of deafness, in indicating its leading causes, and in suggesting means for its prevention, Dr. Kerr Love has brought the whole question out into the open, and advanced the time when deafness shall be far less frequent than it now is. He has, to a large extent, wiped out the just reproach of the past, that science had not contributed its proper share in elucidating the origins of, and the remedies for this serious and wide-spread affliction.

May the outcome of Dr. Kerr Love's strenuous work, involving numerous investigations and scientific researches, be the prevention of deafness in all those cases wherein prevention is humanly possible—a result which would not only add to the sum total of the world's happiness by avoiding affliction in individuals, but also increase the economic well-being of the community.

The heartfelt thanks of the Council and Executive Committee of the Bureau, as well as those of everyone interested in the welfare of humanity, are due to Dr. Kerr Love; and to their thanks I cordially and earnestly add my own.

LEO BONN,
President.

AUTHOR'S PREFACE.

Although no fee was paid for the delivery of these Lectures, it is right to state here that the entire outlay connected with the work was generously borne by Mr. Leo Bonn, the Chairman of the Bureau, and I take this opportunity of tendering my thanks to Mr. Bonn. I have also to thank Drs. Browning and Cruikshanks of the Clinical Research Laboratory of the Western Infirmary, and Dr. Campbell of the Royal Infirmary, for their help in connection with the examination of the blood in the cases of deafness recorded here. At the Institution for the Deaf and Dumb I am particularly indebted to Dr. Addison, the Principal, and to Dr. J. W. Leitch for the help they have so willingly given me. As on a former occasion, I have found the Head Masters of Institutions at home and abroad willing to supply the statistics I have asked for.

To Mr. Bonn's hope I would add my own, that these Lectures may contribute, if but in some slight way or sense, to The Passing of Deafness.

JAMES KERR LOVE.

LECTURES

DELIVERED BY

DR. J. KERR LOVE

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LECTURE I.

On the Nature and Consequences of Deafness.

Introductory.

When I undertook the duty I begin to discharge this afternoon, I defined it as an attempt to bring together or focus our present knowledge on the subject, in the hope that some abler and younger man might enter the field of actual research, and only after much labour and thought suggest steps for the prevention of deafness. One result has been to give me a nearer and more defined view of the subject, another has been to make me enter the field of actual research and begin the work which I meant to leave entirely to another. The work has not lessened my estimate of the difficulty of dealing with the prevention of deafness, it has increased it. But the nearer view has shown me what I conceive to be possible and what impossible; it has shown me where to begin, and how far we may hope to go. You may not agree with me in the steps I suggest, but if I succeed in giving you the nearer and better defined view I shall be satisfied.

Prevention and Cure.

The successful treatment of an infectious disease is not always an unmixed blessing. Successful treatment sometimes diverts attention from the more important work of prevention. Except from the point of view of the individual already affected, treatment and cure are of little importance. From every other point of view, prevention is everything. Plague, cholera, hydrophobia, and relapsing fever, have been swept out of our country because they were too terrible to tolerate, and because we could not cure them. Typhus and enteric fever are disappearing in the same way. Smallpox, even with vaccination to rob it of its terrors, is a rare disease, chiefly because every case is sent to hospital, and tuberculosis seems likely to disappear rather by our thorough isolation of every infected individual than by our efforts to find a cure for the disease. With regard to nearly

every infectious disease which has come thoroughly under human control, the two factors in the control are (1) Knowledge of the specific cause of the disease; (2) Isolation of the infected individual. Cure has hardly ever contributed to the happier state of things. As applied to infectious disease, the word cure may, by contrast with the treatment of former days, most fairly be given to diphtheria, and it is doubtful if this disease is less common than in former days. Now, it is surely not an accident, that with regard to the three diseases which most commonly cause acquired deafness, either one or both of the factors indicated above are absent. That is why we cannot prevent them. We do not know the specific causes of scarlet fever and measles, and we do not isolate all cases, so that both factors are absent in the cases of these diseases. We know the cause of spotted fever, and when the disease is epidemic we isolate the cases, and the disease is well under control. But we are not sure if the acute non-tubercular meningitis of young children is due to the same cause, and we do not isolate these cases when they occur, so the death and deafness rates of meningitis are still very high. Scarlet fever and measles cause each about 5,000 deaths annually in England. Meningitis, under the two headings of tuberculous meningitis and inflammation of the brain, and these do not include all the cases of meningitis, causes as many deaths as scarlet fever and measles put together. In 1909, the last year for which I have the figures, these deaths from meningitis amounted to 11,118. This does not include over 10,000 deaths due to convulsions, many of which were certainly due to meningitis, nor does it include the meningitis which is so often the terminal affection in scarlet fever and measles. And yet unless when the disease is epidemic, and has a special name given to it, we neither isolate nor notify meningitis, which not only as a cause of death, but as a cause of deafness, overshadows scarlet fever and measles. From statistics which I collected from British Schools in 1896, the conclusion was drawn that meningitis caused more deafness than either of these diseases, and that it was the most common cause of deaf-mutism in our country.

Syphilis, the next most common cause of deafness in children, stands in a class by itself. No attempt at its prevention in the sense in which the term is here used, has ever been made. No isolation has been practised. But its specific cause has recently been discovered, and although medical effort and energy are in the meantime directed almost entirely to the treatment of this disease, definite measures for its prevention can hardly be long delayed.

Now, the point I wish to insist on here, is that these diseases—syphilis; meningitis of all kinds, whether tuberculous, epidemic, sporadic; scarlet fever and measles; the rarer kinds of

infectious disease causing deafness, such as enteric fever, whooping cough, are very costly to cure. They kill many of their victims, the deafness they cause is permanent, and the deafness is often associated with other results, such as blindness, mental deficiency, and poor general health. Except in the literal sense of taking care of these deaf children, we cannot cure them. How much finer it would be to prevent such deafness? Where you prevent you do not need to educate. To send into the world a whole life instead of a maimed one, a helper instead of one who needs help, to save the lives of thousands of healthy children, not only from deafness, but from death, that is the problem, and these the inducements held out to those who would prevent acquired deafness. The curative problems of the last generation and some of the educational problems, too, are the preventive problems of this.

The Prevention of Deafness.

Most writing on the subject of Deaf-mutism has been educational. The first to be educated were, probably, adults or young people beyond the period of childhood. We do not know—at least, the present writer does not know—the age of De l'Epee's first pupils, but we know they were not children, and it is unlikely that many of them were under the age of ten years. When in 1792, Dr. Watson started the first public school for the deaf in England, he put down the age for entering his school at nine years, and it is probable that many of his pupils were older. It is still common for deaf children to enter the institutions for the deaf at eight or nine years, in spite of the Government regulation that they must begin their education at seven, and may begin at five years. But this is not all. Schools exist, both in this country and in America, for the education of the deaf at the age of three years. By a kind of evolution backwards, the educationalist is led very near the birth of the deaf child, and by putting the age clock back just a little further, is led to ask: "Can we do nothing to prevent the deafness?" But the student of the deaf child is not the only one who puts this question. A new science of Eugenics has recently arisen, and the Eugenist asks himself the same question, and I regret to say sometimes answers it in the most empirical or pseudo-scientific manner. Sterilize the deaf, or make it illegal for them to marry, or shut them up in asylums, or fine them and imprison them if they have children. Such are some of the suggestions made. Some of the Eugenists are like doctors, who prescribe before they have made any study of the case. I did not call this quackery, I only called it empirical or pseudo-scientific, but it is very closely allied to quackery. The mere fact of deafness is so appalling, its consequences are so disastrous to child progress, that "How to prevent

it?" must have been asked by many thoughtful people who are neither educationalists nor pretend to be scientists. No answer, of course, can be given by these people, because none is possible, or, at least, none worth listening to is possible, except by the student of the deaf child himself, the student who has thought of him before he is born, during his lifetime, and after he is dead. The embryologist, the clinical observer, and the pathologist;—these three must formulate the answer to the question, if any is to be forthcoming.

There are two qualities which must be possessed by those who would make any sane effort towards preventing deafness. A great reverence for childhood, especially when it is deaf, and the scientific habit of mind. Thus fitted, we may get no answer that will carry us far, but we will, at least, be saved the discussion of proposals that are either cruel or stupid. The kind of writing, which is likely to be helpful in the discussion of this question, is well illustrated by that of two authors. That of Dr. A. Graham Bell in his paper, "Marriage: an Address to the Deaf," written in 1891, and that of Dr. Saleeby, in his series of popular papers on eugenics, appearing at the present time. Twenty years separate these papers. Dr. Saleeby does not treat of deafness at all, but of the getting and rearing of healthy children. Much of what Dr. Bell has to say must be revised or extended in the light of recent research, but both write with reverence for the child, and both show the true scientific spirit.

Congenital and acquired Deafness.

Deafness is said to be either congenital or acquired: that is, the child is either born deaf or becomes deaf from some cause operating after birth. This classification is so useful for clinical and educational purposes that I am sure it will remain, but it is not accurate enough for the basis of a discussion on the prevention of deafness. Here we must talk of hereditary and non-hereditary deafness. Some types of deafness do not come on till adult life, and yet they are hereditary, e.g. otosclerosis; others begin in utero and yet are not necessarily hereditary, e.g. syphilitic deafness. The beginning of a child's life is not when it is born but when it is conceived. A poison may enter the system of the mother and destroy or prevent the development of the organ of hearing. The deafness resulting is congenital, but it is not necessarily hereditary. True hereditary deafness is due to a cause which operates from the period of conception, and this cause is present in the germ plasm of one or both of the parents. It is not eliminated during one or two generations. It is not always possible to distinguish between merely congenital and true hereditary deafness, but that objection may be raised with regard to any other classification. It is not always possible to distinguish between congenital and acquired or post-natal deafness.

What Deafness means.

The effect of deafness on the individual is in inverse ratio to the age at which it occurs. If it occurs early enough it will prevent the development of speech or cause loss of recently acquired speech. To this degree of deafness the writer has given the term "surdism," a term which is convenient but never represents a loss of hearing which can be arithmetically stated. Whether speech develop or be lost depends on the use which is made in teaching, of the hearing and speech already present. But apart from the results of teaching, the term "surdism" represents a degree of deafness which is useful in classifying deaf children for educational purposes.

The rule of inverse ratios is interesting in its operation. In adult life deafness influences the mentality of its subject, who begins to be retiring and to avoid society. Old people may remain talkative and garrulous, and, taking the chance of a right answer, may carry on a conversation which becomes disjointed and sometimes ridiculous, but people at middle life tend rather to become morose and retiring. The voice becomes unmusical and wooden if the deafness be profound, but the speech is distinct and the vocabulary is never forgotten. In young adults the vocabulary remains limited and the speech may suffer a little, the ends of words getting cut off and the consonantal sounds becoming poorly articulated, whilst the voice itself becomes unmusical and is poorly modulated. Between 7 and 12 years the occurrence of great deafness is, apart from teaching, apt to arrest the development of the vocabulary and there is some danger of acquired speech being lost, and before seven years great deafness is usually followed by dumbness. Deafness occurring during the first two years prevents the development of speech altogether, and is often indistinguishable from congenital deafness. Hence arises the term "deaf and dumb," a term which has been rendered literally incorrect by the rise of the oral method, and for which the term "deaf" will in these papers be used, unless when some special purpose can be served by the combination. I should like to speak for a moment of the early months of life, say up to the age of 18 months, during which many children hear, and then from a disease like meningitis have all appreciation of sound lost for ever. Do the 18 months or 2 years of hearing count for anything? Most teachers, I think, would answer "No." And if nothing be done for the deaf child till the age of seven years, the answer may be near the truth, but I now quote a sentence from a letter I received from Miss Caroline Yale, of the Clarke School, Northampton, U.S.A., a few weeks ago :—

"In our judgment, for teaching purposes, the child who becomes deaf at a year or two, could not be classed with those who are

deaf from birth. The mental stimulus which they receive before deafness supervened would be, in our judgment, considerable." Helen Keller supports the same opinion regarding the nineteen months before she lost her sight. She says : " During this period I had caught glimpses of broad green fields, a luminous sky, trees and flowers, which the darkness which followed could not wholly blot out. If we have once seen, 'the day is ours and what the day has shown.'"

So with regard to the first two years of hearing. Once having heard, music is ours and all the voice can tell.

Such are some of the effects of deafness on the individual. Look for a moment at what takes place in the ear of the deaf individual to produce these profound results.

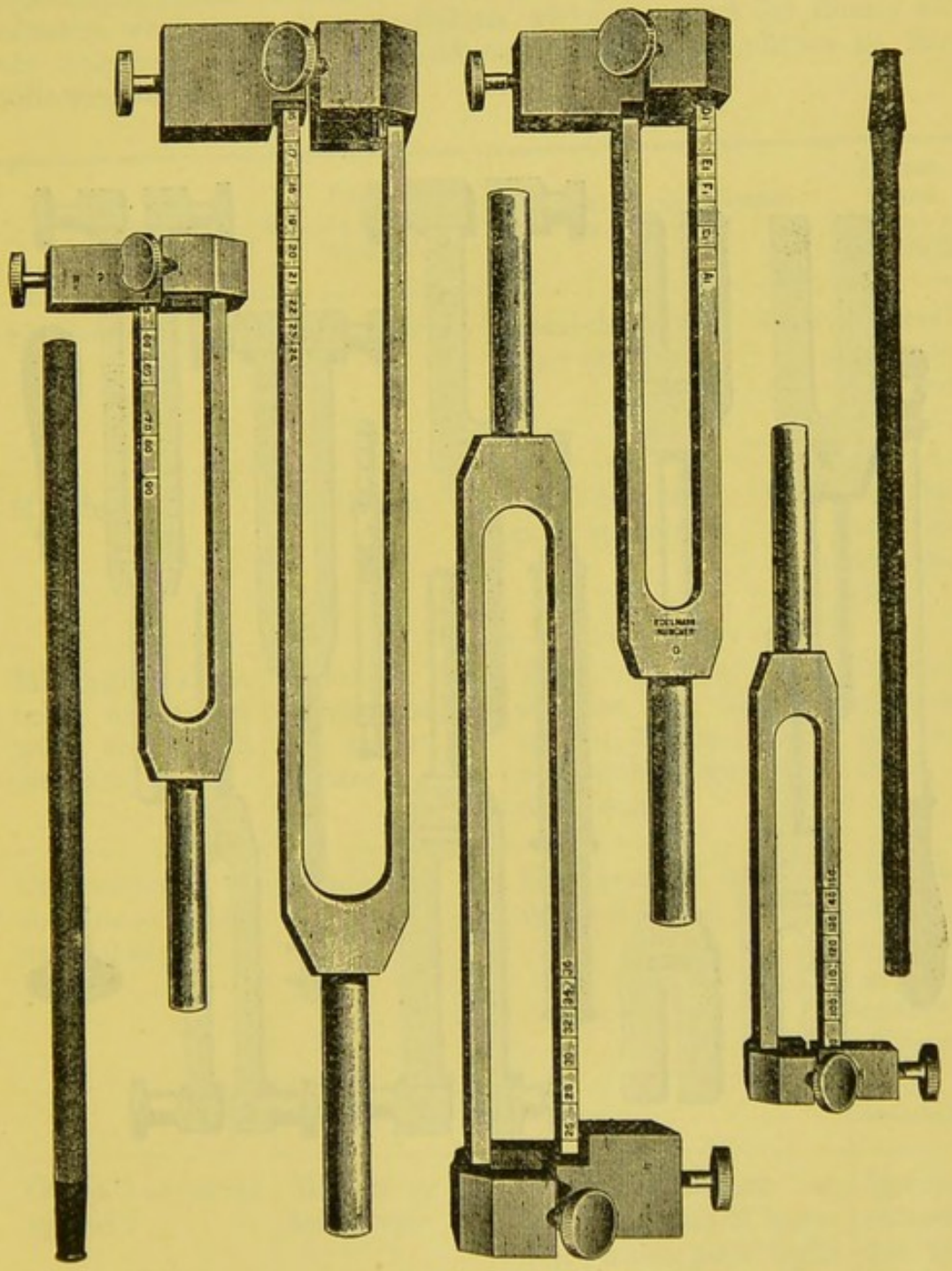
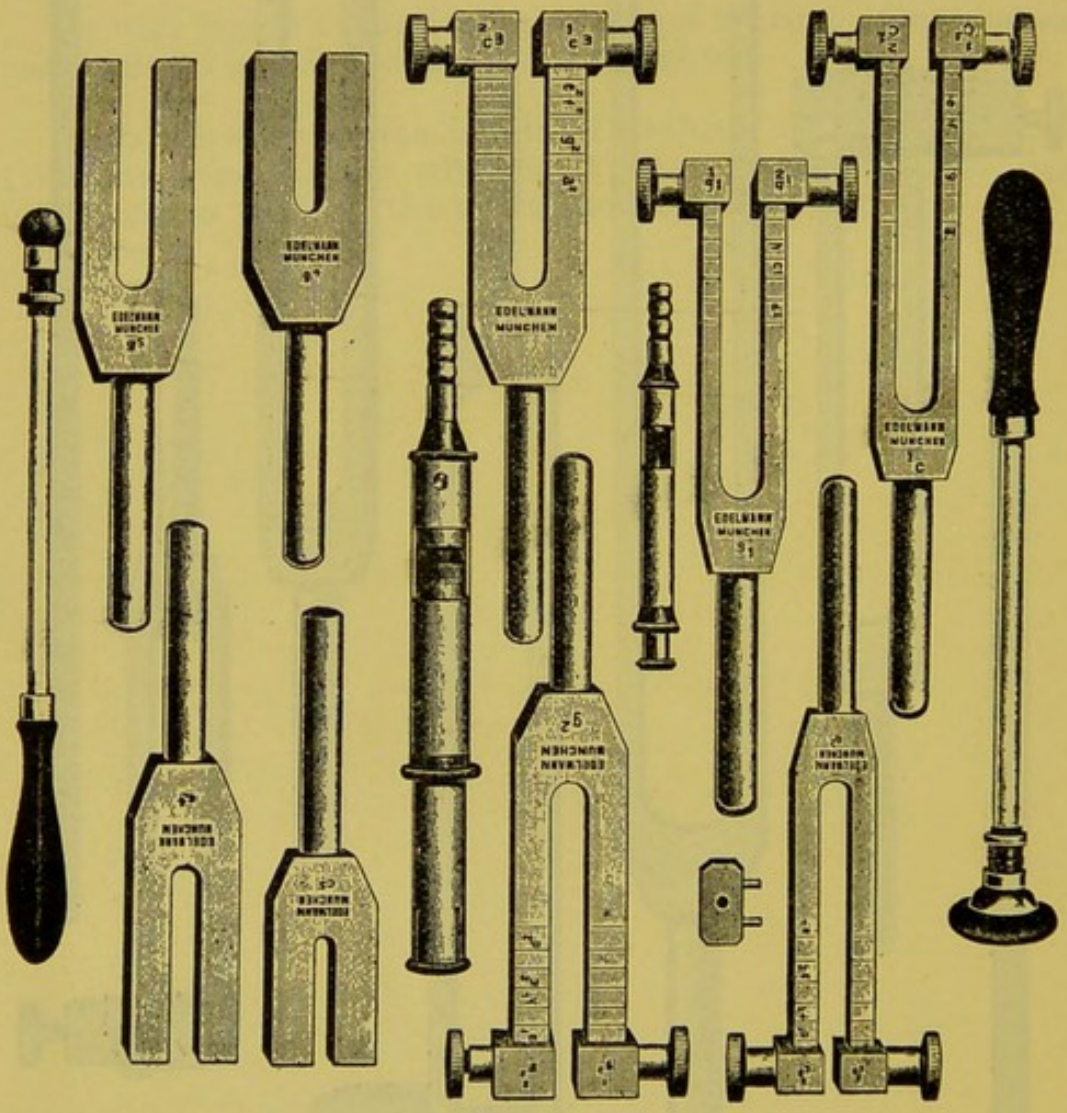


FIG. I.—Forks of the continuous tone series used in mapping the remains of hearing in deaf children.


EDELMANN MUNCHEN

Reverting for the moment to the classification of deafness as congenital or occurring before birth, and acquired or occurring after birth, let us see what are the causes of acquired deafness. Excluding causes which are rare or the operation of which is obscure, we have a few conditions which account for nearly all the acquired deafness of childhood. These are shown in the following table :—

Disease.	Part of hearing apparatus involved.	Effect of the disease on the child.	Educational destiny of the child.
Scarlet fever	Middle ear	Semi-deafness with poor speech	Special schools for the deaf
Measles	Middle ear	Semi-deafness with poor speech	Special schools for the deaf
Meningitis alone or associated with the above diseases	Internal ear, auditory nerve, or hearing centres	Total deafness with absence or loss of speech, or total deafness with preservation of speech	Special schools for the deaf
Obstruction in the nose and naso-pharynx	Middle ear	Hardness of hearing without loss of speech	Backward classes of the ordinary elementary schools
Constitutional syphilis	Middle or internal ear	Slight deafness or total absence of hearing: often poor sight	Special schools for the deaf or blind

If the first two diseases, scarlet fever and measles, become complicated with meningitis, as they sometimes do, total deafness may result, and deaf-mutism follows instead of semi-deafness.

There are two conclusions which may be drawn from a study of this table.

1 The degree of deafness depends on the part of the hearing apparatus involved. When the middle ear alone is involved, the deafness is usually not of very high degree and dumbness is not associated with it.

2 Once disease attacks the nervous apparatus of the ear, it oftens wipes out all hearing and renders the child entirely deaf.

FIG. II.—Chart of remaining hearing in deaf children.

You will see now why cases of acquired deafness in children are either hard of hearing or entirely deaf—a great contrast to what obtains in congenital deafness. If an infectious disease like measles or scarlet fever gets within the petrous portion of the temporal bone at all, it destroys the fine nervous arrangements of the cochlea, and leaves the patient stone deaf. Luckily, the petrous portion is hard, hence its name, and the cochlea well protected, so the disaster I have referred to does not often occur. When meningitis, either alone or associated with these diseases attacks the nerve centres in the brain, the auditory nerve or the structures of the labyrinth, the same effect usually follows. Similarly, when syphilis, whether congenital or acquired, reaches the internal ear, it produces great deafness, and it often attacks the eye at the same time, and so sends the young victim to the asylum for the blind. I do not think nasal obstruction or post-nasal adenoids alone produce surdism—that is deafness with dumbness—but they cause deafness in a larger number of cases than all the other causes put together. Now I have grouped these cases together, because they have two features in common. They are diseases of childhood and youth, and they are all preventible. Further, it is doubtful whether any one of them is, in the true sense of the word, hereditary. Assuming that sanitary and medical science will make steady progress, indeed by the application of knowledge we already possess, all this deafness can be prevented. Among the ranks of the deaf and dumb alone, the prevention of acquired deafness would reduce their number in the United Kingdom from 24,000 to 12,000, for about half the cases of deaf-mutism are acquired. It would reduce the ratio of deaf-mutism from 1 in 2,000 of the population to 1 in 4,000. But what of the deafness not associated with dumbness, the deafness of slighter degree which, while it spares speech, handicaps the worker, dulls the whole perspective of life, and, what is worse, is associated with disease which often kills the child. Epidemic cerebrospinal fever kills far more children than it spares. Measles and scarlet fever carry off many thousands of young children every year in this country. The campaign against acquired deafness is also a campaign against the high death rate in children. And, lastly, what of the deafness due

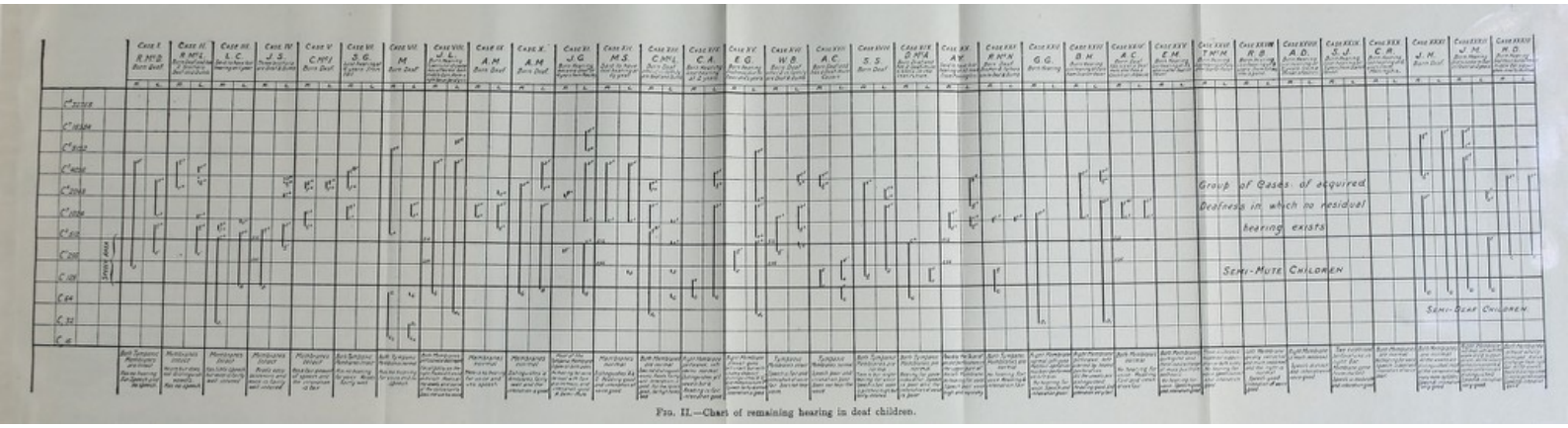


FIG. II.—Chart of remaining hearing in deaf children.

to neglected nasal obstruction? Most of the adult deafness is probably due to this cause. The campaign against deafness in childhood is war against deafness in the adult. It is a fight for the efficiency of the worker, for the happiness of the home, and for the saving of valuable lives to the state. For these lives are all valuable. Few of these children are mentally defective. They are the victims of bad environment. They are all well born, but they are badly reared.

Before discussing these diseases in detail, and the steps necessary for their extermination, there is one class of case which belongs to acquired deafness, but which does not belong to childhood and which is probably hereditary. I refer to otosclerosis. The disease will be discussed later. It is mentioned here to complete the list of common causes of acquired or post-natal deafness.

Why does a Deaf Child not Speak?

Let me ask you to consider for a moment the question, "Why does a deaf child not speak?" His forefathers have been speaking for long enough to make a tendency to speak hereditary. And there is proof that the tendency is hereditary. But the tendency and the particular form which speech has taken are two different things. All spoken language is conventional. Speech is acquired by the child by two methods which co-operate. Firstly, the child hears certain sounds, which he produces correctly after hearing them many times. Literally and figuratively, the hearing child has an ear for speech. But he has also an eye for speech. The second method—and in a normal child it is the subordinate one—by which a child learns to speak is by imitating the movements he sees producing speech. Many of these movements are produced within the mouth and cannot be seen. The "Bs" and "Ps" can be seen so well that a child produces them as quickly by sight as by hearing. The "Gs" and "Ks" cannot be seen at all. But all have distinctive sounds. That is why hearing is the great instrument in learning to speak, and that is why a child who is deaf is so apt to be dumb.

Now picture to yourself the effect of deafness on your own child. At eighteen months you notice that his speech is not progressing. He says Baba and Papa just like any other child because "a" is the open vowel, and because he has seen your B and P. He has heard nothing. But he does not add to his stock of words. You fear he may be deaf. Your doctor has told you that he is. For four or five years you have to face this terrible problem: "How am I to get into real contact by language with my own child?" The State does not recognize that the child

needs anything for these years. And some of the teachers tell you that it is wrong to try to give the child any language for these "five" years. But these five years are the years of language formation, the years of brain development, and at seven years the brain of the deaf child is smaller than that of the hearing child, because nothing has been done to use it. In childhood and youth, if you stop function you stop growth. Here the whole brain stands still. It is like paralyzing a great industry in a busy country. Stop the shipbuilding, and the coal pits and the iron works stop. The whole fabric of society suffers. Stop the sense of hearing and the whole brain suffers. No one has put this so well as Helen Keller, in a letter to the writer:—"The problems of deafness are deeper and more complex, if not more important, than those of blindness. Deafness is a much worse misfortune. For it means the loss of the most vital stimulus—the sound of the voice—that brings language, sets thought astir, and keeps us in the intellectual company of man." And yet charity has always gone out to the blind child to a degree which has been refused to the deaf child. The deaf child has nothing *to show*.

But this is not all, look at deafness in the adult; its misfortuue is not at all understood. We shout to the deaf man, the worst thing we can do by the way, and feel annoyed at the effort we have to make, but we watch the blind man, give him a hand over the crossing, and feel so much better for the slight effort. Anybody can understand a blind man; it takes a student to understand a deaf one. The blind man with his placard or his dog, the one-armed man with his organ, the one-legged man with his crutch, are sure of a penny from the man in the street if they care to pose for it; the deaf man would be in danger of the police officer if he begged. And this feeling is not confined to the man in the street. In a Sheriff's Court a man with a lost finger is sure of a sympathetic hearing, and, under the Workmen's Compensation Act, a substantial award even if he be fit for work: the man who has lost half his hearing gets nothing. The deaf man, like the deaf child, *has nothing to show*, and yet the deaf are cut off from far more of the interest of life, are far more handicapped during the period of education, and are far more isolated at the end of the educational period than any other class of defectives.

Such then is the misfortune of deafness, and you may take it that if it be of long standing it cannot be cured. Temporary deafness, deafness rather of recent occurrence is often cured, suppurating ears can be dried up, abscesses of the brain due to ear disease can be evacuated. These are some of the triumphs of surgery of which otology has reason to be proud. But there is one reproach which is not often spoken of but is constantly felt by almost every otologist—*he cannot cure old-standing deafness*. In spite of all the advances of science, of all the triumphs of

surgery, deafness of a few years' standing is seldom cured, usually gets worse, and the honest practitioner has to see his patient pass from one kind of quack to another, knowing all the time that the hopes hatched of the big promises of these rogues will be disappointed. What a fine field there is here for prevention, for if it be true that chronic deafness can seldom be cured, it is equally true that recently acquired deafness can not only be cured but can nearly always be prevented. I am anticipating a little the subject of a future lecture, but it may be well to point out here that most deafness of the acquired type begins in childhood, and may be prevented by the recognition of its causes and the timely removal of these. I am not one of those who believe that deafness is a blessing. You will get people who tell you that illness elevates character and brings out all the finer features of an individual. This is the theory of the Sunday Schools' books, and it sometimes happens it actual life. But I am here to state that chronic illness of any kind degrades and deteriorates mind and soul as it does the body. Chronic illness as a rule makes most men selfish, querulous, and troublesome, it degrades oftener than it uplifts, and the same is true of chronic deafness. To face the silence of the years alone is far more apt to result in depression and despair than it is to elevate and inspire the sufferer.

It is, perhaps, hardly fair to descend from the sublime despair of the deaf man to the sordid question of the cost of the education of the deaf. It is a sort of anti-climax. But the toll of deafness has not been fully stated, unless the cost to the State of the education of the deaf has been reckoned. It takes over four pounds sterling to educate a hearing child annually, and the child is at school about eight or nine years, so that his elementary education costs about £40. It takes about £40 to educate a deaf child annually in an institution, and as he is about ten years at school, the cost of his elementary education is £400, or ten times as much as that of his hearing fellow. Now there are about 4,000 deaf children being educated in England alone. Their education costs over a million and a half, not annually, but for the whole period. Were they hearing children, it would cost only £160,000.

Such is the great disaster of deafness. In this lecture I have tried to show three things :—

1 The nature of deafness. Its real cause in the ear and in the brain.

2 The terrible consequences of deafness in delayed or arrested mental function and development.

3 That acquired deafness is nearly always caused by an infectious disease, and that it could nearly always be prevented.

How this is to be done, I shall indicate in my next lecture.

But the disastrous effects of deafness can be overstated. By the ignorant they are in one direction always overstated. I have a surgical friend—a very clever surgeon—who, when someone raised the question as to what should be done for the deaf and dumb, suggestively drew his finger across the side of his neck. He would put all the deaf and dumb out of the way very quickly. He evidently thinks the deaf and dumb mentally defective, idiotic, incapable of citizenship, and not worth the trouble spent on them. Now, I want here to state distinctly that deafness and mental defects are not necessarily associated. They are seldom associated at all. There is no more connection between deafness and mental defect than there is between lameness or blindness and mental defect. Deafness raises a great obstacle to the process of education, a far greater obstacle than blindness or lameness does, but deaf people are not more stupid than the blind or the lame. The measure of the obstacle I have mentioned is merely the measure of the effort we are now making to educate them. The measure of the misfortune that deafness involves even in the educated deaf must be the measure of our effort and determination to prevent the great disaster of deafness.

LECTURE II.

On the Classification of Deafness, and on the Prevention of Acquired Deafness.

The Prevention of Acquired Deafness.

The prevention of acquired deafness has to be considered under two heads :—

1 The better management of ear disease when it occurs.

2 The prevention of the diseases which cause deafness.

Municipalities do a great deal in the way of isolation of cases of scarlet fever and measles, but they do little in the way of special treatment of the ear complications of these diseases. Cases of scarlet fever and measles are often dismissed before the ear discharge has ceased. I have seen a case of ear discharge dismissed from a fever hospital in the thirteenth week, and I have seen the brother of the child die of scarlet fever before the infected child was a week home from the hospital. I do not mean to say that this is a common occurrence, but there is something else that is of common occurrence. That is the persistence of the discharge and the destruction of hearing, or even the death of the child, at a later period of life. Even if the discharge has ceased, and it is sometimes thought to have ceased when it still persists, it often recurs shortly after the child passes back to the slum home. The child is often left untreated or is brought to the outdoor department of a general or special hospital where, because of irregular attendance, recovery seldom takes place.

Now the ear disease following scarlet fever is not only infective and produces further cases, it is not only apt to return, to persist and destroy hearing, but in the long run it kills. The run is often a very long one. It may persist for five, ten, fifteen, twenty or even thirty years, and then kill the patient by a brain

affection. Every hospital surgeon knows this, and every aural surgeon has to operate oftener for the complications of the ear suppuration of scarlet fever and measles, than for any other disease. Surely it would be wiser to have these ear complications treated by an otologist whilst the child is in the hospital for infectious diseases, than have the otologist come in at a later stage when hearing is irreparably damaged, or life is in danger. Every large municipality should appoint an otologist to its fever hospital staff, and if a child must be dismissed with an ear discharge, this should be done only after everything possible has been done for the ear itself, and for the naso-pharynx, which so often reinfects the ear. But even then the public has not done with the slum child. To send a slum child back to its home with a discharging ear is not economical for the public, and is disastrous to the child. The treatment of the child has to be paid for by the public somewhere else, and in the meantime hearing is being slowly destroyed, and danger may at any time arise and kill the child.

The case of meningitis is different from that of scarlet fever and measles. It arises, it is true, during the course of these diseases, but it attends other infections. It is sometimes due to syphilis, it sometimes appears in epidemic form as spotted fever, it is often tuberculous, it often attacks children without any specific cause being assigned to it, and the disease is named fits, convulsions, inflammation of the brain, brain fever, etc. A nebulous nomenclature like this is always suggestive of ignorance. The truth is we are about as far back in the study of meningitis as we were with regard to enteric fever before it was separated from typhus. About the only difference in the two cases is that we know that meningitis is nearly always due to a micro-organism, and that it is nearly always infectious. (I use the adverb "nearly" to make room for traumatic meningitis.)

We did not know this about enteric fever in the fifth decade of the nineteenth century. Micro-organisms were not known then.

Now were all forms of meningitis made notifiable and were all isolated, two results would follow. It could be properly studied in hospital (it can never be so in private practice), and it would soon greatly diminish, indeed some forms of it would disappear altogether. Meningitis is one of the most fatal diseases we have, and it is *the* commonest cause of acquired deafness and probably of congenital deafness too.

I have hinted at the cost of curing these infectious diseases. It takes about £10 to treat a case of scarlet fever in hospital, and about £5 to treat a case of measles. But most cases recover fully. With meningitis it is different. Its cost is greater, for it nearly always costs the life of the child, and when the child recovers he is often deaf. To me this loss of over 10,000 children from menin-

gitis, and the loss of hearing in a large proportion of the few who recover is a more ghastly fact than the death rate from consumption itself.

The medical inspection of school children has been so recently established, and systematic treatment of school children is as yet so uncommon that the value of these measures can hardly yet be assessed. But there is no doubt that they can be made very valuable. So far as the treatment of ear disease and the prevention of deafness are concerned, the greatest efficiency will be got from *aural school clinics under the supervision of specialists*. The general practitioner should not undertake this supervision in the large towns where specialists are available. The examination and treatment of suppurating ears are difficult, and can be best done by those who are doing it daily on a large scale. Discharging ears can be most quickly and economically healed by specially trained medical men. *Then this work should be done in the school.* The time wasted both to the child and the parent in taking the former to a public dispensary, where long periods of waiting are the rule, is destructive both to educational progress and to home life.

The writer has probably the largest experience of an aural school clinic in the country. For nearly 20 years he has regularly examined and treated the discharging ears at the Glasgow Institution for the Deaf and Dumb, and for a longer time he has carried out the same work at the Royal Infirmary. More recently he has carried out the same work in the Semi-deaf and Semi-mute School of the Glasgow School Board. The treatment both at the Institution and the Semi-mute School is more efficient than that at the Infirmary, because the ears are *treated regularly by a nurse at the former*, whilst the children are brought irregularly to the Infirmary, and because any treatment carried out by the parents between the visits to the Infirmary is either badly done or not done at all.

Acquired deaf-mutism appeals with peculiar urgency to those who would prevent deafness. Its victims are all good material spoilt in the growing. All its victims are well born with the exception of those suffering from constitutional syphilis. This cannot be said of the congenitally deaf or of the hereditarily deaf. The argument may be advanced that these are contaminated from the start, that they are not worth caring for, that the result will not repay the trouble involved, that it is best to let them die out, if not to kill them outright. All these arguments have been advanced with regard to the deaf born. I shall have to show both the fallacy and the cruelty of them. But none of them apply to the case of those whose deafness is acquired. To allow well-born children to become deaf is as stupid as to plant valuable seedlings in poor ground and then to neglect the seedlings and deliberately

poison the ground. The latter is bad and wasteful gardening, the former bad and wasteful politics.

I would fain say something here about the conditions which make acquired deafness so common amongst the poor, and so uncommon amongst the well-to-do, but as I have to refer to the housing question as it affects the production of sporadic congenital deafness, I postpone further reference to it meanwhile.

To sum up then, the steps to be taken at once for the prevention of acquired deafness are :—

1 The management of the ear complications of the infectious diseases by otologists.

2 The notification for the purposes of study and treatment and the isolation of all cases of meningitis, whether tuberculous, epidemic, or sporadic.

3 The medical inspection and treatment of the ear diseases of school children in school by otologists or by general practitioners under the supervision of otologists.

On the Classification of Deafness, and on the Prevention of Acquired Deafness.

In the first lecture, I alluded to the division of deafness into congenital and acquired. It is a popular classification with some educational and even with some clinical value, but it is insufficient for any scientific purpose, and the prevention of deafness is a scientific subject. I have pointed out the difficulty one often encounters in discriminating between cases of congenital deafness and deafness occurring during the first year of life. Is there no test to which we can bring these doubtful cases, and thereby discover whether the deafness is congenital or acquired? I do not think there is, but there is one which helps in the discrimination, and which affords the basis of a classification far more useful for our present purpose than that into congenital or acquired. The test is the possession of deaf-mute relatives by a congenitally deaf child. I say deaf-mute relatives, not deaf relatives. We now have three classes or divisions of the deaf.

1 Those whose deafness is undoubtedly acquired after birth.

2 Cases of sporadic congenital deafness. These may not all be congenital, some may have occurred during the first year or even as late as the second year of life. For both teaching purposes and for this present purpose, these have to be classed as congenitally deaf. The feature of these cases

which is of importance here, is that there is no marked history of deafness either in the direct line or in the collateral branches of the family.

3 True hereditary deafness. Amongst children this is always congenital, but its distinctive feature is that the family history always shows the deafness in the direct line, parents or grandparents, or in the collateral branches of the family, brothers or sisters, uncles or aunts, or cousins.

This test, the possession of deaf-mute relatives, has to be applied with some skill. I shall have to tell you of sisters who were born deaf and in which the deafness is not hereditary, in which there is no fear of its being carried down to their children, and I shall have to tell you of other sisters who are deaf, who have become deaf since birth, who would be put down by the average observer as cases of hereditary deafness, and yet in the family there is again no heredity and no chance of the production of deaf children.

Note, then, that "congenital" and "hereditary" are not equal or even similar terms when applied to deafness. True hereditary deafness is a much more limited thing than we have been accustomed to suppose.

Reverting then to the new classification, I propose to examine these classes in turn, considering (1) The grounds for the separation of each from the other two, and (2) The mental and physical characters of each class.

First, then, acquired or post-natal deafness has to be dealt with. When a child becomes deaf from scarlet fever or measles, or, as may sometimes happen, from whooping cough or enteric fever, there is usually no doubt that the deafness has been acquired. These are the diseases not of babyhood or infancy, but of childhood. They are most commonly caught in the schoolroom. The proof that hearing existed is incontrovertible. The child is old enough to answer to hearing tests, and the proof that hearing is destroyed or badly damaged is equally incontrovertible. The child speaks, so he must have heard. He now ceases to speak, so unless he has become aphasic, in which case he still hears, his hearing has been lost. As a rule, in meningitis the diagnosis is equally clear, unless the disease have occurred during the first eighteen months of life. Meningitis is marked by striking symptoms, convulsions, coma, and high fever. But meningitis may happen to a congenitally deaf child, and the child may recover from the meningitis. In this case the meningitis is blamed for the deafness, and congenital deafness is said to have been acquired. The disease occurs far more commonly during the first eighteen months of life than does scarlet fever or measles. Hence the mistake in diagnosis above indicated is more apt to occur.

The difficulty is not confined to meningitis. A child gets a fall from a cot or perambulator during the first year. At eighteen months he is discovered to be deaf, and the fall is blamed for the deafness. Yet it is well known that falls on the head in the case of children are much less serious as a rule than are similar accidents to adults. Enough has been said to show the extreme difficulty there is in distinguishing between cases of deafness occurring very early in life, and cases of congenital deafness. Careful examination on the post-mortem table would often settle the question of the real nature of the cause of deafness, were it made in all very young deaf children who die. In deaf school-children the admission schedules must be corrected by the observation of trained clinical observers if reliable results are to be obtained.

The first point I would like to make in connection with the prevention of deafness occurring in very young children, is that it is not the exact date of the occurrence which is important, but that the pathology or the nature of the diseased process is what we must try to elucidate.

The possession of deaf relatives has been used to distinguish the nature of the deafness, and to separate the acquired and even the merely congenital cases from the truly hereditary cases. Both Dr. Graham Bell and Dr. Fay have applied this test extensively, and with interesting results. Every head master of an institution for the deaf applies it, and draws conclusions which are helpful to him in handling the deaf. And yet the test is seldom properly applied, because it has never been properly defined. I have narrowed it down in an earlier part of this lecture, and, I think, made it a safer test by making the test the possession of deaf-mute relatives. But even this, as we shall see, is fallacious. The correct definition is an important one, for there is reason to suppose that the pathology of true hereditary deafness is different from that of merely congenital deafness. If measures of prevention were to be applied they would certainly differ in the two classes. The common response in institution schedules in answer to such questions as this, "Have any cases of deafness occurred in the family?" is very far from satisfactory. Of course deaf-mute relatives are mentioned, such as brothers, sisters, cousins, aunts, parents, or grandparents, and were the information given confined to the occurrence to deaf-mutism, the results would be, on the whole, reliable. But I recently came across the following in an institution schedule, "Grandfather became deaf." Now grandfathers usually do. It is not uncommon to find this—"Several uncles and aunts were hard of hearing, and two brothers are hard of hearing." Dr. Fay, in his work on "The Marriages of the Deaf in America," evidently accepts such evidence as this as proof of hereditary deafness, for

he says in that work, "There is reason to believe that slight imperfection of hearing is of scarcely less importance in connection with the question of heredity than total deafness." And although he finds it necessary to draw a line of demarcation somewhere, and does it by including those only for whose benefit schools for the deaf are intended, he makes the term "deaf" include those who in school reports, census reports, marriage records, etc., amongst others are described as the very deaf, the deaf, and the very hard of hearing. Now the examination of school reports and census reports is a very unsatisfactory means of proving anything. I will approach the subject of the value of slight imperfections of hearing as proof of the heredity of deaf-mutism from the side of what we know of the nature of particular diseases causing deafness. The pathology of most diseases of the ear, especially as they occur in the adult, is quite well known. Is there any disease known to otologists which commonly expresses itself in one generation as deafness or hardness of hearing in the adult, and in the next generation or any subsequent generation as deaf-mutism? There is none. Neither otosclerosis which is hereditary, nor chronic aural catarrh, which is not, do anything of the kind. And these are the two great diseases which produce hardness of hearing in adult life. The only known disease which may produce deafness in the adult, and deaf-mutism in the children, is syphilis. It is not safe to say that this succession of deafness never occurs. I believe it does. But it is safe to say it is rare, and I am not aware that any case has ever been recorded. If this view, therefore, of the relationship of the various types of ear disease be true, it must be stated that no deafness which is not congenital, and which is not associated with dumbness, is worth recording as a proof of heredity or family deaf-mutism. But does the possession of deaf-mute relatives amount to a proof of family or hereditary deaf-mutism? I know several cases of brothers and sisters who have become deaf-mute from disease after birth, and I have referred already to one case in which two sisters were congenitally deaf, and a third became deaf at eleven years of age from congenital syphilis. Were only one deaf-mute relative available as proof of the hereditary deafness of my patient, I would rather trust to a deaf-mute cousin than to a deaf-mute sister or brother, and I would not trust to a hard-of-hearing relative of any description as a proof of the hereditary deafness of a deaf-mute child.

The second point I wish to make clear is that we are in need of deaf-mute literature of a very clear definition of what hereditary deafness is. The doctors have been about as guilty as the teachers in the use of the term hereditary as applied to deafness. But if we are going to talk of preventive measures, our definitions must be quite clear. Any haziness here will mean bungling and error later on. That haziness exists at present I am now about to show you.

The Mental and Physical Characters of the three classes of Deaf Children.

Although teachers of the deaf are not trained clinical observers, and therefore not to be trusted with difficult points in diagnosis or in classification, most of them who are at the head of institutions for the deaf are shrewd observers. They have been long in contact with the deaf. Nearly all of them have under their care a good many children, about the heredity of whose deafness there can be no doubt, and also a good many about whom the fact that the deafness has been acquired is quite clear. They are, therefore, the best authorities on the subject. I am now about to deal with the mental and physical characters of the three classes of deaf children.

I have been long familiar with the opinion held by some head masters, that children with acquired deafness, including some of the semi-mute and semi-deaf, are less intelligent and make less brilliant pupils than those born deaf. The opinion is not universally held, many teachers, both in Europe and America, having expressed to me the opposite view. I have a suspicion, based on my own experience and observation, that much of this difference of opinion is due to the importance assigned by teachers to the value of remaining hearing and speech as assets in the education of the deaf child. In other words, it depends to some extent on the degree of the teacher's oral enthusiasm how he will rate the capacity of children whose deafness has been acquired. If he be not much of an oralist, if he depend for education chiefly on signs and finger spelling, these assets will be rated at a low value or not taken into account at all. If he think that the acquisition of speech by the deaf child is an object of the first importance, he will value these assets very highly, and, perhaps, undervalue mere mental backwardness. Still, some of the men who thus regard the child whose deafness has been acquired, who think him mentally inferior to the deaf-born child, are teachers of great experience, and their opinion cannot be lightly set aside. In any case, an examination of the facts of the case may throw some light on the opinions I have quoted.

With the object of eliciting the opinion of the most experienced teachers on the mental and physical condition of the various classes of deaf children, I addressed the following circular to the head masters of the institutions of the United Kingdom. Some circulars were sent also to head masters of institutions in the United States of America, and in Holland and Denmark.

650 Shields Road,
Glasgow.

February, 1912.

Circular to Head Masters of Institutions, and to Teachers of Day Schools for the Deaf.

Dear Sir,

By a curious coincidence the writer has been asked by the two great Bureaux which exist for promoting the Welfare of the Deaf: the American Volta Bureau and the English National Bureau, to take up the question of the Prevention of Deafness. The requests came within a few weeks of each other, and were entirely unconnected. Only one conclusion can be drawn from this coincidence, i.e. that the time is ripe for the consideration of this large and important subject. Whether public opinion is ripe or not, the minds of those who are thinking most deeply about the deaf and who are most anxious to help them, are turning in the direction of prevention.

As a worker for the deaf, your help may be asked by the writer from time to time. He has always found teachers of the deaf not only the most willing, but the most capable students of the deaf child, and he is sure that teachers will be amongst the first to take an active share in devising wise measures for prevention. The subject is so large and so involved that much preliminary study and inquiry must precede practical measures. For the purpose of this inquiry the deaf should be divided into three classes :—

1 Those whose deafness is undoubtedly acquired after birth.

2 Cases of sporadic congenital deafness. These may not all be congenital, some may have occurred during the first year or even as late as the second year of life. For both teaching purposes and for this present purpose, these have to be classed as congenitally deaf. The feature of these cases which is of importance here, is that there is no marked history of deafness either in the direct line or in the collateral branches of the family.

3 True hereditary deafness. Amongst children this is always congenital, but its distinctive feature is that the family history always shows the deafness in the direct line, parents or grandparents, or in the collateral branches of the family, brothers or sisters, uncles or aunts, or cousins.

Keeping this classification in view, will you be so kind as to say :—

1 In which of the above class or classes do you find most mentally defective or very backward children ?

2 In what class or classes do you find most children in poor physical condition ?

3 In what class or classes do you find that the highest family death rate has occurred, i.e. amongst the brothers and sisters of the deaf child ?

4 If there is a medical officer attached to your school, please ask him to say how many children have keratitis or Hutchinson's teeth ? (In answering this query the total number of children in the school should be given, as well as the number of children affected.)

The writer will value your general impressions or opinions on these subjects, but in order to give uniformity to the information desired, the greatest value will, of course, attach to a statement of the conditions existing among the children at present in attendance in your school. The writer would be greatly obliged by your sending your replies to the questions before April 1st, 1912.

Yours ever,

Readers will draw their own conclusions from a perusal of these statistics*. American and Dutch teachers are almost unanimous in the opinion that cases of mental backwardness and physical depravity are commoner amongst the acquired and sporadic cases than amongst the hereditary cases, whilst the opinion of British teachers is somewhat divided although it tends in the same direction. The writer's opinion is that where only cases of true heredity are included, this intellectual and physical fitness of Class III would be clearly established.

Now what are we to make of contradictory returns like these? At first sight they are discouraging for they seem, taken as a whole, to teach nothing. The individual returns mutually slay one another. When one man says that he finds nearly all his dull pupils amongst the children whose deafness is acquired, and another, amongst those who have been born deaf, I suspect his standard of acquirement is better fitted for the one than the other. When another man finds his most of his dull pupils amongst the hereditarily deaf, I suspect he is not making proper distinction between sporadic congenital deafness and true hereditary deafness. Indeed, several teachers volunteer this information: "Your classification is so different from ours that we are unable to make any return which would be of value." That is the gist if not the exact wording of several returns. It seems to be new to many head masters that any such distinction should be made. And yet nearly twenty years ago, Dr. Fay, of Washington, spent several years on his book, "Marriages of the Deaf in America," the gist of which is: "mind whom you marry, beware of people with deaf relatives." Dr. Bell did the same some years earlier in his "Deaf variety of the human race." And yet there are many schools in which the distinction is not made. Now the distinction is not easy, because the material in which the facts about the deaf are recorded, the institution schedules, is very poor. I am not speaking of any institution in particular. Our schedules in Glasgow are no better than the rest—sometimes they are filled up by a medical man, and even then they are often poorly done, and sometimes they are filled up by a layman. Sometimes the head master has to do the work, and sometimes it is not done at all. And yet till it is done, and done very carefully for every deaf child, the head master and the school doctor co-operating, much that should be done for the prevention of deafness cannot even be attempted.

The *third point* I wish to make, therefore, in connection with the classification of deafness is that our present records of the cases of deaf children are quite insufficient for scientific purposes. A much more rigid form of inquiry should be used by school authorities,

* The statistics will be given in an appendix at the end of the published lectures.

and a much more careful examination of deaf children should be made. It seems to be the usual custom to regard the occurrence of two brothers or two sisters, or of a brother and sister who have been born deaf, as proof of the heredity of the deafness. This proof standing alone must be rejected in fairness to the deaf themselves, and in the interests of scientific accuracy. A clear definition of what hereditary deafness is, must precede any proposal for the prevention of hereditary deafness.

The writer does not blame the teachers who have taken a deaf brother or sister as proof of the heredity of the deafness of a deaf-mute child. To a certain extent the circular invites this evidence. The truth is, the common idea of hereditary deafness in the minds of those who deal educationally with the deaf is, that of their being several deaf members in a family. Dr. Fay began his great work with the idea that the relationship of a deaf brother or sister would be the most important one as an indication of the liability to deaf offspring, and finished with the conclusion that this evidence of heredity was of about the same value as the possession of other deaf relatives, not including brother or sister. The present writer, as the result of this inquiry, would put the possession of a deaf brother or sister as the least important evidence of the heredity of a case of deafness, as a kind of evidence which is of little value at all when it stands alone, and he thinks this will be found to be in accordance with what we know of heredity. This subject will be discussed later when dealing with the question of hereditary or family deafness.

If the replies to the questions in the foregoing circular do not point very definitely in any one direction, they serve at least one useful purpose. They show that in the institutions for the deaf there is a vast amount of clinical material which is unclassified, unstudied, and therefore misunderstood. Here I am discussing, not the education of the deaf, but the prevention of deafness. There are many objections to institution life for the deaf. But there is one great argument in favour of it. For eight or ten years deaf children are gathered together under conditions which make clinical observation not only possible, but easy, conditions which make the study of family records not only helpful, but interesting, conditions which would, within a single generation, were they properly used, give a perfectly clear indication of what should be done in the way of preventing both hereditary and sporadic deafness. Is there any clinical field in the world in which the conditions for statistical or clinical research are more favourable than the institutions for the deaf? There is none. And yet it is almost entirely unworked. Fancy having ten years instead of ten days for the study of our hospital cases!

In dealing with the figures from the Glasgow Institution, the following plan was adopted:—Every schedule and every child was

examined, and the latter was relegated to his or her particular class only after the two had been compared. As a rule, the presence of two deaf-born children in a family was admitted as proof of hereditary deafness. Only in a few cases where a known and non-hereditary case was discovered, was this evidence rejected. This standard was accepted, so that the return of the Glasgow Institution might be brought into line with those of other schools. The following figures show the proportion belonging to the three classes :—

During the last eight years 214 children have been admitted to the Institution. This represents a little over the present attendance, but may be taken as a generation of deaf children at the Institution, for the average school period is about eight years.

Of these 214 children, 95, or about 44·5 per cent, were probably born hearing and have become deaf since birth, 60, or about 28 per cent, are cases of sporadic congenital deafness, and 53, or nearly 25 per cent, are cases of hereditary deafness. Six cases have been excluded from the table, because five were cases in which the schedule was not filled up or the information was so meagre that they had to be put down as doubtful, and one was a case of dumbness in a hearing child.

Acquired deafness	95	44·5
Sporadic congenital deafness	60	28·0
Hereditary deafness	53	24·8
Excluded	6	2·3
	214	99·6

These Glasgow returns are fairly representative of the classification of over 2,000 deaf children included in the returns. In particular the hereditarily deaf may be taken as 25 per cent over all the schools which up to this date have sent returns.

The unsatisfactory nature of the returns I have submitted, made me treat the Glasgow figures in a different way. With a view to ascertain the distribution of mental defect or backwardness amongst the three classes of deaf children, I asked that the 21 children who were most defective or mentally backward be taken out of the school roll and their names given to me. The teachers did this, and then Dr. Addison gave the list his general approval. On referring to the list of pupils in attendance, I found that 5 of the children were cases of acquired deafness, 13 cases of sporadic congenital deafness, and only 3 cases of hereditary deafness. But of the three cases of so-called hereditary deafness, the proof of heredity was the possession of a single deaf brother

or sister, a proof which, by itself, is no proof at all. Not a single one of these three backward children had a deaf progenitor or a deaf relation even in the indirect line.

One way of bringing out the proportion of children belonging to each of these three classes is to take a school to which backward children are sent, and to see how these divide themselves under our three heads. The best school in the world for such a test as this is the Homerton Residential School for Backward Deaf Children in London. By the kindness, and with the help of Mr. Barnes, I have been able to do this at my various visits to Homerton. The following is the result :—

	Number.	Per Cent.
Acquired deafness	17	21·8
Sporadic congenital deafness	51	65·4
Hereditary deafness	10	12·8
	78	100·0

Here the hereditarily deaf fall to about half the percentage at the Glasgow Institution, the sporadic cases rise to more than double, and the acquired cases fall to less than half.

But further, the hereditary cases at Homerton have nearly all some other lesion than deafness; retinitis pigmentosa is present in one case, cretinism in another, a third is hydrocephalic, etc. *This points to the fact that when hereditarily deaf children are mentally defective, the cause is not the deafness, but some condition which causes both the deafness and the other defect. Heredity and degeneration are not the same thing.*

Alongside the Homerton School in London may be put Clyne House, the School for the backward deaf at Manchester. Of a little over 300 deaf children at Old Trafford, Manchester, sixty-five backward deaf are educated at Clyne House. Of these sixty-five, eleven are put down as cases of hereditary deafness, but in only five of these eleven is the evidence of heredity taken from the direct line or the collateral branches, the evidence in the other six cases is the occurrence of a deaf brother or sister. So that we have only five cases of weak-minded children amongst the hereditarily deaf in a school of over 300 children. As against this we have forty cases of backward congenitally deaf, and fourteen cases of backward children whose deafness has been acquired.

With such unsatisfactory data as exist, it may be well to

describe a type of each of these three classes of deaf children. It must be constantly kept in view that on having clear conceptions as to how the child came by his deafness, and to what extent, if any, he is able to pass this deafness down to his children, will depend what steps are to be taken in the way of prevention. Reasons for some of the mental and physical characters present in each class will emerge from the study of types. A child whose deafness has been acquired, whose deafness is clearly post-natal, may be a mental and physical wreck. Scarlet fever and measles may damage the eyes as well as the ears, tuberculosis may riddle the lungs, the lymphatic glands, and the bones, as well as destroy hearing, whilst meningitis which so often destroys life, and which so often complicates these diseases, may, should the child recover, leave him damaged in his entire brain, as well as make him deaf. Even with some speech and hearing left, he may make but poor progress in the schoolroom. And if speech and hearing are not much used in the schoolroom, if the use of language in writing and finger spelling is counted as the proof of educational progress, the child with his poor eyesight or his damaged intellect, is put down as a dull boy. No wonder many teachers find their dull children amongst the post-natally deaf. Luckily, all but the ear generally escapes, and I have always found a larger proportion of the semi-deaf in the highest classes of the best schools than I have found throughout the school. But these damaged children cannot transmit their deafness. Even when a syphilitic father has made the child deaf, the child cannot send the deafness down to the grandchild. Syphilis blights and stunts and kills, but, thank heaven, the deafness of it goes down neither to the third nor the fourth generation.

At the other end of the scale is the child with true hereditary deafness. His parents may hear, but one grandparent is deaf or two uncles or aunts and several cousins may be deaf and dumb. He need not have a deaf brother or sister, although he often has. No recent poison has entered his family to cause the deafness, which may form a family feature extending through a hundred years. His family is not tuberculous or cancerous or epileptic or syphilitic. He is simply the subject of a persistent family peculiarity like a six-fingered or a red-haired man. Why should he be either physically or mentally deficient? My experience of this type of deaf child is that he is neither. But he has the power, and so have his hearing brothers, of sending down this peculiarity—this deafness—without diminution or change of type. Clearly we must mind whom he marries, if, indeed, he marries at all.

And, lastly, there is the great middle class of the sporadic congenitally deaf. It has no type. It probably has several pathologies.

It certainly has very varied clinical features. Some of these children are healthy and, apart from the deafness, sound of body and mind. A healthy man and woman who were not related before marriage have a deaf child, and no chemical or biological test we have will disclose the cause of the deafness. Or, again, cousins have married, and a deaf child results. There is no history of deafness in the family. Or, thirdly, these sporadic cases are often degenerates. Either some poison has entered the blood or the family life is ebbing I know the last phrase is popular rather than scientific. But if it leads me to state that I do not think these sporadic cases often transmit their deafness, it has served my purpose. Often they are so handicapped that they cannot transmit anything. I think the class I now refer to tend on the whole to die out. I believe the largest number of physically and mentally weak amongst the deaf belong to this class. I need say nothing further about this class, because it forms the subject of a later lecture. Meanwhile, I have been driven to adopt the picture of a type for each class, because it is not always easy to say to which class a given case belongs. Further, the classification itself is provisional and not final. At any time a fresh advance in the pathology of deafness might break up Class II into several sub-divisions.

To sum up therefore—

If prevention of deafness is to be attempted we must—

1 Make the pathology of deafness and not the date of its occurrence, the basis of our classification.

2 We must have a strictly scientific definition of what the term "hereditary" as applied to deafness means.

3 We must have a much better admission schedule containing a careful record of the personal and family history and a careful clinical examination of every deaf child.

If work on these lines is to be carried out, the spirit and methods of research must enter our institutions for the deaf. At first these were called asylums, now they are well regulated establishments in which the education of the deaf is carried out on scientific lines. *But they must do more: they must help us to prevent deafness.* They can do this if they follow the lines of development of the hospital. In mediæval times the hospital was a refuge for lepers; later, in England in the sixteenth century, the hospital became a place where medical and surgical cases were taken for treatment, and what is important for my present purpose, where physicians and surgeons used the cases for the teaching of pupils or students. To this extent the institutions for the deaf have followed the hospitals, but the hospitals have gone further. Within the last half century hospitals have become the

great centres for the discovery and elaboration of preventive measures in the management of disease. There is scarcely any preventive measure that we know of that has not been hatched and elaborated within the walls of a hospital, and so great has this department of hospital work become that many hospitals are now equipped with clinical research laboratories.

These laboratories do not interfere with the medical and surgical work of the hospital: they assist it; and it is quite certain that as this part of hospital work grows, much of the medical and surgical work will be done away with. Prevention will anticipate treatment, it is better than cure.

And so it must be with the institutions for the deaf. Their scope must be enlarged: they must help us to prevent deafness. And they can do this without an operating theatre or a drug store. Within their walls is the only material available for the study of the prevention of deaf-mutism. This study does not require the scalpel or even the pill, but the careful examination and classification of deaf children, and the careful collection of statistics. Time spent in this way will not make for poorer but for better education, and it will point the way to the prevention of deafness.

When I come to speak of hereditary deafness, I shall have to compare the relative values of two methods of research which may be carried out in the institutions: the biometric, which deals with deaf-mutes as a class, and the personal, which deals with the individual himself and each member of the family to which he belongs. Here let me say that any correct classification for purposes of prevention must deal with the individual. The careful clinical investigation of 100 cases of deaf-mutism by which the personal and family history are recorded, and the pathology of the deafness as far as possible determined, will do more to point the way towards prevention than the returns from various sources regarding the general characters of 10,000 deaf-mutes.

I have already paid my tribute to what I believe to have been the great work of the institutions for the deaf, they have taught us the powers and capacity of the deaf child. Even if the deaf child must remain, I think most of the institutions must go. But I should like the institution to do one other piece of work for us before it goes: to point the way to the prevention of much of the deafness which now afflicts our children, and to point it so successfully that when it disappears, it will do so in a cloud of glory, and carry most of the disasters of child deafness with it.

LECTURE III.

Sporadic Congenital Deafness and Deafness from Syphilis.

THE mystery of the first deaf child in a family, all the members of which have hitherto heard, is the chief subject of this lecture. In the first two lectures I have dealt with deafness which undoubtedly comes after birth, the causes of which are for the most part quite clear, and I have therefore been able to indicate the lines on which efforts towards prevention should proceed. In the next lecture I shall deal with deafness which, whether we understand it or not, is at least to be expected, deafness which, even when the parents both hear, may in some cases be quite safely predicted, deafness which by familiarity has been robbed of much of its mystery. But in this lecture we have to deal with deafness which comes as a surprise, which is but poorly understood by any of us, and which is therefore mysterious.

If you inquire into the social status of the children attending any school or institution for the deaf, you will find that nearly all the children come from the poorest classes. I made such an inquiry four years ago, with regard to the children attending the Glasgow Institution.

Glasgow is a city of nearly a million inhabitants, and the institution there draws its 180 deaf children about equally from the city and the west and north of Scotland. Through the kindness of Mr. Welch, the senior teacher of the Glasgow Institution, and of Mr. Wright, the officer of the School Board of Glasgow, I am able to present information on three points which suggest themselves in thinking of this question.

1 How many apartments are in the houses from which the children of the Glasgow Institution are drawn ?

2 How many people occupy these houses ?

3 What is the nature of the accommodation in the homes of the children belonging to the Glasgow area proper ?

Mr. Wright has visited the home of every deaf child in Glasgow in the gathering of the facts for the answer to the third question.

Mr. Welch found, from inquiries amongst the children, that five of the Glasgow children had no home, that seventy-six had homes. In these seventy-six homes there were 168 apartments with 524 inmates, inclusive of twelve lodgers. This gives an average of $2\frac{1}{5}$ apartments to each home of seven inmates, an average of 3·145 inmates to each apartment, and of about five children to each family. As one of the apartments in such small houses is always the kitchen or cooking establishment, I need hardly point out that even after the institution has relieved the home of its deaf children there is dangerous overcrowding for those that are left. Mr. Wright visited 78 homes; five of these he found excellent, seven good, twenty-eight fair, and thirty-eight, or about 50 per cent, wretched. In only twelve of these seventy-eight homes has child-life a reasonable chance of remaining healthy and pure. In thirty-eight no deaf or hearing child should be left.

During the four years which have elapsed since these figures were drawn up matters have not improved. It still remains true that nearly all deaf children in our schools and institutions are drawn from the poorest classes. It is difficult to avoid the conclusion that poverty and overcrowding have something to do with the causation of deafness in young children.

The census returns for the City of Glasgow in the year 1911 have just been issued. I take the following figures from the return bearing on the accommodation in the inhabited houses of the city:—

Glasgow.—Persons per room at Censuses of 1901 and 1911.

Size of house.	(Persons per room, 1901.)	(Persons per room, 1911.)
All Sizes ...	1·846 ..	1·827
1 Apartment ...	3·183 ...	3·196
2 Apartments ...	2·463 ...	2·432
3 Apartments ...	1·803 ...	1·734
4 Apartments ...	1·332 ...	1·254
5 Apartments (and upwards) ...	0·787 ...	0·761

If you compare these figures with those I have given above, you will see *that the social status of the families from which the deaf children of Glasgow come is that of the house of one apartment.* What does this mean? It means—as Dr. Chalmers,[1] the Medical Officer of Health, has shown in a former document from which I have quoted—a one-apartment standard of living, of air

supply, of food, of clothing, and it results in a dwarfed child—I will show you that it means far more than that. It means untreated syphilitic disease, uncontrolled use of alcohol in many cases, a carelessness in the upbringing of children, and these, when added to the other conditions, result in an enormously high child death-rate, and in a deaf-mute rate which is never approached in the houses of the well-to-do. Such are the conditions which make for the increase of sporadic congenital or infantile deafness, and although in the institutions the children who are spared may be made fairly good specimens of men and women, the hearing is never recovered. The damage to the organ of hearing takes place before birth or during the first years of life, and the deafness is permanent.

This is true of all classes of deafness in young children unless, perhaps, the cases of true hereditary deafness. It is certainly true of acquired deafness. I do not require to argue here the question with regard to scarlet fever, measles, and meningitis. All of these diseases are more fatal, and more commonly cause deafness when they occur amongst the badly nourished children of the poor when they are not properly attended to medically and surgically, and when they have to be treated in the overcrowded parts of large cities.

Associated with poverty and overcrowding, is parental neglect. Here is an instance which I hope is not common. Three years ago, two children suffering from whooping cough were removed from Stobhill, which is a poorhouse or workhouse, to Ruchill, which is an infectious diseases hospital. On recovery, one was sent to the Royal Infirmary because there was some ear discharge and because it was a deaf and dumb child. Soon the discharge ceased, but the child remained deaf. The child became a favourite in the ward, but after two months I began to make proposals for her removal to an institution for the deaf. Nothing, however, was done till the end of the third month. During the whole of these three months the mother was a regular visitor to the child. About this time, the father became interested enough in the child to pay a visit to the ward. His exclamation was : " That's no ma wean at all." And it turned out to be so. For three months this woman did not know her own child from another. The whole of this family was being boarded and educated by the parochial authorities. The duties of the parents ceased with the birth of their children.

The difficulty is increased rather than diminished when we find that the children of the very poor are at birth physically equal to the children of the well-to-do. Last year the writer made observations on this point at the Glasgow Maternity Hospital. He found that the average weight of the children born in this hospital, which received the poorest mothers in Glasgow, was 7·1 lb. The average weight for a healthy child is 7 lb.

We are therefore driven to the conclusion that the children of the poor are well born. It is true that some of them have in their blood a poison which will express itself by death and deafness a little later in life, but it is equally true that this poison need not so express itself. The poison is present amongst the well-to-do, and seldom causes either death or deafness there. The disastrous results are due to the conditions of poverty, overcrowding, and neglect, which are inseparable from the lot of the children of the poor in the cities of this country.

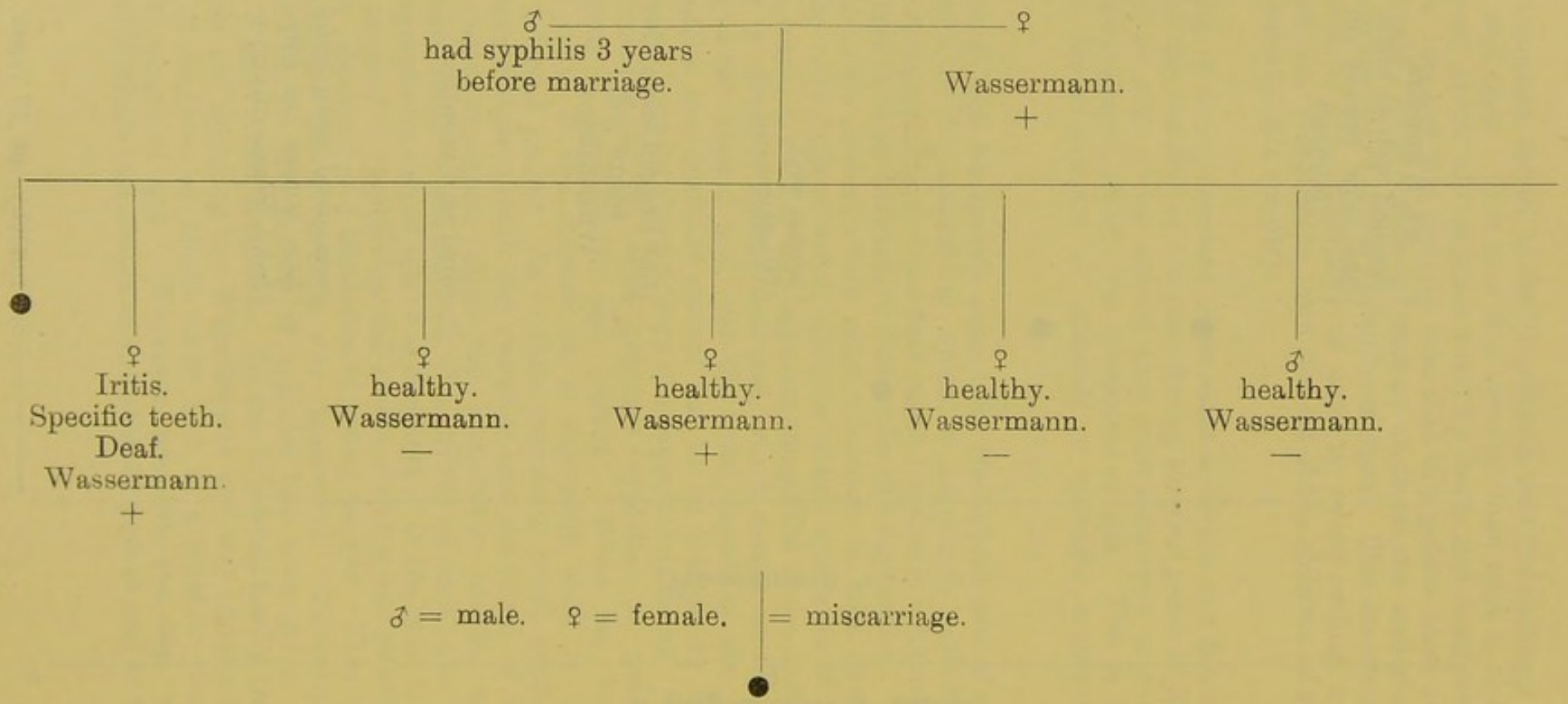
If deafness is to be prevented, there must be decent and healthy conditions for the children of the poor during the first years of life. Like a plant, or any young animal, they must have room to grow, they must have simple, clean, free conditions of life. This is the first step for the prevention of infantile or sporadic congenital deafness.

But we must look for specific causes for the appearance of the deaf-born child, or for something which is commonly added to poverty and overcrowding, and the first cause I notice is congenital syphilis. Syphilis is an instructive disease in this connection. It is probably the only disease which causes deafness in both parent and child, the only disease which operates before and after birth. It, therefore, forms a kind of link between congenital and acquired deafness, for it certainly causes deafness, which comes on in the child as late as the second and even the third decade of life. A study of syphilis and deafness cannot fail to be interesting and may throw some light on the ætiology of congenital deafness. We have here nothing to do with primary syphilis, or indeed with any form of syphilis in the parent. What we have to do with here is the disease as it expresses itself in the child of the affected parent As it thus manifests itself, syphilis is an infectious disease, due to the entrance into the blood of the parent of a micro-organism called the spirochæte pallida, and which expresses itself in the children in a variety of ways, and by a variety of symptoms, one of which is deafness. It has long been known that congenital syphilis caused a very striking combination of symptoms - deafness and blindness in young people. This was known long before the spirochæte was discovered. Recently a bio-chemical test for the poison of syphilis has been given us. This is the Wassermann Reaction. In the following family trees the indication for applying the Wassermann test was usually the appearance of deafness or blindness or both in a child or young person – 5–20 years of age. Wherever possible, the test was applied to the brothers and sisters of the affected person and to the mother.

Tree I.
K— Family.
9 pregnancies—4 deaths.
Wassermann +
♂ = male.
♀ = female.
= miscarriage.
= still-birth at term.
♀ healthy, æt. 17 years
♂ semi-deaf, semi-blind has bosses on forehead. Wassermann +
♂ died at 4 months.
♀ has pegged teeth, but seems well. Wassermann +
♀ seems well. Wassermann +
æt. 6 months, seemed well at birth, has now bosses on forehead.

Tree II. Mac— Family.

6 pregnancies—1 death.



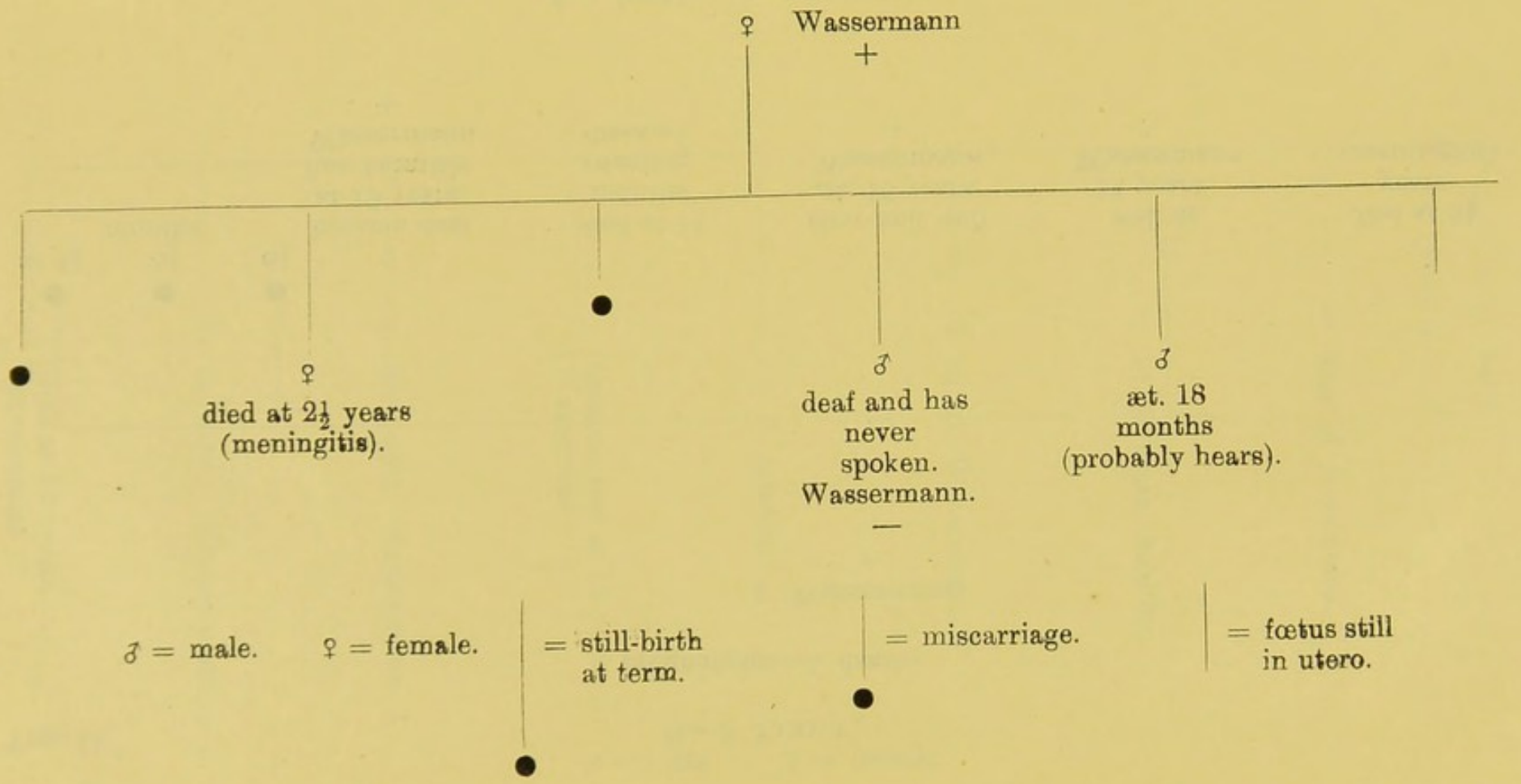
♂ = male. ♀ = female. | = miscarriage.

●

Tree III.

G— Family.

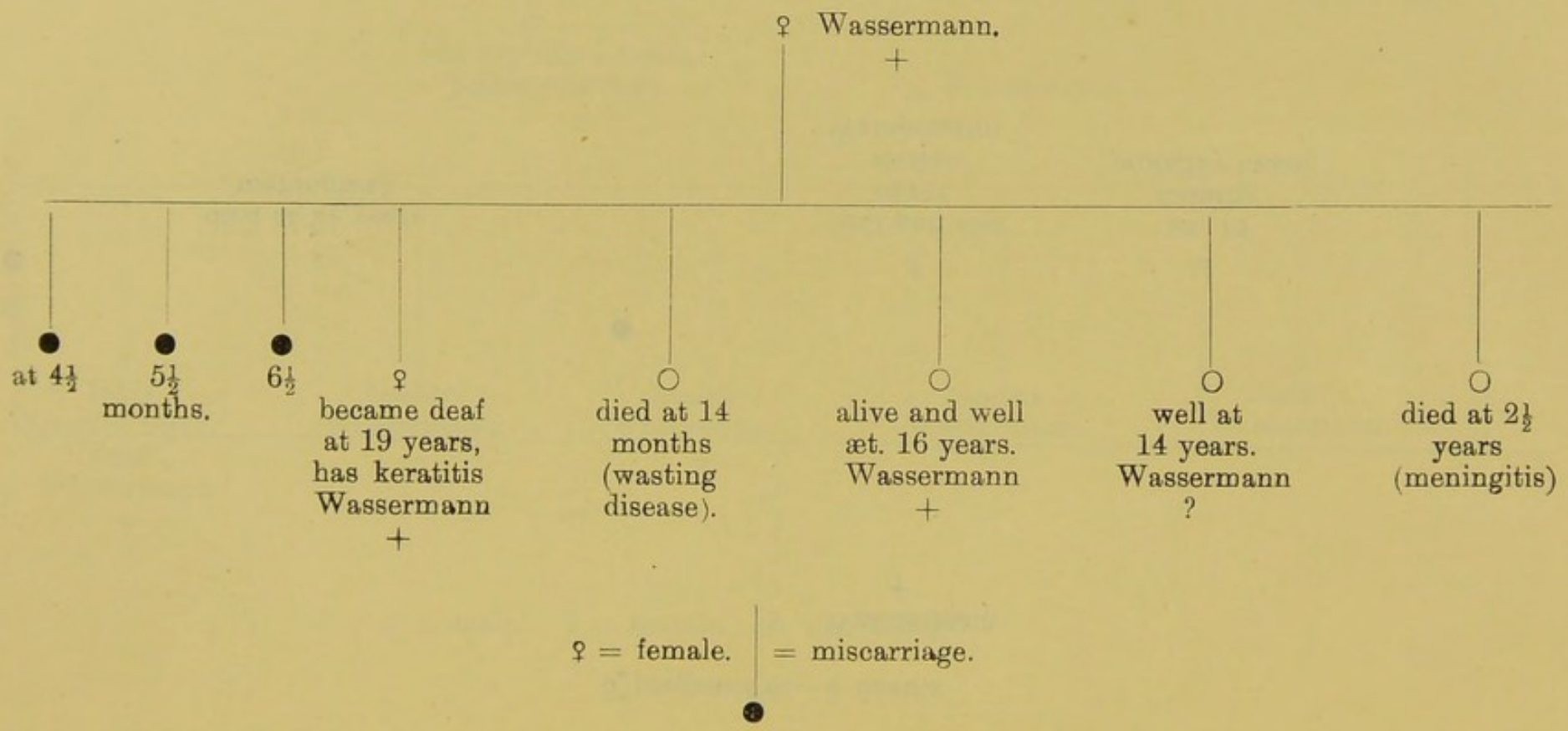
5 pregnancies—3 deaths.



Tree IV.

G—S Family

8 pregnancies—5 deaths.



Tree V.

D— Family.

9 pregnancies—2 deaths.

♀ Wassermann +

- ♂ baby.
- ♂ died of pneumonia.
- ♂ æt. 5 years, healthy.
- ♂ æt. 6, Wassermann ?
- ♂ æt. 9, healthy.
- ♂ became deaf at 12 years. Wassermann —
- ♂ born deaf. Wassermann +
- ♂ born deaf. Wassermann +
- ♂ died at 13 weeks (pneumonia).

♂ = male. ♀ = female.

Tree VI.

A— Family.

6 pregnancies—3 deaths.

♀

- ♂ died at 14 months (inflammation of the bowels).
- ♂ died at 7 months (teething).
- ♂ died at 3 years (convulsions).
- ♂ healthy.
- ♂ deaf and nearly blind. Wassermann ?
- ♂ has had a nasal affection. has had a still-born child.

♂ = male. ♀ = female.

Tree VII.

K—D Family.
9 pregnancies—4 deaths.

♀ has left iritis. Wassermann +
(married 26 years. 24 years ago had illness due to infection from husband)

♂ died at 9 months.

♂ æt. 12, healthy.

♀ æt. 16, healthy.

♀ æt. 18, lost hearing at 15, has iritis. Wassermann +

♀ æt. 20, lost hearing at 17. Wassermann +

♀ æt. 23

○ æt. 2 years, healthy.

● = still-birth at term.

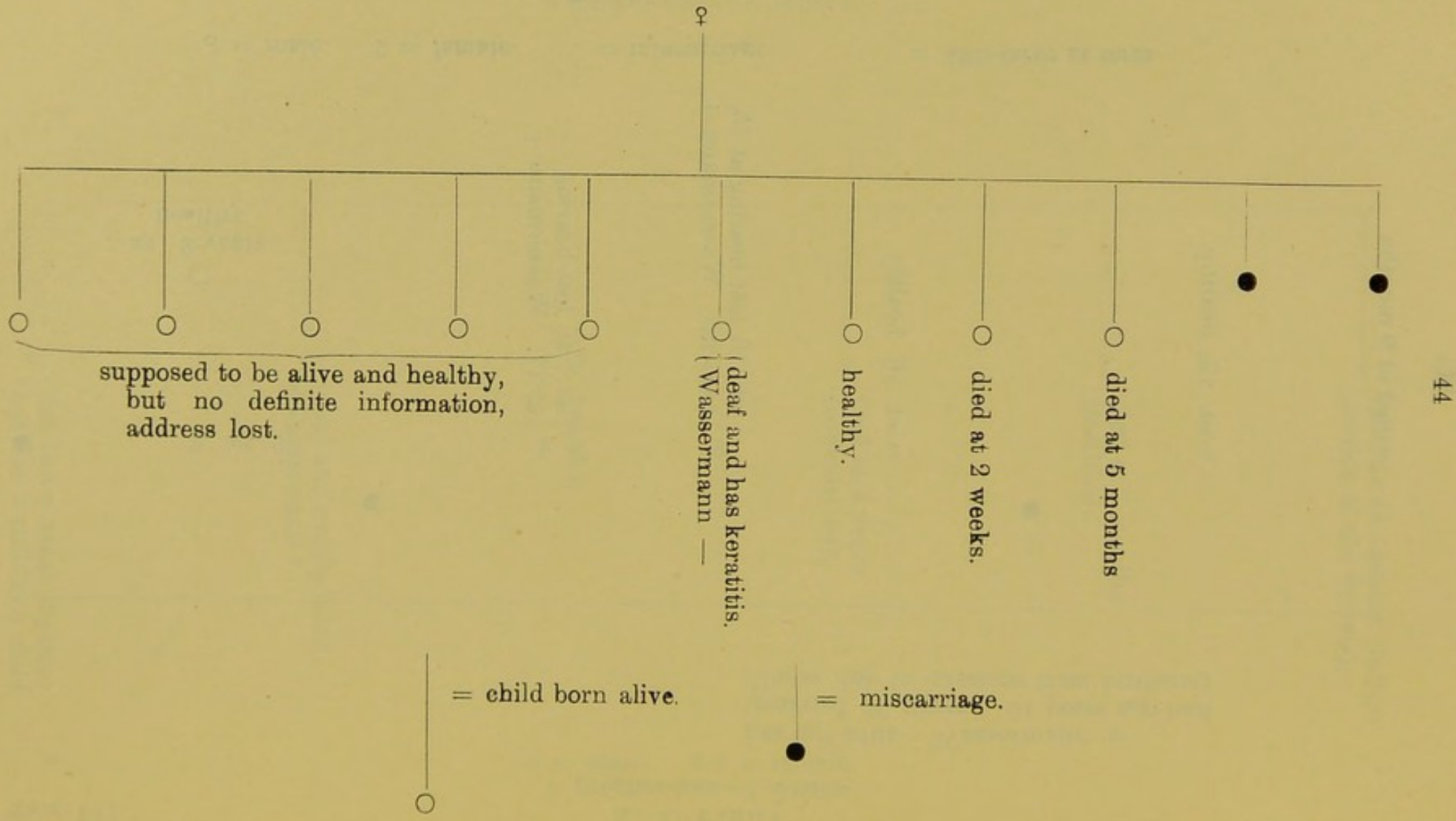
● = miscarriage.

♂ = male. ♀ = female.

Tree VIII.

L— Family

11 pregnancies--4 deaths.



Tree IX.

H— Family.
Wassermann +
4 pregnancies—1 death.

♀ blood poisoning whilst nursing the first child.

♂ seems well. Wassermann.

♀ æt. 13. Keratitis at 7 years. total deafness at 7½ years. Wassermann +

= still-birth at term.

♂ æt. 19, well.

♂ = male. ♀ = female.

Tree X.

S—R Family.
(Wassermann test refused.)
10 pregnancies—6 deaths.

♀

- ♂ æt. 3 years, delicate, and has gastric catarrh.
- ♂ æt. 6, getting deaf, has depressed nose, had snuffles at 6 months.
- ♂ died at 22 months (bronchitis and rickets).
- ♂ died at 7 days.
- ♂ died at 1 month.
- ♂ æt. 9, had fits.
- ♂ died at 4 months (bronchitis).
- ● cross-birth.
- ♂ died at 15 months ("rickets of the brain").
- ♂ æt. 7, well.

● = still-birth at term.

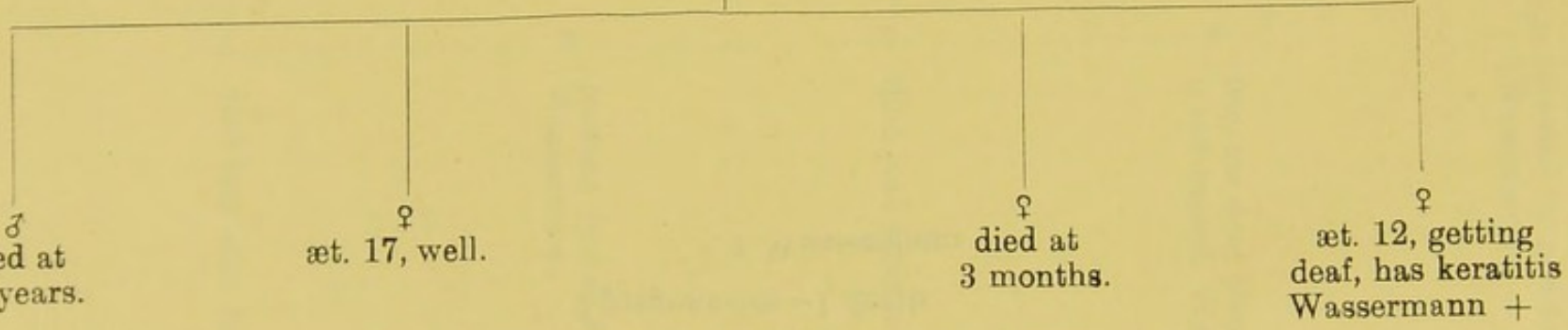
♂ = male. ♀ = female.

Tree XI.

McM— Family.

4 pregnancies—2 deaths.

♀ (dissolute.)



♂ = male. ♀ = female.

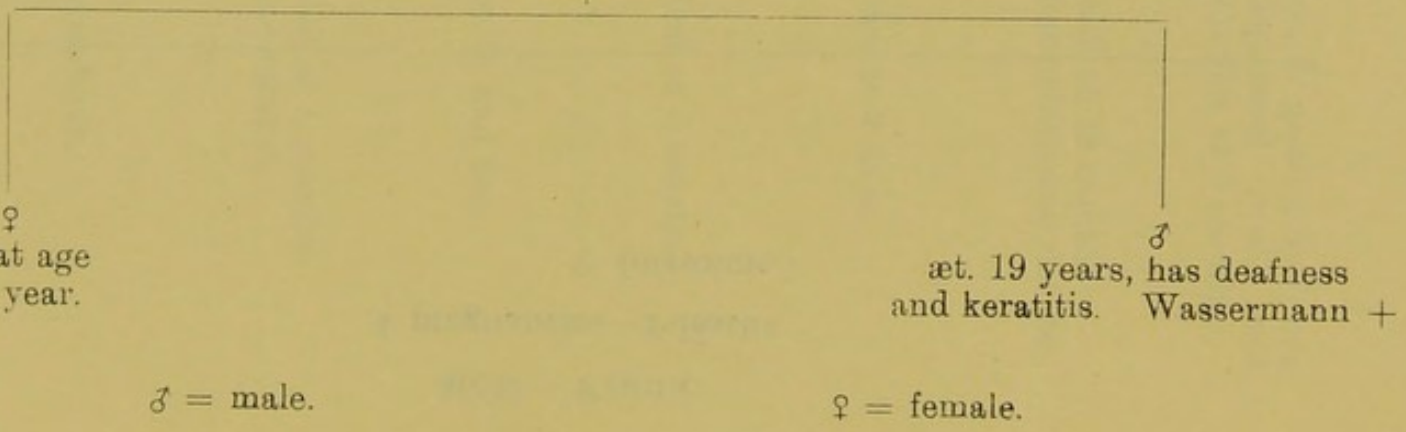
Tree XII.

G—Y Family

(Husband died 3 months after birth of second child.)

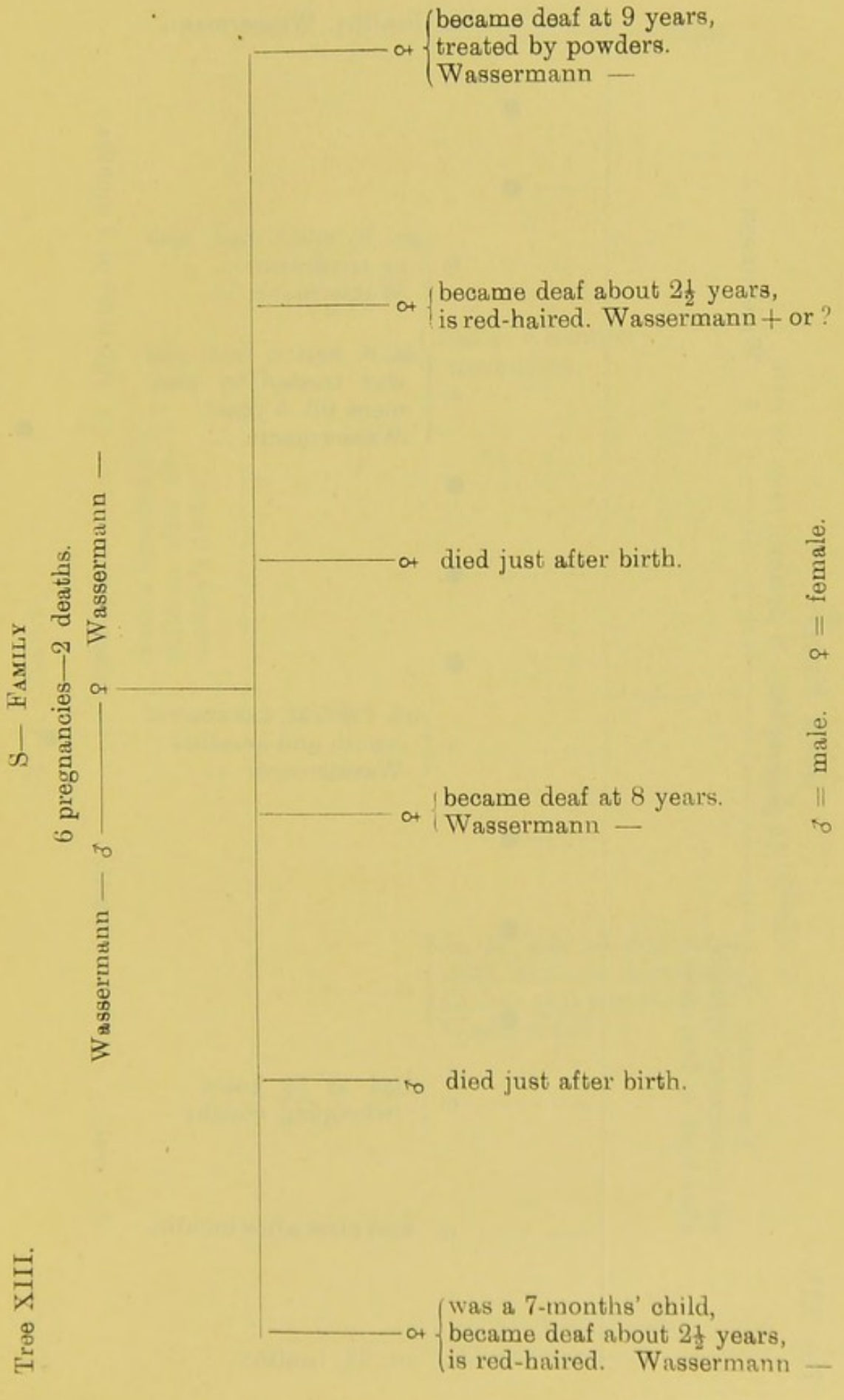
2 pregnancies—1 death.

♀ Wassermann +



♂ = male.

♀ = female.


Tree XIII.
S— Family
6 pregnancies—2 deaths.
Wassermann — ♂ — ♀ Wassermann —
♂ became deaf at 9 years, treated by powders. Wassermann —
♂ became deaf about 2½ years, is red-haired. Wassermann + or ?
♂ died just after birth.
♂ became deaf at 8 years. Wassermann —
♂ died just after birth.
♂ was a 7-months' child, became deaf about 2½ years, is red-haired. Wassermann —
♂ = male. ♀ = female.

Tree XIV.

G—M Family.

15 pregnancies—8 deaths.

♀ Wassermann +

Known to ♂ have contracted syphilis after birth of first child.

♂ healthy. Wassermann —

♂ æt. 6, never had rash or treatment. Wassermann +

♀ æt. 8, had a rash and was treated by ointment till 5 years. Wassermann — = still-birth at 7 months.

♂ æt. 12, deaf, has scarred mouth and keratitis. Wassermann + = miscarriage.

♀ died at 3½ years (whooping cough).

♂ died after a few months.

♂ æt. 23, healthy.

♂ = male. ♀ = female.

Tree XV.

D—K Family.
5 pregnancies—3 deaths.
♀ dead.

(father deserted the children after the mother's death.)

♂ { died at 4 years (measles and pneumonia)

♀ { died at 6 months (meningitis).

♂ { æt. 13, was an 8-months' child, deafness came on at 12, has also keratitis. Wassermann +

♂ { æt. 14, health good. Wassermann —

♂ = male. ♀ = female. ● = still-birth at term.

Tree XVI

McN— Family.

7 pregnancies—1 death.

♀ refused Wassermann test (history of sore throat and mouth after birth of fifth child).

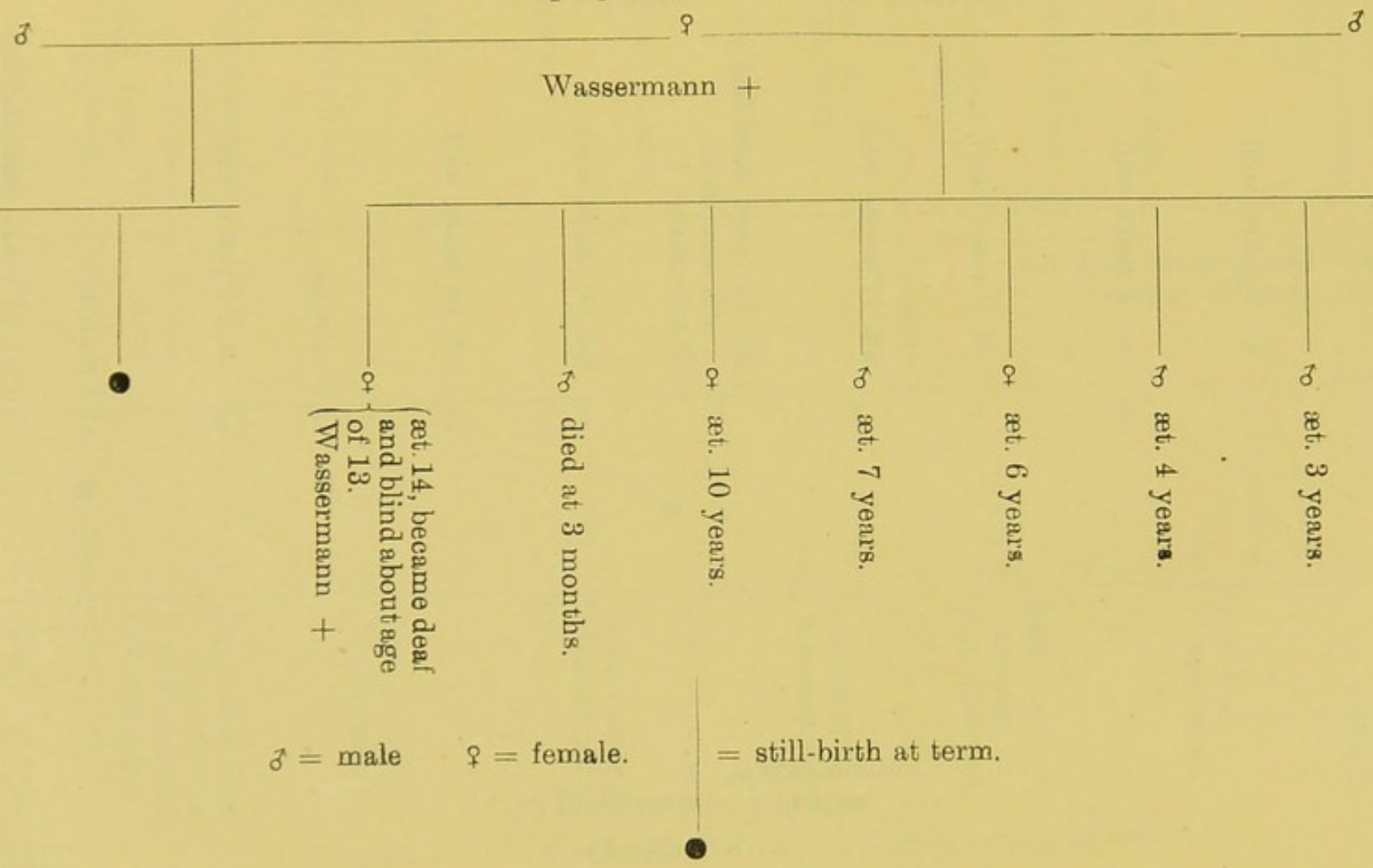
- ♂ æt. 14, getting deaf, eyes unaffected. Wassermann test refused.
- ♂ æt. 15, eyes unaffected, became deaf at 13. Wassermann +
- ♂ æt. 21, well.
- ♂ æt. 23, well.
- ♂ died at 1 year (scarlet fever)
- ♂ æt. 28, well.
- ♂ æt. 30, well; has two children, both healthy.

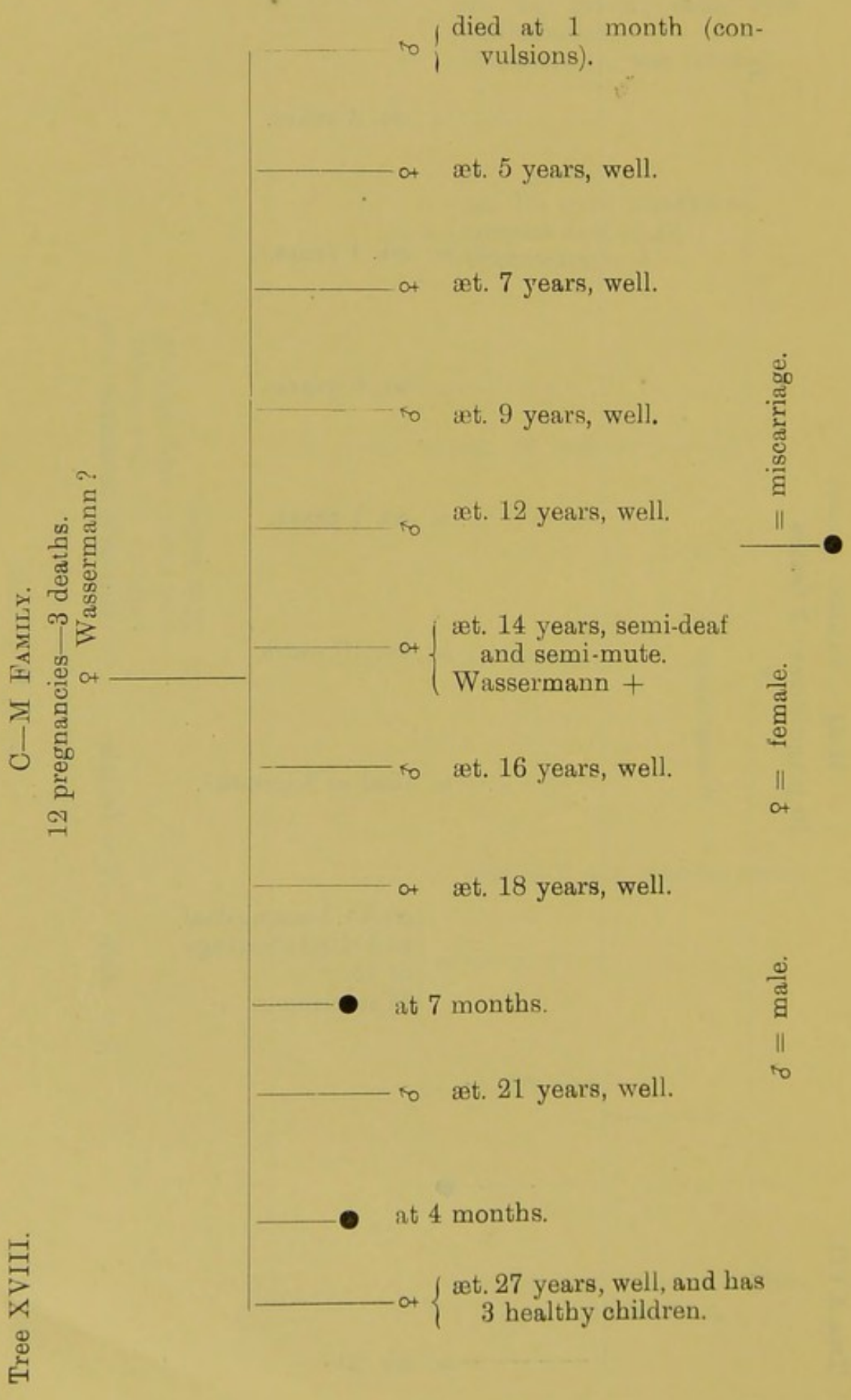
♂ = male ♀ = female

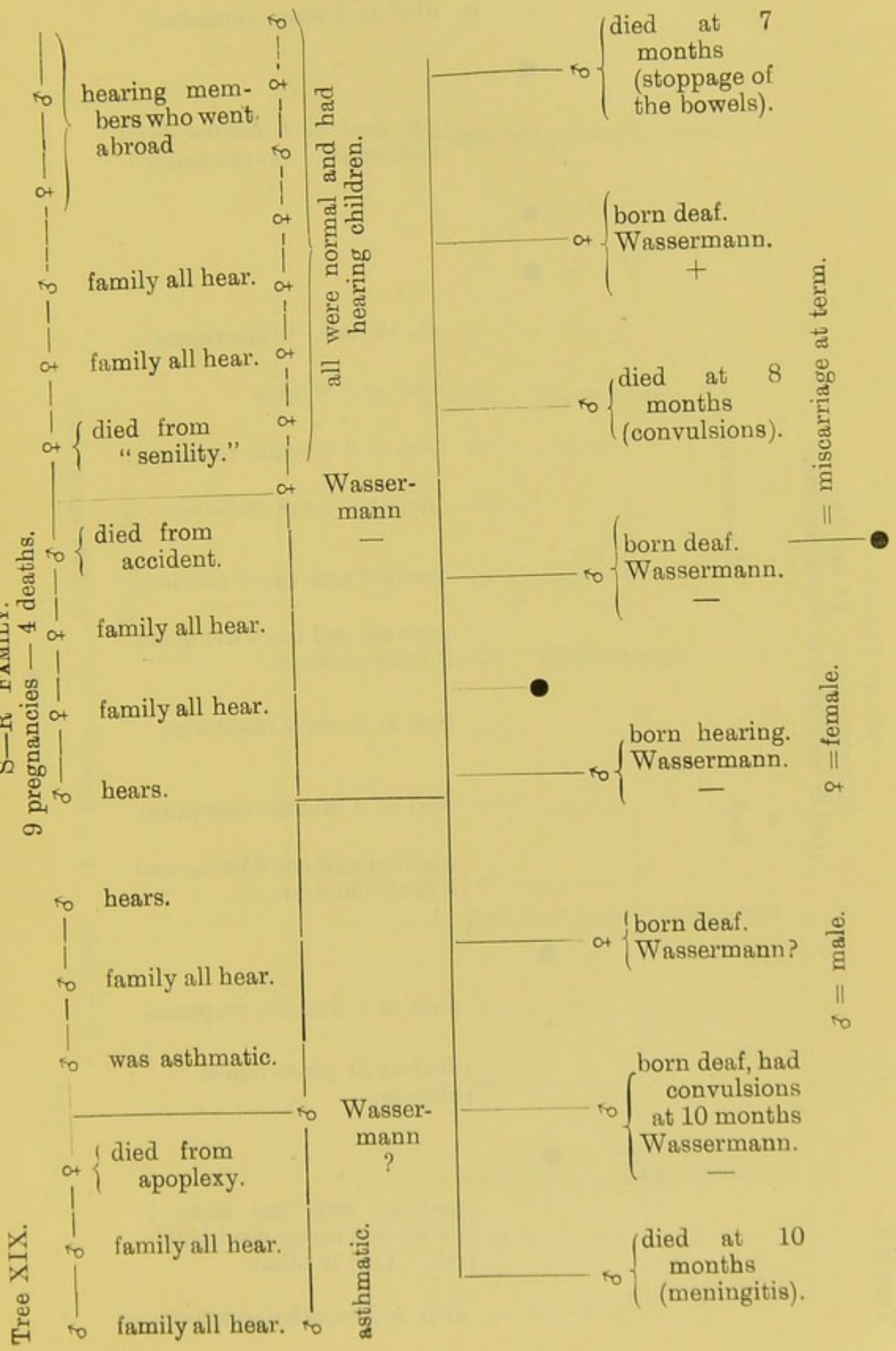
Tree XVII.

McQ— Family.

10 pregnancies—2 deaths.




Tree XVIII.
C—M Family.
12 pregnancies—3 deaths.
♀ Wassermann ?
♂ died at 1 month (convulsions).
♀ æt. 5 years, well.
♀ æt. 7 years, well.
♂ æt. 9 years, well.
♂ æt. 12 years, well.
♀ æt. 14 years, semi-deaf and semi-mute. Wassermann +
♂ æt. 16 years, well.
♀ æt. 18 years, well.
at 7 months.
♂ æt. 21 years, well.
at 4 months.
♀ æt. 27 years, well, and has 3 healthy children.
♂ = male.
♀ = female.
= miscarriage.


Tree XIX.
S—R Family.
9 pregnancies — 4 deaths.
hearing members who went abroad
family all hear.
family all hear.
died from "senility."
died from accident.
family all hear.
family all hear.
hears.
hears.
family all hear.
was asthmatic.
died from apoplexy.
family all hear.
family all hear.
all were normal and had hearing children.
Wassermann —
Wassermann ?
asthmatic.
died at 7 months (stoppage of the bowels).
born deaf. Wassermann. +
died at 8 months (convulsions).
born deaf. Wassermann. —
born hearing. Wassermann. —
born deaf. Wassermann?
born deaf, had convulsions at 10 months Wassermann. —
died at 10 months (meningitis).
= miscarriage at term.
♀ = female.
♂ = male.

Tree XX.

M—D Family.
20 pregnancies – 14 deaths.
(father and mother were cousins.)

♂ dead. — ♀ Wassermann —

♂ = male. ♀ = female = miscarriage at term.

- ♂ died at 2 years (measles)
- ●
- ♂ got deaf at 4 months from meningitis. Wassermann +
- ●
- ●
- ♂ æt. 18, well. Wassermann +
- ♂ died at 8 weeks.
- ♂ died at 2 months (delicate).
- ♂ died at 2 years (measles).
- ♂ married and has 2 children.
- ♂ married and has 3 living and 2 dead children. — ●
- ♂ died at 2 years (teething).
- ♂ died at 9 months (teething).
- ♂ married and has 3 living and 2 dead children.
- ●
- ♂ died at 5 months (rupture).
- ♂ died at 21 years (chest disease).
- ●
- ♂ married and has some 3 living and many dead children. One is blind.
- ♂ died at 2 months (smallpox).

Tree XXI.

D—H Family.

5 pregnancies—1 death.

♀ Wassermann —

♂ well, too young for testing.

♀ well. Wassermann +

♂ well. Wassermann —

♂ died at 2 years (meningitis).

♀ born deaf. Wassermann +

♂ = male. ♀ = female.

Synopsis of Syphilitic Families.

No	Name.	Pregnancies.	Living	Dead.	Deaf and Blind	Wasserman Test.	Deafness.
1	K— Family ...	9	5	4	1	+	Acquired
2	Mac—Family...	6	5	1	1	+	Acquired
3	G— Family ...	5	3	2	1	+	Congenital
4	G—S Family ...	8	3	5	1	+	Acquired
5	D— Family ...	9	7	2	3	+	Congenital or acquired
6	A— Family ...	6	3	3	1	?	Acquired
7	K—D Family ...	9	5	4	2	+	Acquired
8	L— Family ...	11	7	4	1	?	Acquired
9	H— Family ...	4	3	1	1	+	Acquired
10	S—R Family ...	10	4	6	1	refused	Acquired
11	McM— Family	4	2	2	1	+	Acquired
12	G—Y Family ...	2	1	1	1	+	Acquired
13	S— Family ...	6	4	2	4	+ weak	Acquired
14	G—M Family...	15	5	10	1	+	Acquired
15	D—K Family ...	5	2	3	1	+	Acquired
16	McN— Family	7	6	1	2	+	Acquired
17	McQ— Family	10	8	2	1	+	Acquired
18	C— Family ..	12	9	3	1	+	Acquired
19	S—T Family ...	9	5	4	4	+	Congenital
20	M—D Family...	20	6	14	1	+	Congenital or acquired
21	D—H Family...	5	4	1	1	+	Congenital
		172	97	75	31		
			172				
				106			

In many of the families the Wassermann test has been carried out in every living child, and wherever possible the mother has been included. In one or two cases the blood of the father has also been tested. In some families, because the members are scattered, a complete Wassermann test has been impossible, and in some the same result has been due to refusal to have the test applied. But in no case is the diagnosis of syphilis in any doubt.

The preceding family trees surely form a remarkable group. In 21 families there are 172 pregnancies; there are 30 miscarriages or still-born children; including these there are 75 deaths, nearly all in the first or second years, and in addition to these there are 31 deaf, or deaf and blind children. There remain 66 living children, of whom many are known to have been born

before the poison entered the parental blood. As a rule I have called the 66 living children healthy, but by this term I mean only that they are not blind or deaf. Many of them are not healthy, and more will become unhealthy because the poison has been shown to be in their blood. Nearly two-thirds of the children born are dead, or if they are alive are either deaf or blind or both (106 in 172), and with a few exceptions there are no adults in the families. In many of the families one or more deaths from meningitis have occurred.

It is doubtful if any disease, even tuberculosis, is so destructive of child life or so disastrous to child health as syphilis. Tuberculosis may appear in a larger number of families although even this may be doubtful. By far the commonest cause of death amongst these young children is meningitis, or some form of head affection going under the name of fits, convulsions, etc. Is there not here a partial explanation of the great number of deaths from meningitis which I have noticed in an earlier lecture? And yet this disease, so destructive to child life, and so disastrous to child health, is not notifiable, and amongst the poor is hardly ever treated. When I add that it is both preventable and curable, surely I may urge that it is time it were dragged out of its hiding-place and spoken of freely even amongst educated lay people like any other infectious disease.

A study of these family trees points to the following conclusions:—

1 Syphilis is an infectious disease, which, having entered the blood of the parents, is transmitted to the children.

2 Amongst the children it stunts and dwarfs and kills. Many of them are still-born, many die within a few months, or during the first year, and of those who survive some become blind, some deaf, some both blind and deaf, whilst some continue in apparently good health.

3 The Wassermann reaction or test nearly always gives a positive result when the combination of keratitis (blindness) and deafness occurs in the child of syphilitic parents. Occasionally the result is negative in the presence of the combination. It sometimes gives a positive result in the apparently healthy brothers and sisters of those affected by blindness or deafness, thus showing that they are really infected, and that at a later date symptoms may develop.

4 A common cause of death amongst these syphilitic children is meningitis, I think it is the commonest cause of their

death, and this disease occurs most commonly during the first or second years.

5 Untreated or insufficiently treated syphilis in the parent may be discovered by the Wassermann reaction many years after infection. Healthy and diseased children may be born at any stage of the family history, but the usual family record is that the earliest children are still-born, then diseased children, and lastly, healthy children. The later children have the best chance to live.

Now these are not all the conclusions which may be drawn from a study of these trees, but they are those which I think, bear most directly on the subject of these lectures, the prevention of deafness. How, then, are we to prevent such deafness? *By the notification of the disease when it appears in the children, and by the immediate treatment of both mother and child.* "Fresh legislation," some one may say. "Further interference with the liberty of the subject." "Further prying into family affairs." Nothing of the kind, although, were fresh legislation necessary, the case seems urgent enough to warrant it. But in recent legislation we have the machinery for our purpose ready to hand. Like most of my profession, I have many faults to find with the National Insurance Act. But maternity benefit will be claimed, even for dead-born children, and for all children who die shortly after birth, and if the commissioners insist on a certificate of the cause of death, the syphilitic families will be discovered, and without any public disclosure of the reason for the step, treatment will be instituted which will counteract the poison in the blood of the mother, and will save the children of the future. The disease is very amenable to treatment, and it is because it is untreated that it passes down to the children.

It may be urged that these are cases of acquired deafness, the deafness does not appear till the child has reached the school age. Notice how many of these children die young, and especially how many of them die of meningitis, and refer for a moment to our ignorance (I pointed it out in a former lecture) with regard to the causation of meningitis. Then listen to what the pathologist tells us about the post-mortem examination of the brain in syphilitic children who die.

"Mayer (quoted by Fraser)[2] has examined microscopically the inner ears of eleven cases of congenital syphilis occurring in infants; in nine of the eleven, purulent otitis media was present, but this condition is found in 90 per cent of infants at autopsy; in only one case was the tympanic membrane perforated, and in no case was there any bone disease or inflammatory invasion of the labyrinth from the middle ear. On the other hand, he comes to the following conclusions:—

1 Inflammatory processes occur in the meninges of children affected by congenital syphilis.

2 Specific interstitial inflammation of the acoustic nerve accompanies this meningitis.

3 The inflammatory process thus spreads to the inner ear, most frequently giving rise to irritation, but sometimes to inflammatory exudation."

Mayer thinks that these changes are the same as those which give rise to late specific deafness, and that the conditions observed by Walker Downie—in a case first published by myself—are only the later stages of this process.

We have, therefore, in the meningitis of the young children of syphilitic families, a link between the syphilitic blindness and deafness of the child of school age and the children who become deaf so soon after birth that they are regarded as congenitally deaf, and we may have a link to some cases of true congenital deafness.

Where can you see these congenital syphilitics who have become deaf after the speech habit has been formed, from 6 to 16 years old? They do not always become quite deaf, and even if they do, their speech is not lost. They are found in the ordinary schools, where they make no progress. There are a few in the Institutions for the Deaf, where, because of their defective sight, (we have seen that many of them have keratitis,) and because of their damaged brain, they are put down as duffers. Many of them go to the Institutions for the Blind. There is a whole class of them at the Homerton Residential School for the Deaf, under Mr. Barnes, and we have several of them in the semi-deaf and semi-mute classes in the Glasgow Day School for these latter children. But no treatment we know of cures the defects of hearing and sight, and they nearly always die early, or become a permanent burden to the community. *These cases are cases for prevention, not for cure.*

Let me remind you here that we are discussing syphilis as a cause of deafness amongst the poor, untreated syphilis, plus poverty and overcrowding. Syphilis occurs amongst the well-to-do, but it does not cause much deafness there. It is a disease which yields to treatment. It is so amenable to treatment that after two or three years of constant supervision and treatment, marriage is usually followed by a healthy progeny. But this supervision and treatment is seldom possible amongst the poor. It is generally not attempted. Partly from ignorance, and partly because of the intrinsic difficulty of keeping it up, the patient either does not apply for treatment, or cannot continue it. This is

my own experience amongst the poor. Here is what Mr. Cheatle[3] says about it :—"I carefully inquired of the mothers of congenitally syphilitic children with internal ear deafness, whether treatment had been applied in infancy, and invariably the answer was in the negative." And if the child is not treated, no more is the mother. As a rule she does not know why her child is deaf. You see now why her children die, or become deaf.

If congenital syphilis causes children to be still-born, if it causes disease of the nasal passages (popularly known as snuffles) during the first weeks of life, if the children of syphilitic parents often waste away during the early months of life. if many of these children die of meningitis during the first twelve or eighteen months of life, is it not possible, nay, is it not probable, that when the children of syphilitic parents are born deaf, the cause of the deafness is the poison of syphilis ?

If the poison of syphilis be present in the blood of the children of syphilitic parents (and the trees that I have given show that this is the case), it is the history of this poison which must claim our attention. We do not think of the birth of the child as altering the type of the disease, we rather regard the birth of the child as an accident in its existence. The style of feeding, and the method of breathing have changed, a larger number of possible causes of deafness threaten the child in the new environment, but the nature of the deafness is not necessarily altered by the accident of birth. In syphilis, at least, the same poison has operated from the beginning of the child's existence, which is not the time of birth, but the time of conception.

The conclusions in this section are based on the examination of the blood of over 150 persons, about the half of whom were born deaf, and about a third of whom have become deaf since birth. The remaining cases were not deaf at all, but were related to others in the list who are deaf. The test was the Wassermann reaction, which was carried out by Drs. Browning and Cruickshank at the Clinical Research Laboratory of the Glasgow Western Infirmary, and by Dr. Campbell, Bacteriologist to the Royal Infirmary. The material was collected from the children at the Glasgow Institution for the Deaf and Dumb, Langside, Glasgow, from the children seeking admission to the Glasgow School for the Semi-deaf and Semi-mute, and from the Ear Department of the Royal Infirmary.

The following is a list of the cases :—

No.	Name.	Source.	Grounds of Suspicion.	Result of Wassermann Test.
1	T. McS.	D.D.I.	Paralysis of tongue and lips	+
2	D. M.	Do.	Born deaf. Brother deaf	—
3	J. M.	Do.	Do.	—
4	G. H.	Do.	Sporadic congenital deafness	—
5	I. G.	Do.	Do.	—
6	J. S.	Do.	Acquired deafness. Cerebro-spinal fever at 9 years	—
7	R. McI.	Do.	Sporadic congenital deafness	—
8	A. W.	Do.	Acquired deafness. Meningitis at 6 years	—
9	J. W.	Do.	Born deaf. Half-cousin deaf and dumb	—
10	W. B.	Do.	Acquired deafness. Middle ear disease	—
11	A. McC.	Do.	Acquired deafness at 8 years. Purulent middle ear disease	—
12	R. W.	Do.	Sporadic congenital deafness	—
13	M. C.	Do.	Do.	—
14	M. D.	Do.	Do.	—
15	M. A.	Do.	Do.	Doubtful
16	G. M.	Do.	Do. Said to have been 10 deaths during infancy in the family	
17	J. L.	Do.	Sporadic congenital deafness Has vowel hearing, is weak minded, was illegitimate	—
18	R. K.	Glasgow School Board	Acquired deafness and keratitis	+
19	M. K.	Glasgow School Board	Family of R. K.	+
20	M. K.	Glasgow School Board	Do.	+
21	M. K.	Glasgow School Board	Do.	+
22	K. McI.	D.D.I.	Deafness and keratitis	+
23	M. McI.	D.D.I.	Family of K. McI.	+
24	I. McI.	D.D.I.	Do.	—
25	A. McI.	...	Family of K. McI.	—
26	P. McI.	...	Do.	—
27	M. McI.	...	Do.	+
28	A. McL.	D.D.I.	Lost hearing at 2 years	—
29	G. S.	Do.	Meningitis. Date not given	—
30	H. M.	Do.	Sporadic congenital deafness	—
31	I. F.	Do.	Do. Middle ear discharge	—
32	A. G.	Do.	Sporadic congenital deafness	—
33	E. M.	Do.	Do.	—

No.	Name.	Source.	Grounds of Suspicion.	Result of Wassermann Test.
34	D. S.	D.D.I.	Lost hearing at 2 years from teething. Has tuberculous scars on both sides of neck	—
35	H.McK.	Do.	Condition at birth doubtful	—
36	A. D.	Do.	Has disease of curvical vertebræ	Weak +
37	G. S.	Do.	Meningitis at 11 months	—
38	A. B.	Do.	Brother and sister deaf and dumb. Mother also deaf. Father hard drinker	—
39	M. D.	Do.	Sporadic congenital deafness	—
40	D. M.	Do.	Three maternal uncles hard of hearing	—
41	M. W.	Do.	Acquired deafness. Has tuberculous scar on neck	—
42	J. B.	Do.	Sporadic congenital deafness. Depressed nose. Scarring of angles of mouth	—
43	P.	Do.	Sporadic congenital deafness	—
44	T. M.	Do.	Has brother deaf in the school. Cause of deafness, pneumonia at 6 years	—
45	McK.	Private case	Mentally defective.	—
46	C.	D.D.I.	True hereditary deafness. Ayrshire family	—
47	G.	Do.	Acquired deafness. Assigned cause, fright at 3 years	—
48	S.	Private case	Otosclerosis ?	—
49	L. W.	D.D.I.	Born deaf. Has sister and brother deaf-mutes	—
50	M. W.	Do.	Do.	—
51	M. D.	Do.	Born deaf. Sisters deaf.	+
52	J. D.	Do.	Do. do.	+
53	B. D.	School Board	Acquired deafness at 11 years. No keratitis. Sisters deaf	—
54	A. D.	Do.	Brother to above	—
55	M. D.	...	Mother of above	+
56	M. N.	D.D.I.	Sporadic congenital deafness	—
57	J. F.	Do.	Do.	—
58	S. G.	Do.	Illegitimate. Condition at birth unknown	—
59	S.	Private case	Born deaf (sporadic)	—

No.	Name.	Source.	Grounds of Suspicion.	Result of Wassermann Test.
60	M. K.	D.D.I.	Unknown cause at 2 years	—
61	M. C.	Do.	Born deaf. Has sister in Institution	—
62	M. S.	Do.	Acquired deafness. Became deaf at 9 years	—
63	I. S.	Do.	Sister to above. Became deaf at 8 years	—
64	J. S.	Do.	Sister to above. Became deaf at 2½ years	—
65	M. S.	Do.	Father to above	—
66	M. S.	Do.	Wife of last case	—
67	M. S.	Do.	Daughter of 65 and 66. Became deaf at 2½ years	Doubtful
68	A. G.	Private case	Acquired deafness. Has keratitis	+
69	M. G.	...	Mother to 68	+
70	E. S.	D.D.I.	Sporadic congenital deafness. Deformed	—
71	W. M.	Do.	Born deaf and has brother deaf-mute	—
72	I. W.	Do.	Born hearing. Deafness has come on gradually and is said to be due to adenoids, but has a brother in another School for the Deaf	—
73	H. R.	D.D.I.	Sporadic congenital deafness	—
74	A. McE.	Do.	Deafness at 17 months said to be due to measles. Sister of 2½ years probably deaf	—
75	D. M.	Do.	Hearing lost at 6 years. Cause unknown	—
76	E. M.	Do.	Suspected syphilis. Gradually lost hearing at 7 years. Has eye affection	—
77	J. D.	Do.	Meningitis at 2½ years	Weak +
78	J. A.	Do.	Condition at birth not known. Father insane	Doubtful
79	D. A.	Do.	Sporadic congenital deafness	—
80	I. C.	Do.	Has two sisters deaf and dumb. Was born deaf	—
81	J. T.	Do.	Sporadic congenital deafness	—

No.	Name.	Source.	Grounds of Suspicion.	Result of Wassermann Test.
82	M. C.	School Board	Born deaf. Suspected syphilis	—
83	C. C.	D.D.I.	Sporadic congenital deafness	—
84	N. D.	Do.	At 8 years became deaf and blind. Mother dead. Father disappeared. There is one brother	—
85	A. J.	School Board	Deaf from birth but has vowel hearing	—
86	R. D.	Do.	Said to have had meningitis at 1 year	—
87	M.McN.	Do.	Sporadic congenital deafness	—
88	R. G.	Do.	Is mentally defective, semi-deaf, has vowel hearing. Grandparents deaf	—
89	H. M.	Do.	Semi-deaf and semi-mute. Has vowel hearing	—
90	E. C.	Do.	Is a mentally child. Said to be semi-deaf from birth	Doubtful
91	J. R.	Do.	Fall at three months. May have been born deaf	—
92	J. H.	Do.	Suspected syphilis. Teeth specific. Left eye hazy, palate high. Can't close mouth	Weak +
93	M. R.	...	Known to have had syphilis which I treated. Leuco-plakia of old standing	—
94	M.	School Board	Said to have lost hearing at 15 months	—
95	B.	Do.	Sporadic congenital deafness	—
96	O. B.	Do.	Motor aphasia	—
97	M. M.	Do.	Deaf. Has cleft palate, hare lip, and is rickety	—
98	J. G.	Do.	Acquired deafness and keratitis	+
99	A. G.		Sister of above	—
100	G. G.		Brother to 98	+
101	P. G.		Brother to 98	—
102	M. G.		Mother to 98	+
103	G.	Do.	Meningitis at 11 months, said to be due to cerebro-spinal fever	—
104	McD.	Do.	Sporadic congenital deafness	

No.	Name.	Source.	Grounds of Suspicion.	Result of Wassermann Test.
105	S. M.	Royal Infirmary	Born deaf	—
106	M. M.	Do.	Mother to 105	—
107	M. G.	Do.	Mother of 108	+
108	A. G.	Do.	Born deaf	—
109	I. G.	Royal Infirmary	Acquired deafness. Interstitial keratitis	+
110	J. G.		Brother of 109	Doubtful
111	A. G.		Brother of 109	+
112	M. G.		Mother of 109	+
113	E. McN.	Do.	Became rapidly deaf at 13 years	+
114	F. C.	School Board	Acquired deafness with keratitis	+
115	J. D.	Do.	Acquired deafness. Disease of bones and glands	+
116	S. K.	Royal Infirmary	Acquired deafness without keratitis	+
117	M. K.		Sister of 116. Acquired deafness without keratitis, Mastoid disease	+
118	M. K.		Mother of 116	+
119	M. F.	School Board	Acquired deafness with keratitis	+
120	J. G.	Do.	Do.	+
121	J. D.	Royal Infirmary	Do.	+
122	G. L.	Do.	Do.	Doubtful
123	A. A.	Do.	Lost hearing at 13 years, and has keratitis	Doubtful
124	R. McL.	School Board	...	—
125	L.	Private Practice	Head injury with deafness and giddiness	—
126	J. J.	School Board	Supposed whooping cough at 15 months	—
127	C. M.	Do.	Sporadic congenital deafness	Weak +
128	M. McQ.	Do.	Keratitis of 2 or 3 years' duration, deaf for 8 months	+
129	R. B.	Tollcross Deaf School	Keratitis and deafness	+

No.	Name.	Source.	Grounds of Suspicion.	Result of Wassermann Test.
130	M.McQ.	Royal Infirm'y	Mother to 128	+
131	J. R.	Do.	Has tonsils and adenoids for operation. Has a deaf mute brother at Langside. Miscarriage	—
132	W. L.	Do.	Has deafness of two years standing. Keratitis of older date	+
133	M. M.	...	Mother to 16	—
134	L.McM.	School Board	Keratitis and getting deaf	+
135	M. S.	...	Father to 137–141	—
136	M. S.	...	Mother to 137–141	—
137	J. S.	...	Born deaf. Brother to 141	—
138	J. S.	...	Born deaf. Sister to 141	Doubtful
139	J. S	..	Brother to 141, but hears	—
140	A. S.	...	Born deaf. Brother to 141	—
141	A. S.	D.& D.I.	Born deaf. (See 135-140)	+
142	M. C.	...	Mother to 90	—
143	M. H.	...	Mother to 92	+
144	T. M.	...	Brother to 16. Son of 133	+
145	M. M.	G.R.I.	Has lost both eyes. Has mastoiditis on one side	Weak +
146	M. D.	...	Mother of case 36	—
147	A. D.	...	Brother of case 36	—
148	C. D.	...	Brother of case 36	+
149	M. A.	...	Mother to 150 and 151	—
150	J. A.	D.D.I.	Sporadic congenital deafness	+
151	R. A.	Glasgow School Board	Sister to 150. Getting deaf recently, no keratitis	—
152	J. R.	Do.	Getting deaf. No keratitis	—
153	J. R.	Do.	Do.	Weak +
154	M. R.	...	Mother to 152 and 153	—
155	M. H.	Private	Meningo myelitis	+
156	M.R.	Royal Infirm'y	Mother to 131	+
157	R.R.	D.D.I.	Congenital deafness. Brother of 131	+

NOTE.—Three or four cases throughout this list fall to be deducted, e.g., case 155, as not being associated with deafness at all.

Generally speaking, the search for evidence of syphilis amongst the congenitally deaf who are not hereditarily deaf, was not so fruitful as amongst the cases of acquired deafness and keratitis due to syphilis, but it—the evidence—was quite definite. The impression was formed that although the inquiry established the fact that congenital syphilis does cause congenital deafness, the latter is usually an evidence of expiring syphilis, and that the Wassermann reaction does not discover all the cases of congenital deafness which are due to congenital syphilis.

The following cases point to the conclusion that congenital syphilis causes congenital deafness.

S— Family. Cases 62 to 67, and Tree 13.

I quote this family first because, although probably no child was born deaf, deafness occurred in two children as early as 2½ years, and in the remaining two at 8 and 9 years respectively. It is true that only one of the four children gave a positive reaction, and that this positive was weak or even doubtful. Many years ago, before the Wassermann reaction was known, I treated one of these girls for syphilis. There was never any keratitis present in any of the four children, and presumably there was no active process going on when the Wassermann test was applied. I quote the family as an instance of expiring syphilis, and look on the cases as a link between the cases of deafness and keratitis occurring in adolescence, and the cases of true congenital deafness due to syphilis which I am about to quote.

Case 16, and Tree 20.

Here the reaction is doubtful, but there have been nine deaths and five miscarriages in a family of 20. The child himself had meningitis at four months, and this is presumably the cause of the deafness. The family history and the doubtful reaction seem to me to point to syphilis as the cause of the meningitis. It is of course possible that the child was born deaf. I rather assume, however, that the deafness was due to syphilitic meningitis. A young unmarried brother of this boy's gives a positive reaction. See Case 144.

The D— Family. Cases 51 to 55, and Tree 5.

Here, two deaf-born children gave a positive reaction, a child who becomes rapidly deaf at 11 years, but who has never had keratitis, gives a negative reaction, but the mother gives a well-marked positive reaction. The proof that syphilis is the cause of the congenital deafness seems complete in spite of the fact that the case of recently acquired deafness gives repeatedly a negative reaction.

Case 36, and Tree 21.

This girl was chosen for examination because she had a curvature of the cervical vertebræ, which clinically had been diagnosed as syphilitic. Her blood gave a positive reaction. There is no other deaf-mute child in the family, but one died of convulsions, in infancy. An apparently healthy brother gives a positive reaction.

G— Family. Case 108, and Tree 3.

Here, out of 5 pregnancies there is only one healthy child, and he is only a year and a half old. There have been two miscarriages. one child died at 2½ years, of meningitis, and the only remaining child was born deaf. The mother gives a positive reaction, although the deaf-born child is negative. It is difficult to imagine a more conclusive proof of the syphilitic origin of congenital deafness, and the idea that such deafness is due to an expiring, and now actually burnt-out infection, is suggested by the negative result of the blood test in the case of the child.

Cases 135 to 141, and Tree 19.

Without the Wassermann test one might believe that this group of cases exhibited a mutation—that before one's eyes, a new deaf family was being formed. In spite of the death of three children in very early life, two of whom died of meningitis, the occurrence of four deaf-born children in a living family of five, strongly suggests heredity. The most careful inquiry, however, failed to find a single deaf relative, and no case of epilepsy or feeble-mindedness could be found. The application of the Wassermann test, however, accounts not only for the deaf-born children, but for the deaths from meningitis. The family is a good example of congenital deafness due to syphilis.

I do not think these cases exhaust the congenital deafness due to syphilis in Langside Institution. Indeed, since this lecture was delivered, two cases occurring in my hospital practice have sent me back to Langside, with the result that in each case evidence of syphilis as a cause of congenital deafness has been got.

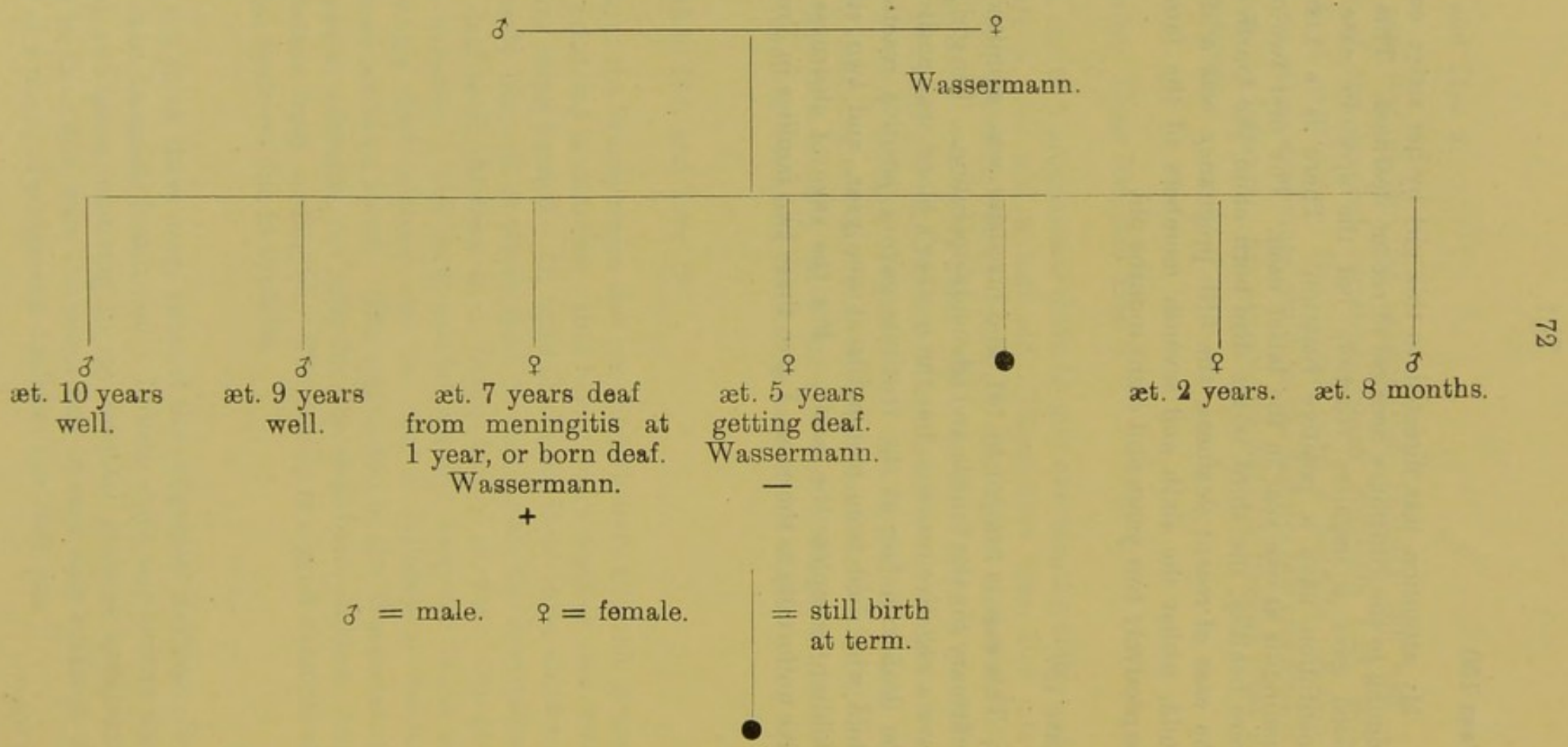
Case 150.

My attention was directed to this girl by her sister, case 151, coming to the Infirmary because of recent deafness. This child's blood gave a negative reaction, but the sporadic case at the Institution gave a positive reaction. There is a history of meningitis at one year in the latter case. The first two children were healthy, the third is the deaf-born child, the fourth child is the case of recent deafness, the fifth pregnancy was a still-born child, whilst the sixth and seventh members of the family are respectively two years and eight months old.

Case 157.

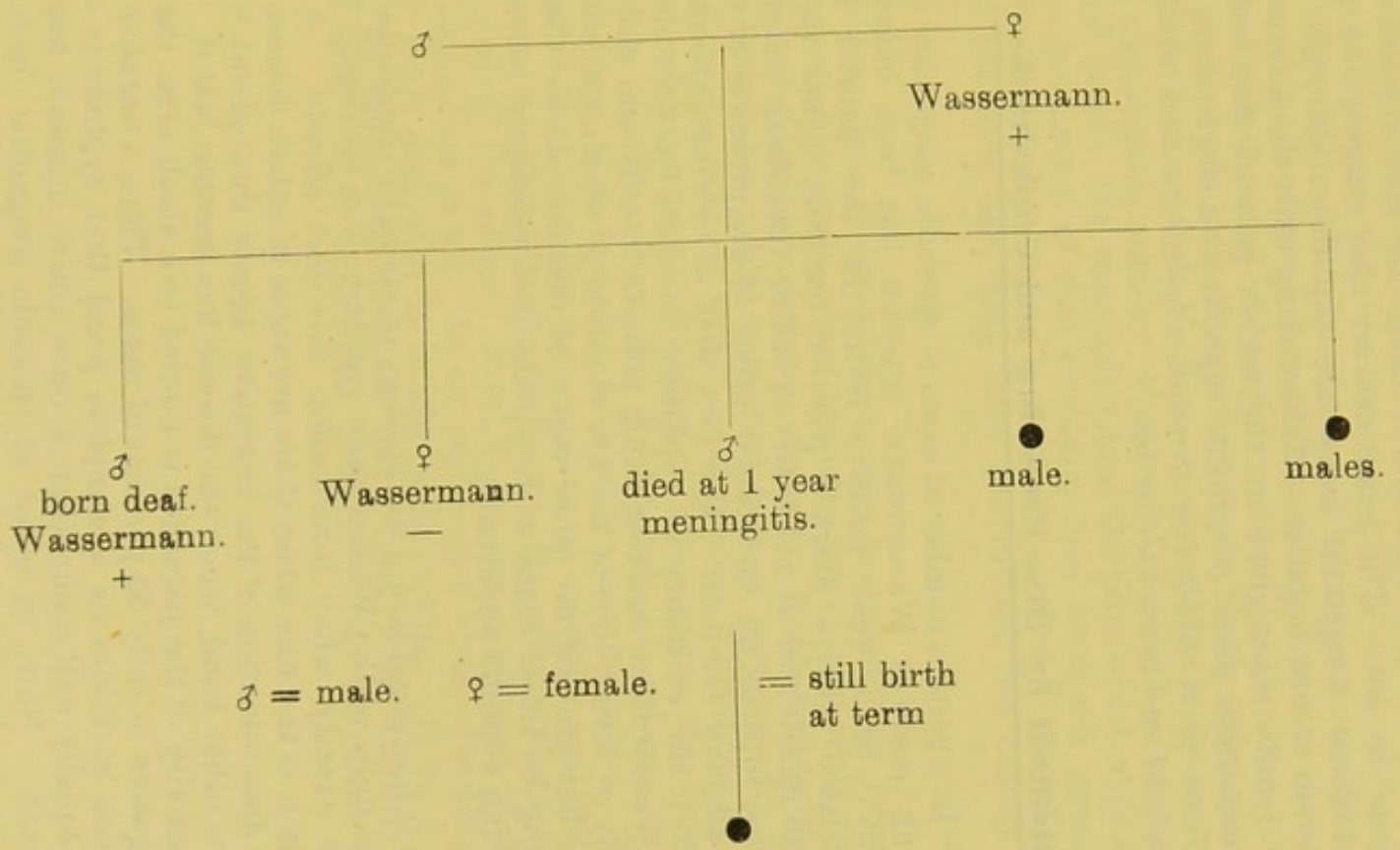
This case is brother to 131, and his sister was admitted to the Infirmary for the tonsils and adenoids operation. The girl's blood gave a negative reaction, but the mother's blood was positive, and the deaf-born boy at the Institute gave a positive reaction. A child who died from meningitis at one year, and two still-born children, complete the family. For the sake of clearness and to give uniformity to the cases, I give these two families in Tree form.

Tree XXII. A—N Family.



Tree XXIII.

R—E Family.



These examinations of the blood of deaf children establish—so far as I know, for the first time—the fact that *congenital deafness is sometimes due to the poison of syphilis.* When no active process is going on, apart from the deafness, the Wassermann test sometimes gives a negative reaction. By the time a congenitally deaf child has reached the school age, the poison which has caused the deafness has often burnt itself out, and a positive reaction cannot be got. The examinations also suggest the probability that some congenital cases are syphilitic, although the blood reaction is now negative. Taken along with the acquired cases of the family trees given in the earlier part of this lecture, *these examinations show congenital syphilis as a single cause producing deafness from adult life through adolescence and childhood into babyhood and intra-uterine life.*

Statement by Drs. Browning and Cruikshanks.

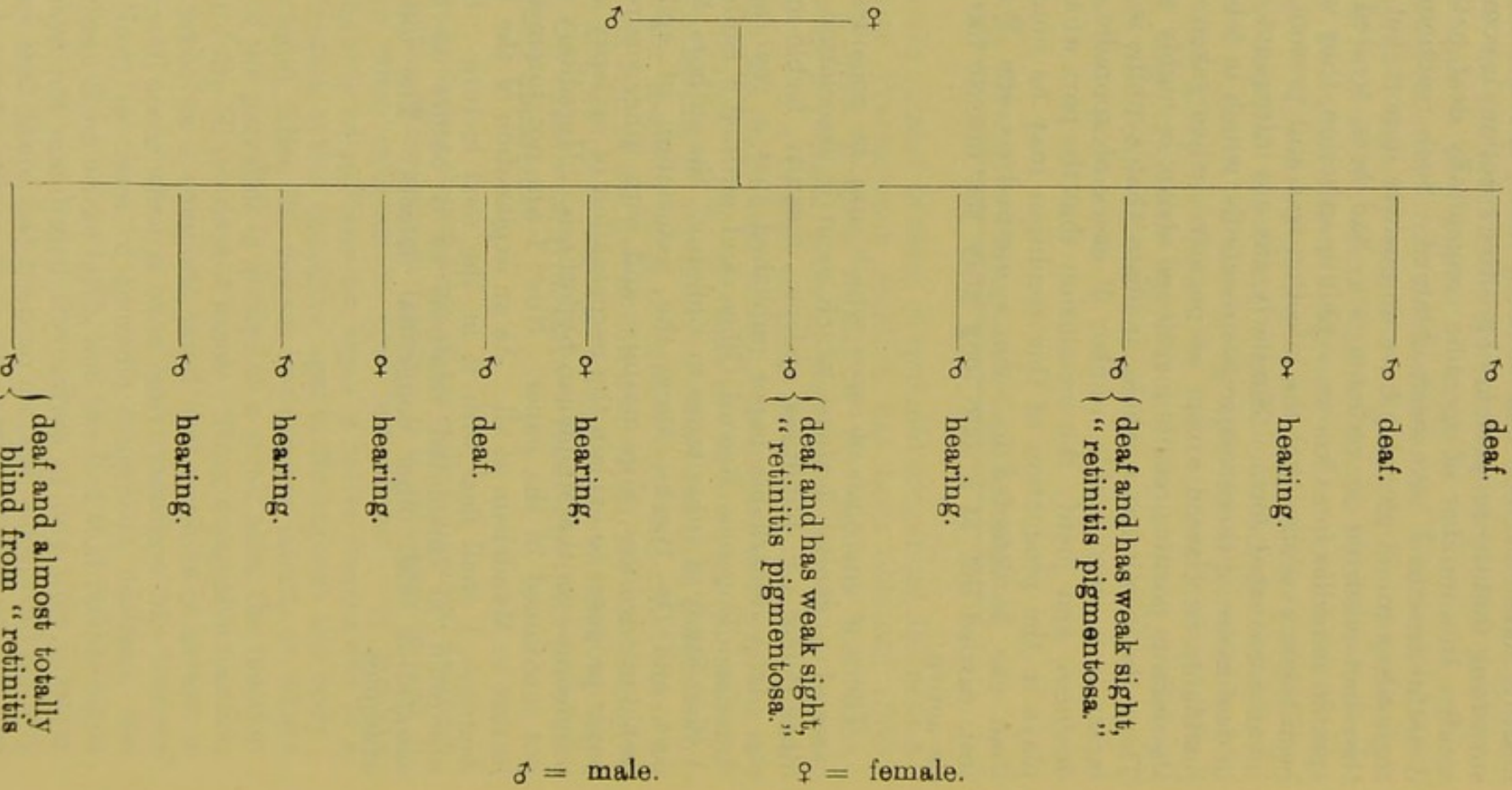
"In a certain number of cases of sporadic congenital deafness, a strong positive Wassermann reaction has been obtained (fifth family), or a weak positive result in the patient has been associated with a marked positive reaction, either in a parent (ninth family), or in a brother or sister (twentieth family); these results furnish an undoubted proof of the presence of syphilis in the affected families. The fact that in one instance (nineteenth family), the existence of syphilitic infection has been detected by the Wassermann reaction being positive in only one child out of a family of seven, four of the five children of which are congenitally deaf, but present no other signs of disease, shows that we are dealing in these cases with syphilis in a relatively inert form, an expiring syphilis apparently."

"When considering the etiology of sporadic congenital deafness in the light of the Wassermann reaction, it is necessary to bear in mind exactly what information this test affords. A positive reaction is the rule when there are signs of active disease due to a wide dissemination of the causative agents throughout the body; on the other hand, when the disease has become latent, or where the activity of the parasites is limited to a small area, the reaction is negative in fully 50 per cent of cases. Thus, a negative reaction can not be taken as a complete proof that syphilis is absent, it may equally well occur when a once active infection has become dormant. Now, in cases of sporadic congenital deafness, the damage has been done before birth, and the fact that further signs of disease have not manifested themselves at any time in other organs, shows that there has been no marked widespread activity of the causal agent. Since then, the active disease process has come to an end before birth, and the patients, otherwise apparently

healthy, have not been examined till many years later, it is not surprising that the proportion of positive reactions is comparatively small. In a number of sporadic congenitally deaf patients also, doubtful reactions have been obtained. Such reactions taken by themselves would probably have no positive import, but supposing they had occurred in patients who had been treated with the specific remedies for a known syphilitic infection, they would have been taken as a sign that the infection was still present, although in an attenuated form. Similarly, the not infrequent occurrence in deaf cases, of these suspicious reactions, which in tables cannot justifiably be classed except as negative, when taken along with the definite positive results mentioned above, is highly suggestive. Thus, the results as a whole, indicate that syphilis is the causal factor in a considerable number of cases of sporadic congenital deafness, and justify the conclusion that the part which syphilis plays in the production of this condition may be much greater than can be detected by such a method as the Wassermann test, carried out at a date long after the disease has ceased to be active."

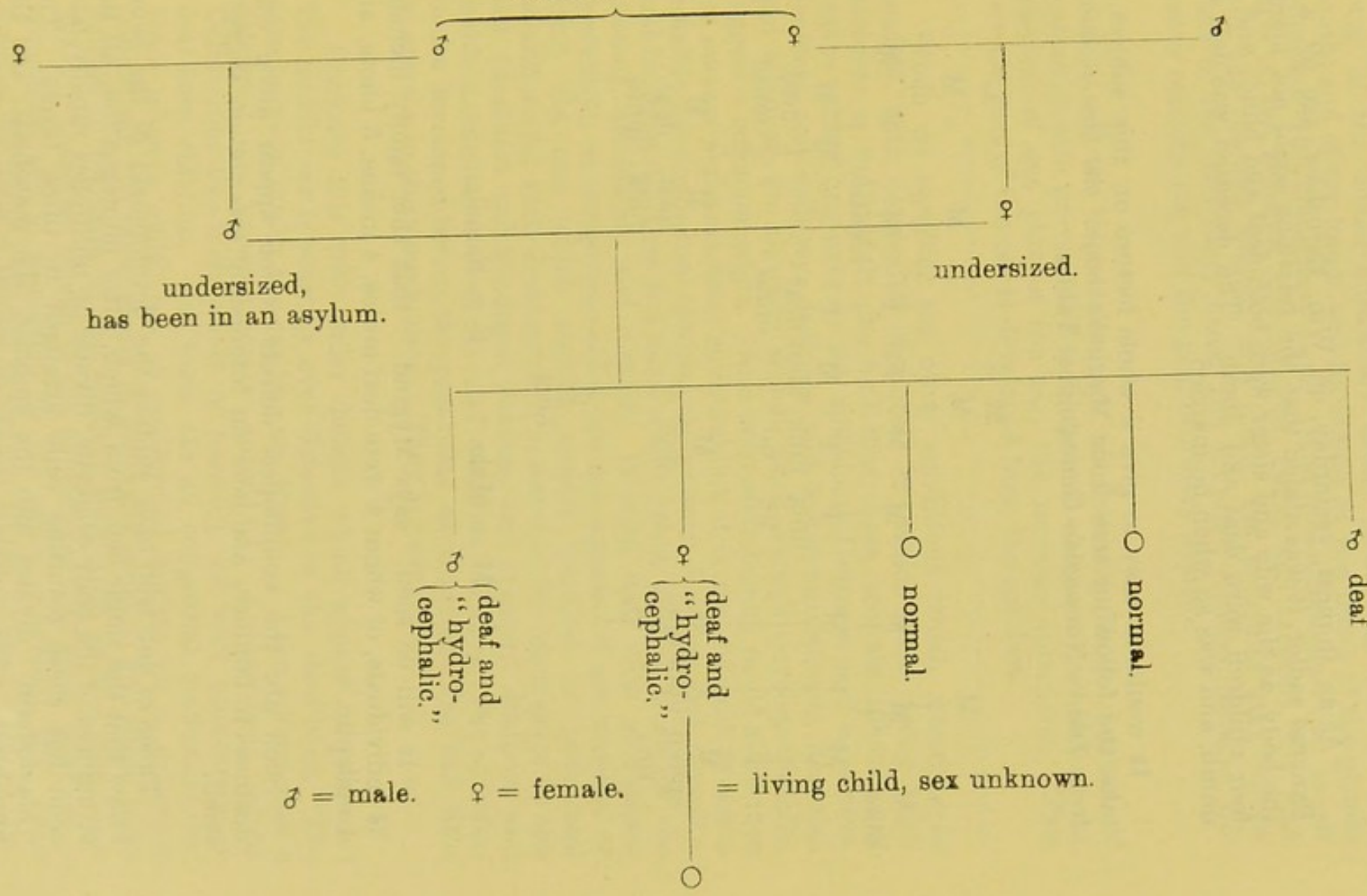
There is one class of cases which may be considered here—cases of congenital deafness which occur in association with some other defect, e.g. blindness, epilepsy, insanity, feeble-mindedness, etc. In a remarkable paper published just a year ago by the American Eugenics Record Office, and entitled "Bulletin No 4. A First Study of Inheritance in Epilepsy," the authors, Mr. Davenport and Dr. Weeks, show the association of epilepsy with feeble-mindedness, with insanity, and with other neuroses. The paper proposes to explain the perpetuation of epilepsy and feeble-mindedness on the Mendelian hypothesis. Hereditary deafness is not mentioned in the paper. Now, I am not interested in this lecture in Mendelism at all. As an explanation of the heredity of deafness, I shall deal with it in the next lecture. Here I am interested in congenital deafness as it occurs in families in association with other congenital defects. The following are examples:—

There is no history of deafness in the family, except that an aunt is said to have become quite deaf from scarlet fever. The parents are not blood relations. The mother says that she suffers from hysteria.
6 deaf and 6 hearing children.



Tree XXV.

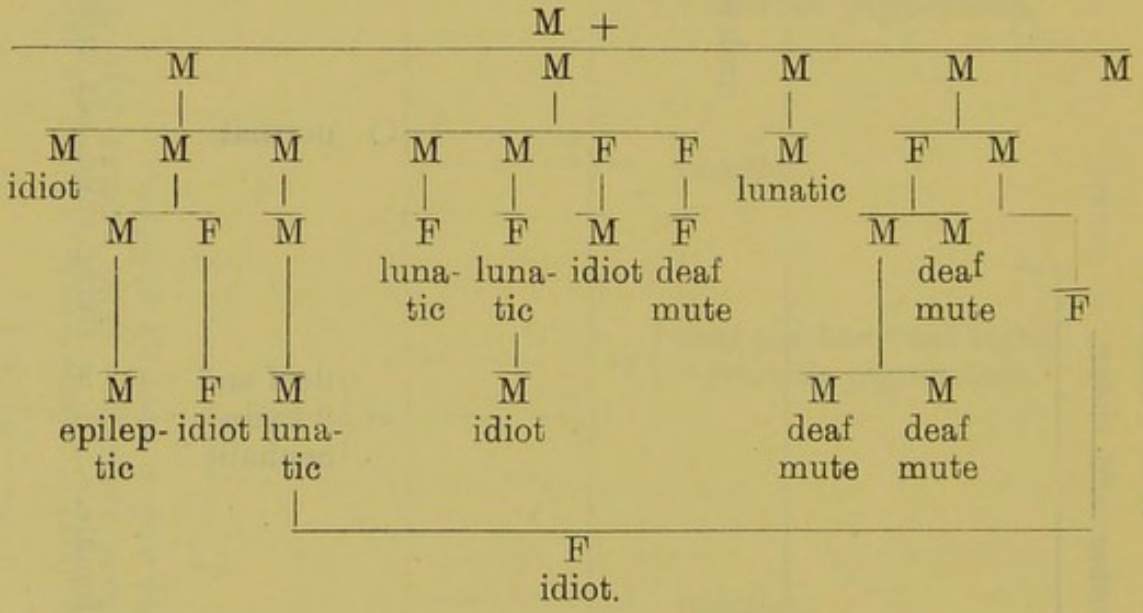
W— Family.



Here is another case which I have quoted more than once :—

"At an inquest, yesterday, on Wm. Earnshaw, age 59, a St. Pancras sadler, it was stated that the relations could not identify the body, as the wife and sister were both deaf and blind, and the four children were deaf and dumb. The deceased was deaf and dumb, and was so when he married."

It would be easy to give a whole lecture on this subject, I take the following tree from Mygind's book,[5] the tree is quoted from Dahl's Norwegian Genealogical Tables.



+ M = Male. F = Female.

"It will be seen," says Mygind, "that this family included 34 individuals, of whom 4 were deaf-mutes, 4 insane, 5 idiots, and 1 epileptic."

Such are the commonest defects which appear along with deafness in families, and here an interesting speculation suggests itself.

Those of you who have studied the development of the ovum know that the single cell, from which, after impregnation, all the structures of the body originate, divides or multiplies rapidly, and soon has these resulting cells arranged in three layers. The "blastoderm" divides into the epiblast, the mesoblast, and the hypoblast. The epiblast gives rise to the epidermis and its appendages, the great nervous centres. the principal parts of the

eye, ear, and nose. The hypoblast gives rise to the epithelial lining of the whole alimentary canal (excepting that of the mouth) and of the lungs, and the lining of the ducts of the glands connected with alimentary canal. The mesoblast gives rise to all parts of the skeleton, the muscles, faciæ, and tendons, the true skin, the vascular system, and blood, the muscular and fibrous coats of the alimentary canal and all other visceral passages, the serous membranes, and the genito-urinary system.

Now all the higher degrees of deafness (those degrees of deafness which prevent the development of speech) are due to an affection of one part of the ear, the nervous apparatus. This nervous part of the ear is developed from the epiblast.

When we consider the other conditions which alternate in families with congenital deafness, or which exist along with deafness in individuals, we find that these, too, are affections of organs which originate in the epiblast. Deafness and blindness, deafness and epilepsy, deafness and feeble-mindedness, deafness and albinism, are all pairs, which, when viewed developmentally, suggest a common origin. And even after having made allowance for nurture and post-natal environment, it is not difficult to see a possible developmental association between deafness and insanity, and between deafness and alcoholism. Now putting aside for the present, alcoholism and insanity (I shall deal with alcoholism presently), as conditions which do not appear till adolescence or adult life, and which require special nurtural or post-natal conditions for their development, notice that the other pairs on the list (deafness and blindness, deafness and epilepsy, deafness and feeble-mindedness, deafness and albinism) always exist at birth, or are developed before the post-natal environment has had time to operate in their production. They are congenital.

Compare this with other defects which appear in the ear! The middle ear is scarcely ever defective in the deaf-born. The membrane is intact, the ossicles are there. I have seldom seen a deformed or supernumerary auricle in a deaf-born child. Deformities like cleft palate or hare-lip, are very uncommon in deaf-born children. Yet these are all congenital malformations. Even when a child has a malformed auricle or a deformed middle ear, the internal ear is generally sound. But these latter defects do not arise in the epiblast, they arise in the mesoblast. We are therefore driven to the conclusion that when deafness is congenital and is associated in the same individual with other defects, the defects belong to organs which arise in a single layer of the blastoderm, and that these defects arise in the earliest days of the existence of the fertilized ovum.

Defects arising in association with deafness but belonging to another layer of the fertilized ovum, sometimes occur. An example taken from the Glasgow Institution is here given.

This girl, who is not mentally defective, was born deaf. She shows brachydactyly, a similar deformity of the foot, and deformity of the face and head. Her blood gives a negative Wassermann reaction. (*See illustrations at end of lecture.*)

The connection of syphilis with some of these congenital defects may here be noticed.

Dr. Chislett,[6] of the Woodilee Asylum, Lenzie, has tested 22 young people by the Wassermann reaction. They are described as follows :—

Idiots and imbeciles, 14 cases (one is a deaf-mute), eight positive, six negative ; the deaf-mute is positive.
Juvenile general paralysis, two cases (both positive).
Epileptic idiots, three cases (one positive).
Paralytic idiots, 3 cases (all negative).

In connection with the similar work described in this lecture on deaf-mutism, this author's remarks are worth quoting.

"The interesting fact emerges that children who suffer from mental diseases of congenital origin, but show no other sign of syphilis, may show a positive reaction ; and children whose parents are syphilitic may have a positive reaction, although at the time of examination they may appear to be in ordinary health, and show no signs of previous disease.

"The significance of the results which have been detailed is that syphilis plays a larger part in congenital mental affection than is generally supposed. It is important, both for the classification of mental diseases and for the elucidation of the ætiological bases of such maladies, that the serum reaction should be determined over a large series of cases. It would appear that the terms "racial degeneration" or "stigmata of degeneration" when applied to cases of congenital mental disease may convey a false impression, especially when such cases are of syphilitic origin, and are due to specific infection of the individual. Congenital syphilis outside the nervous system produces degeneration only in the sense that an infection leads to destruction of structural elements. In the same way, it is not too much to say that nervous disease associated with congenital syphilis is the

expression of anatomical changes that are due to an intra-uterine infection with the *spirochæta pallida*. The changes which such degeneration produces in a primarily plastic brain are likely to be permanent and hopeless from the point of view of individual therapy. If medical science is prepared to urge prophylactic measures for the prevention of such diseases, it is well that it should be definitely established and recognized that a considerable proportion of cases of congenital mental deficiency is infectious in origin, and that the infection is syphilis."

Dr. Carl Browning sends me some figures supplied by Dr. Gilmour, which the latter gentleman has been good enough to put at my disposal for the purposes of this lecture.

Of 120 consecutive cases (excluding general paralysis) admitted to Gartloch Asylum,

72 females	13 reacted positively	=	18%
48 males	13 ,, ,,	=	27%
120 total positive Wassermann results		=	22·6%

The American Eugenists attempt to deal with these defects—they do not refer to deafness, however—on the Mendelian hypothesis. These authors do not refer to syphilis as a cause of mental defect or of epilepsy. They refer, however, to the possible effect of alcohol.

"We see," in the tables presented, "a constant excess beyond expectation, of epileptic and feeble-minded offspring from alcoholic parents. In so far, our results support the view that alcoholism to a certain extent, is a cause of defect, that ten or twenty per cent. more children in any fraternity are defective than would be, were it not for alcohol. However, a word of caution must be added. It is not improbable that some of the alcoholics are actually feeble-minded, and any such would tend to increase the average of defective offspring, because of their inherent defective germ cells, and quite apart from any poisoning effect on the germ cells, of alcohol. The hypothesis that alcohol is a race poison, deserves more critical, especially experimental study, on the lower animals."

If alcohol can be shown to increase the tendency to feeble-mindedness in an already predisposed offspring, it is almost certain that syphilis does the same. Remember the American figures have nothing to do with deafness, and I am only applying them to deafness which occurs in association with feeble-

mindedness and epilepsy. Indeed it is because of this association that I have included these as cases of Sporadic Congenital Deafness.

The poison of syphilis may not be discoverable by the Wassermann reaction, it may not cause the death of children before birth or shortly after birth, it may not express itself in blindness and deafness in the school child of 10 or 12 years of age, and yet it may, given a tendency to deafness, increase the number of deaf progeny in a family. It may be argued that both syphilis and alcohol poison the blood of the better classes. The better classes are not more chaste than the poor, and they are in some senses as intemperate. With regard to syphilis, I have shown that it is the lack of treatment of the disease, which is responsible for the high death and deafness-rate of the children. With regard to alcohol, it is the excess and the conditions provoking the excess, which account for the results in the children. Men do not drink for the love of drinking. Men drink, and so do women, because for the time they thus forget their wretched environment.

> "Kings may be blessed, but Tam was glorious
> O'er a' the ills o' life victorious."

Thus Burns pictures the power of alcohol, and Burns was right.

It is the power of alcohol to give a temporary victory over misery, and to set up a temporary heaven, that gives us the key to the drinking habits of the poor. And from the figures I have given you about the housing of the families from which the deaf children of our cities come, you will see that these offer an apology for the abuse of alcohol by the poor. In sporadic congenital deafness therefore, there are some cases, which, when the family is taken as a unit, exhibit a symptom-complex—feeble-mindedness, epilepsy, deafness; attending these families there is a cause-complex—poverty, over-crowding, alcoholism, and untreated syphilis. Case 38 may have arisen in this way.

I have no new temperance legislation to propose to you.

With regard to the housing question, it would be easy to deduce arguments from the figures I have submitted for the better housing of the poor. *Until we solve the housing question most of our temperance legislation will be futile, and the stream of infantile deafness will go on unabated from the lowest ranks of society, the chief source of it in the past.* In particular, I would say that the system of raising one and two apartment houses to a

height of four and five flats (a system so common in Scotland) renders slum life inevitable. Children cannot be reared either physically or mentally pure under these conditions. I cannot close this lecture without an urgent appeal to this Bureau to do all in its power to procure the notification of congenital syphilis. The frightful death-rate which I have shown to occur amongst the little children of syphilitic families ; the blindness and deafness which ruin the lives of many of those children who survive to the school age, these are reasons for making the notification of congenital syphilis a question of great urgency. And a new fact has been added by this lecture. *Congenital syphilis is a cause of deaf-born children, and a cause, probably to a greater extent, than any test we at present have, can demonstrate.* This, if a further proof were needed, is an additional reason for the notification of congenital syphilis.

It is difficult to think of a subject like this without letting one's mind take the cast of the speculative thought of the day, and my mind turns for illustration in the direction of Bergsonism.

If life in this world is due to a great initial impulse, and if in one groove, this impulse has expressed itself as man, then within that groove, nothing but man can come into being. The current that flows in this groove is always human. If the material of this current be cells, and if the current divide itself into national and family branches, we may suppose that national and family features have arisen from a fortuitous distribution of groups of cells which agree in their main features, but differ in detail. In some families the cells are deficient in those determiners or factors which go to the complete make up of a perfect nervous system, and the children born into such families are feeble-minded or epileptic, or are born deaf. These defects may be accentuated by such poisons as alcohol and syphilis. Within the family stream, the defect is permanent, and is developed to its utmost by the intermingling of similar cells, or by the marriage of those who are related by blood. The defect may become less frequent by streams or families uniting, one of which is perfect or in which the defect does not exist. But the defect cannot be stamped out, so long as the family goes on at all, and the practical question is whether the defect is so serious for the individual and for the community that the latter should take steps to protect itself. The answer to this question I propose to give in my next lecture.

[1] Chalmer's Inquiry into the Physique of Glasgow School Children.

[2] Fraser. Congenital Syphilitic Disease of the Ear. Edinburgh Royal Infirmary Reports, 1908.

[3] Cheatle. Syphilis in relation to Otology. Proceedings of the Royal Society of Medicine, November, 1910.

[4] Davenport and Weeks. Reprinted from the Journal of Nervous and Mental Diseases, Vol. 38, 1911.

[5] Mygind. Deaf-mutism. Rebman, 1894.

[6] Chislett. Journal of Mental Science, 1911.

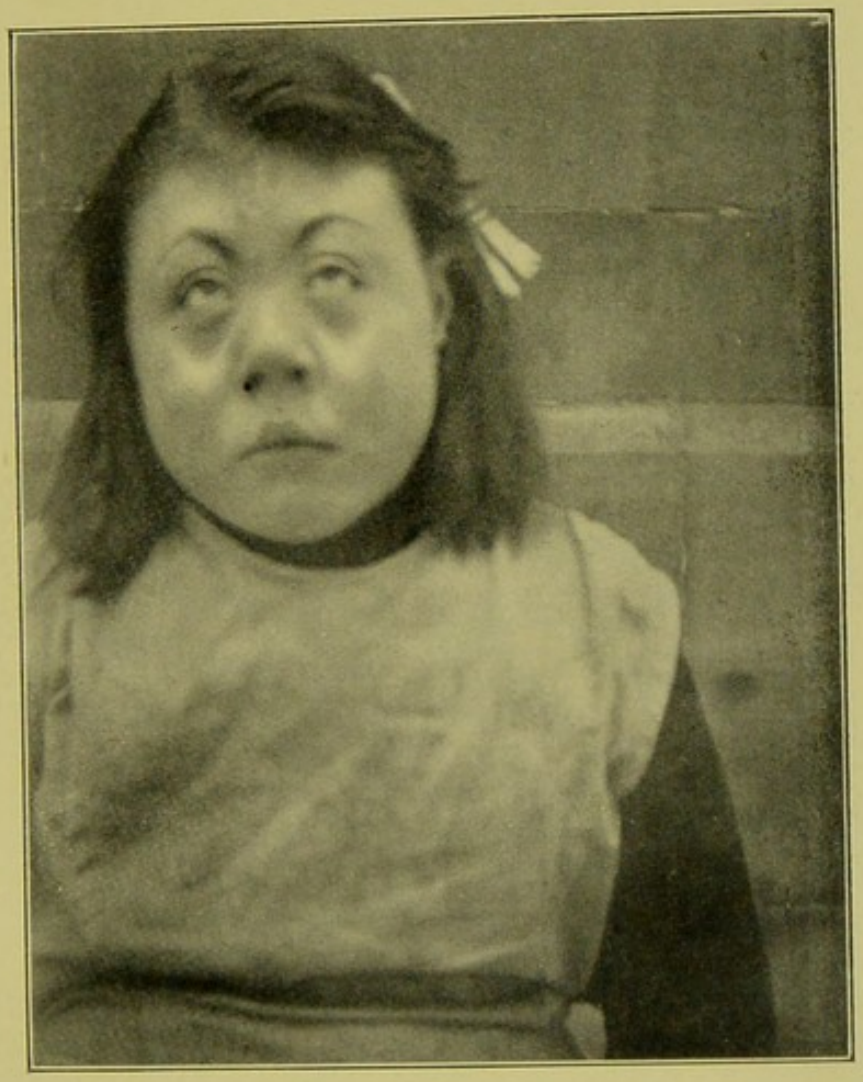


FIG. II.

Case of Brachydactyly with deformity of the foot and head. The deafness is congenital.

(*See* p. 80.)

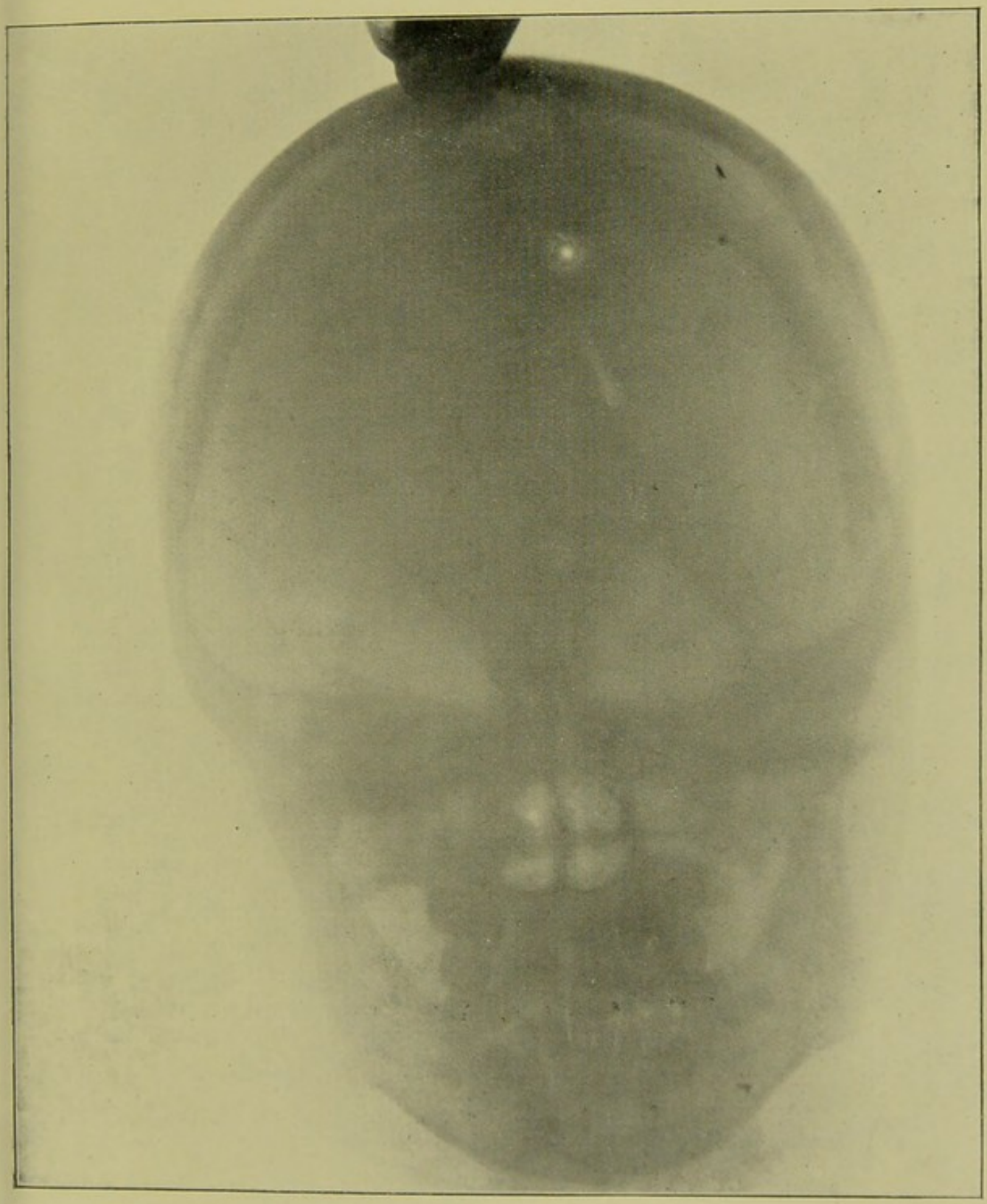


Fig. III.

Case of Congenital Deafness with Brachydactyly, etc.
The head from before.—(*See* p. 80.)

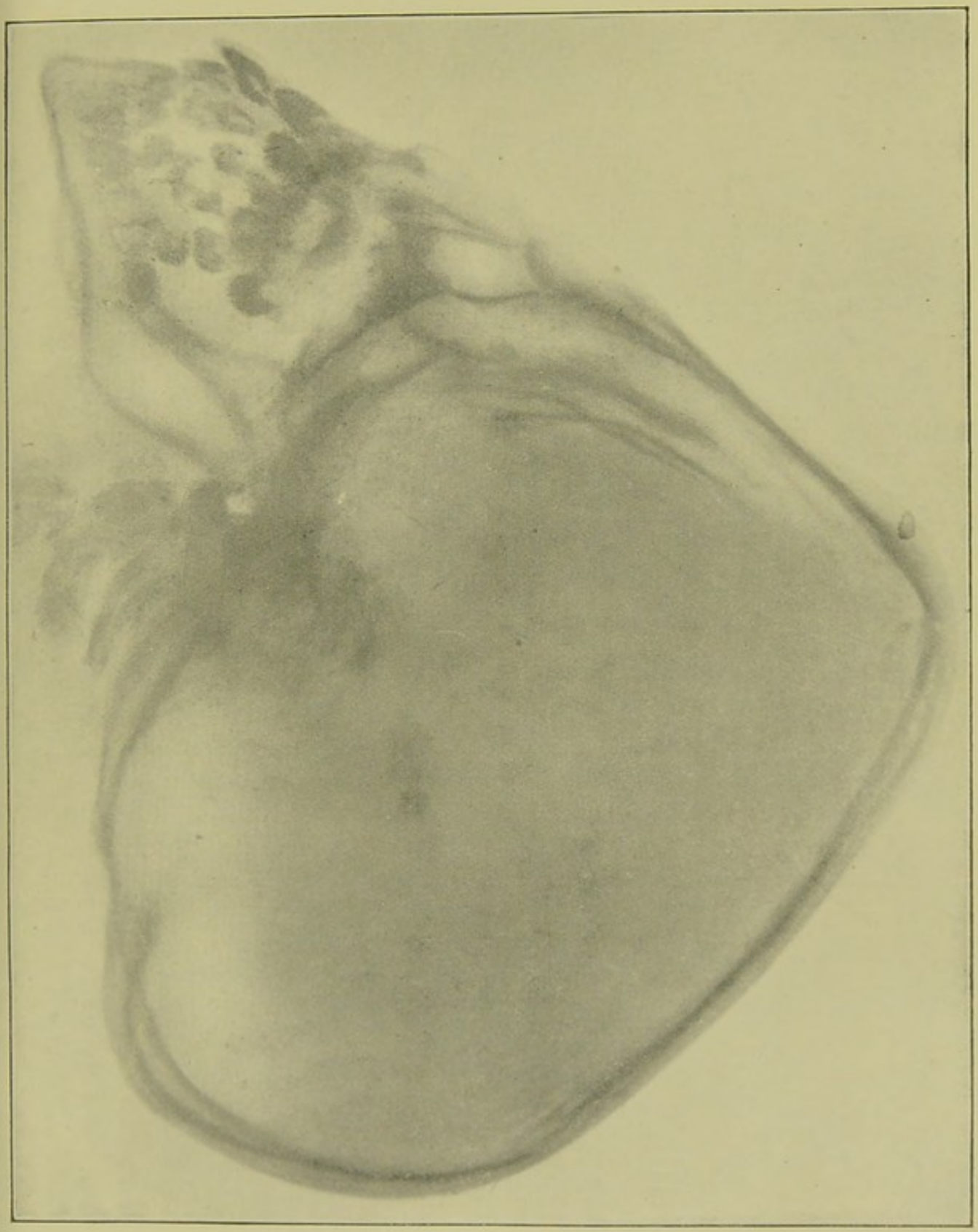


FIG. IV.

Case of Brachydactyly, etc. Lateral view of head.

(*See* p. 80.)

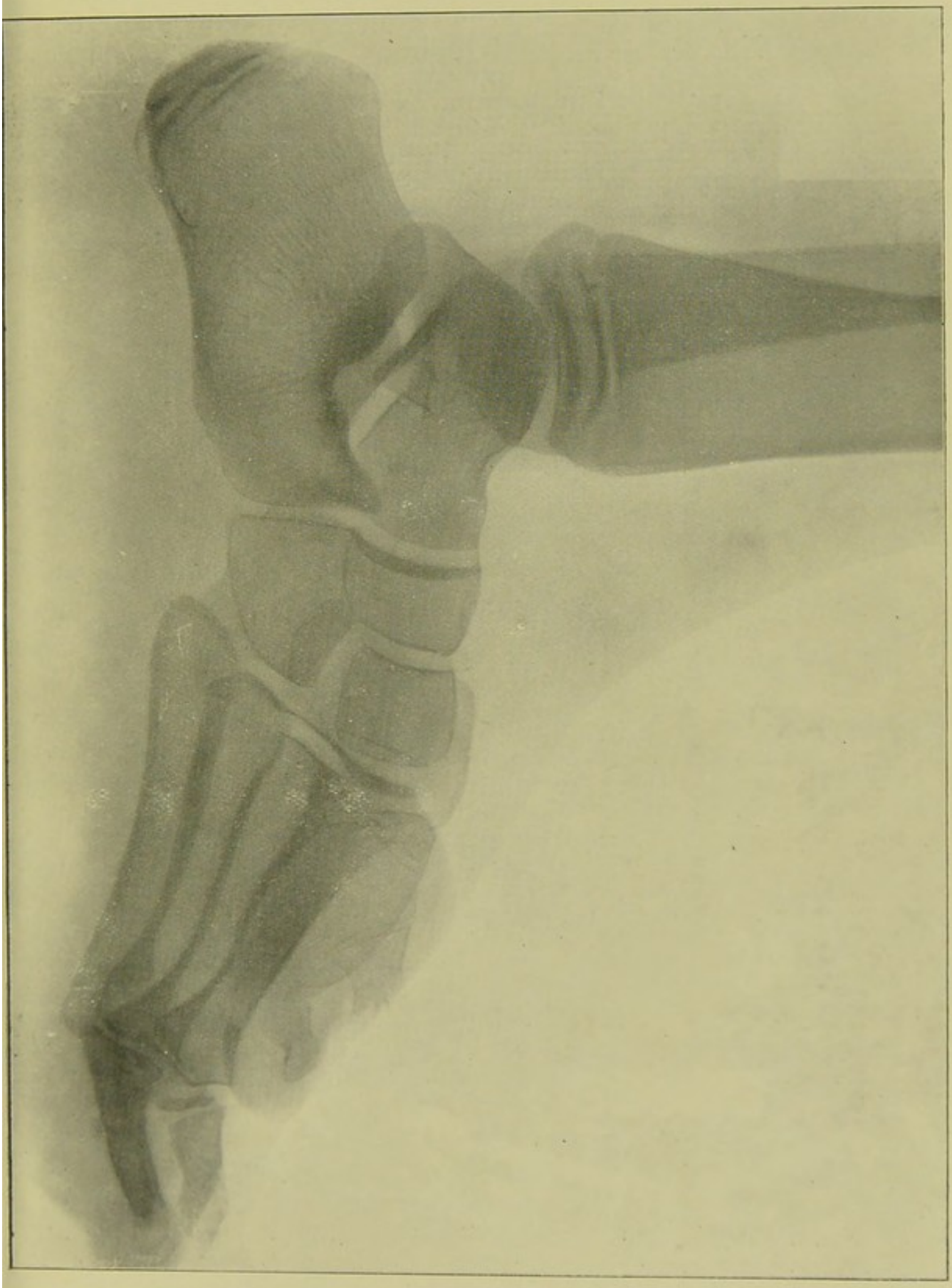


Fig V.

Lateral view of the Foot in Case referred to on p. 80.

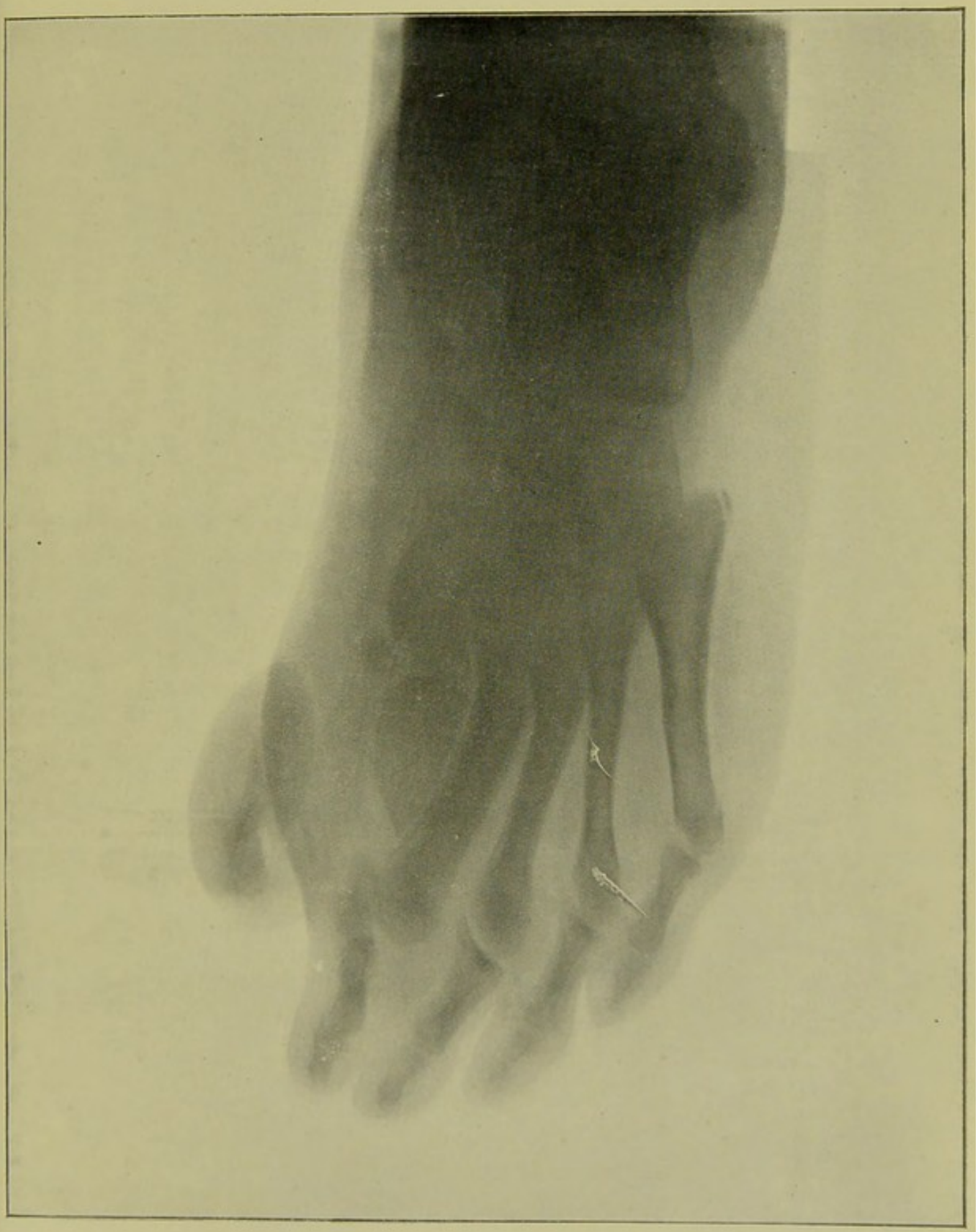


FIG. VI.

Case of Brachydactyly, etc. Foot from above.

(*See* p. 80.)

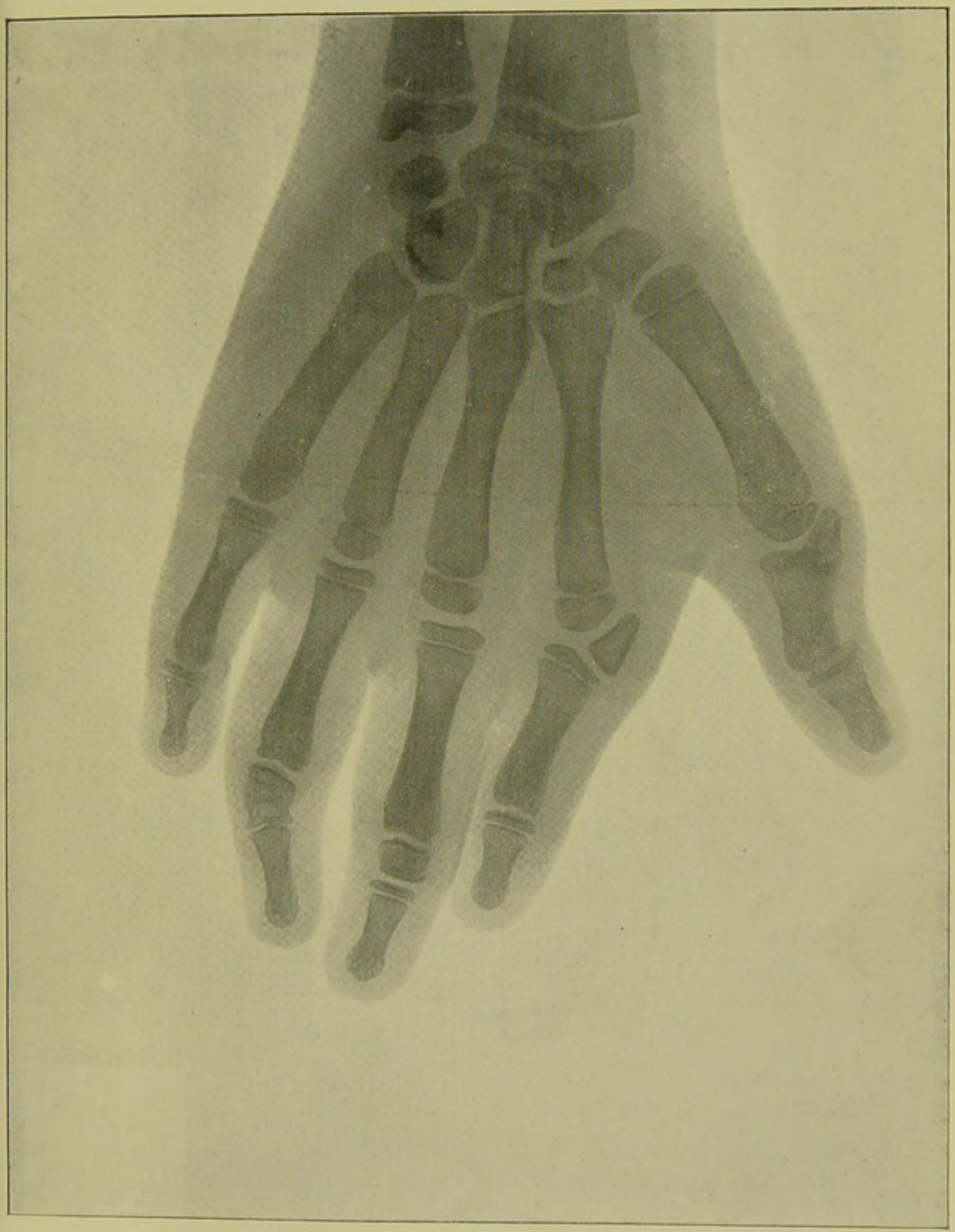


FIG. VII.

Case of Brachydactyly, etc.

(*See* p. 80.)

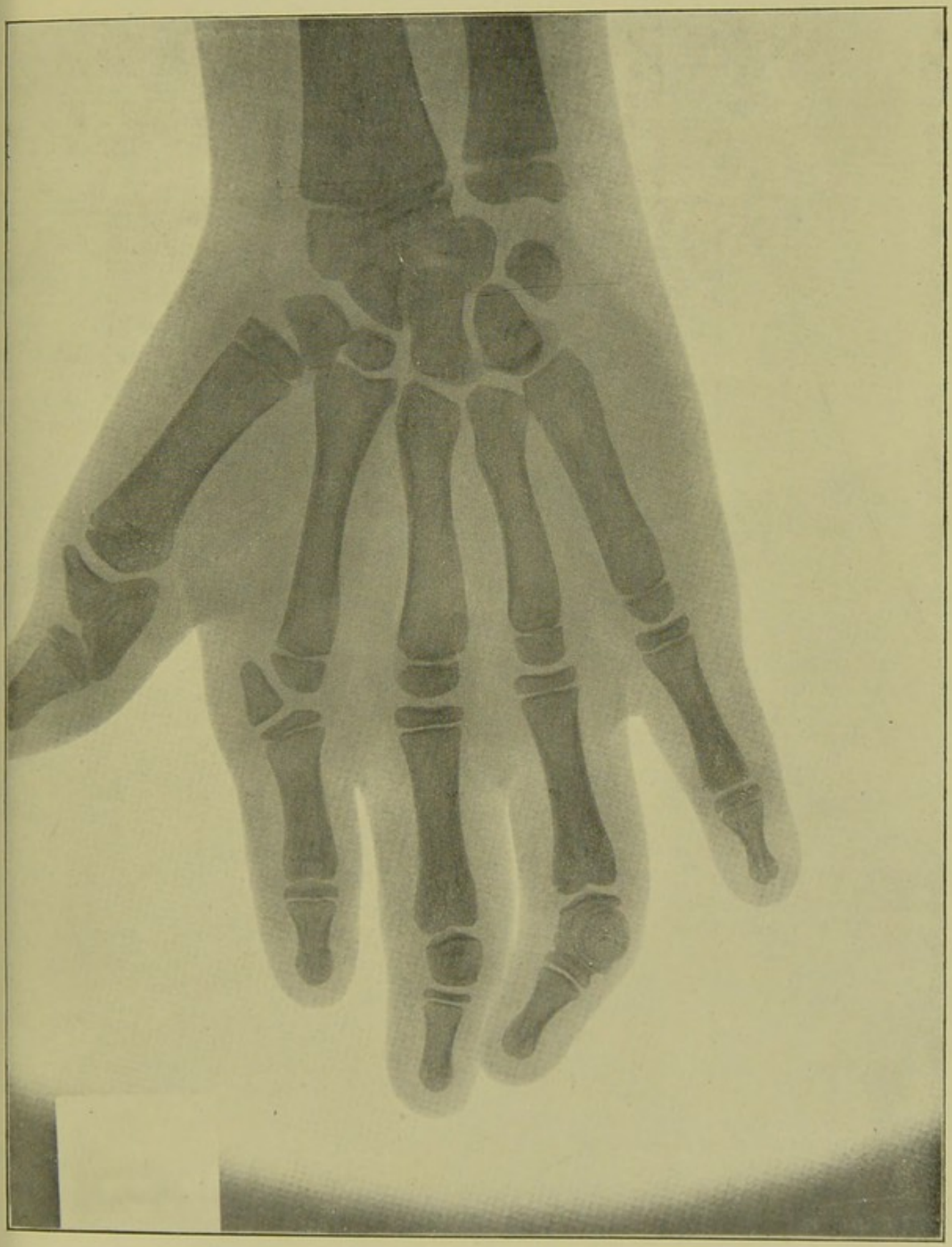


Fig. VIII.

Case of Brachydactyly, etc.

(*See* p. 80.)

LECTURE IV.

Hereditary Deafness.

TOWARDS the end of last lecture I dealt with a form of defect which is congenital and hereditary, but which only now and again expresses itself as deafness. In this lecture I mean to deal with a defect which always expresses itself as deafness, and which is hereditary, true hereditary deafness. We found in an earlier lecture that there were few mentally defective children amongst the hereditary deaf, that these latter were nearly always mentally fit. One advantage of a classification which excludes all other types of deafness, is that the remaining cases are much more likely to belong ætiologically to a single class. When a defect is present at birth, and when it is repeated in successive or alternate generations we have a relatively simple problem. These conditions are supplied by true hereditary deafness. If we are to reduce the study of the ætiology of deafness to its simplest terms, it must be by a rigid classification such as this. As a cause of deafness I have dealt at some length with syphilis for two reasons: (1) to show the kind of research which, I believe, must be carried on over the whole field of deafness if we are to prevent deafness; (2) to help to eliminate from this lecture deafness which is not truly hereditary. As an immediate result I am able to say to the members of several families, e.g., the S—R Family (family 19), "You may marry if you choose. You may or may not have healthy children, but you are quite unlikely to have deaf children." And it is worth noting, in passing, that the only hearing member of this family has been a good deal exercised in his mind over this very question. I have dealt with alcohol as a cause of deafness much more shortly. Along with syphilis and lead it has been grouped as making up the "racial poisons,"* But it must always be remembered that neither alcohol nor lead gives rise to infectious diseases. Syphilis is due to a micro-organism, and its proper place is alongside of scarlet fever and measles. Were I at liberty here to deal with syphilis in the parent as I have dealt with it in the child, the parallelism I seek to establish between this disease and the exanthemata would be

* The phrase is Dr. Saleeby's.

seen to be much closer. For the prevention of all three, the watchwords are "notification" and "isolation." Whatever may be said of syphilis and alcohol, of poverty and overcrowding, as causes of sporadic congenital deafness, these can hardly be said to cause true hereditary deafness. These poisons cause degeneracy and death. In the families of the hereditarily deaf, the children are deaf without any associated stigmata, and the defect is the same in the sixth generation as in the first. Except for the fact of deafness, the families of the hereditarily deaf are a strong, virile, prolific, and sane set of people. They are not degenerates.

To the question which may fairly be put, "Do you propose to account for all sporadic congenital deafness by these poisons?" I answer, "No." There is no one more profoundly impressed by how little I have accounted for than I am. I have put forward the "Research on Syphilis" chiefly as an example of the kind of work by which, I believe, the extremely difficult problems of sporadic congenital deafness may be unravelled. To the further question, "Do you mean to say that amongst the sporadic cases there are none hereditary?" I also answer, "No." The explanation of this will be seen shortly.

How are we to define heredity as it applies to deafness? Or, rather, who are the hereditarily deaf? They are the deaf-born offspring of deaf-born progenitors. Any widening of this definition or inclusion of other kinds of deafness will confuse the issue and lead to wrong measures of prevention. It is true that there are other kinds of family deafness and in a sense of hereditary deafness. Syphilitic deafness is family deafness and otosclerosis may be hereditary. But neither disease supplies the two conditions—that the deafness is present at birth and that it exists in a progenitor. All previous attempts to discuss hereditary deafness have failed more or less completely, because deafness, in which one of these conditions was absent, has been admitted into the discussion. Even when the deafness exists at birth we must find proof of the deaf progenitor before we admit the case to be one of true hereditary deafness. The definition involved in the above may not include all the hereditarily deaf, but, inasmuch as it includes only those who are hereditarily deaf, the conclusions drawn will be safe. In the second lecture I made the statement (p. 23), "I would not trust to a hard-of-hearing relative of any description as proof of the hereditary deafness of a deaf-mute child." This statement is sure to be questioned by teachers of the deaf, by missionaries to the deaf, and by statisticians who accept "deafness" as a single factor. It may as well be examined here It would indeed be curious were it found that deaf-mute children had no hard-of-hearing relatives. Nearly all hearing and speaking children have. "During the first decennium of adult life (from 20 to 30) one man out of every three men is sure to be

suffering from some degree of impaired hearing in at least one ear" (von Troltsch quoted by Bruhl). And yet this simple fact, quite well known to every aurist, is seldom noticed in books and is never taken into account at all by those who associate deaf-mutism with hardness of hearing Another common fact, commonly ignored, is that hardness of hearing tends to "run in families." Does this make it hereditary? Let us see. From my case book I can pick out many of these families. Here is one. A youth, on whom I performed the mastoid operation, had his deafness caused by scarlet fever; several in the family are hard of hearing; two have had active nasal obstruction, by the treatment of which hearing has been improved; a third brother and one sister have deafness without nasal obstruction; whilst one sister and two brothers hear perfectly. The mother, who is over 70 years of age, is hard of hearing. Now it is quite clear that we are dealing here with several distinct and unassociated causes of deafness, one of which is probably hereditary, whilst the others are not. Neither scarlet fever nor chronic aural catarrh are in the strict sense of the word hereditary, whilst otosclerosis, about which we know so little, almost certainly is. And it would seem that all these three diseases have operated in this family. And yet there never has been a deaf-mute child in the family, either in the direct or collateral lines. But, supposing that one of these people were infected by syphilis and a deaf-mute child now appeared, all the above hardness of hearing would be brought forward as proof of the heredity of the deafness causing the deaf-mutism. Of course, we might fall back on the rather nebulous theory that there was a vulnerability of the organ of hearing to diseases of any kind. But both pathology and modern theories of heredity require something more concrete than this.

I could multiply these cases, but it would serve no useful purpose. Rather let me choose another symptom. Take lameness instead of deafness. The case is purely hypothetical. James is lame, indeed, he has lost his foot which was shattered in the South African War. John, his brother, is lame, too, from an old fracture of the thigh—there is an inch of shortening of the limb. Andrew, a third brother, walks quite well, but he has a son who has tuberculous disease of the hip—the latter is therefore lame. But this boy's grandmother is lame too. She has rheumatoid arthritis, and has to go to Harrogate every year for six weeks. And yet nobody would say this lameness is hereditary. The illustration seems ridiculous, and yet it is as safe to say that the lameness here described is hereditary, as it is to say that the hardness of hearing, which is sometimes associated with deaf-mutism, is hereditary. Deafness, like lameness, covers many quite unassociated conditions. The statement must therefore be made *that unless and until the hardness of hearing in a deaf-mute family can be pathologically associated with the deaf-mutism, it*

cannot be trusted as proof of the heredity of the deaf-mutism. The truth is that the deafness which causes deaf-mutism is due to internal ear defect or disease, occurs before or shortly after birth, and is generally a finished and complete condition before we are asked to deal with it, whilst the deafness which amounts only to hardness of hearing, comes on generally long after birth (most commonly in adult life) is a progressive condition, and is generally an affection of the middle ear. There could hardly be two conditions affecting one organ more completely dissociated.

Above I have contrasted the hardness of hearing of the adult with the almost total deafness of the deaf-born child. The presence of the one in a family has been commonly accepted as proof of the heredity of the other. It is possible that future research may succeed in associating these two conditions. This has never been done, and until it is done, the proof cannot be admitted. When a relative of a deaf-mute is born partially deaf—a rare condition—an explanation may be offered, and the partial deafness taken as proof of heredity. This I shall notice when discussing Mendelism.

For over a hundred years a method of segregation of the deaf has been going on amongst us, which renders the intermarriage of the deaf very easy, and makes it very common. *The education of the deaf in any form tends to their intermarriage, for it takes the individual deaf-mute out of his isolation, and brings him in contact with other deaf-mutes, but* the education of the deaf in institutions and their association afterwards in missions is so perfect an arrangement for promoting their intermarriage, that I doubt if anything more effective could be produced, were the intermarriage of the deaf the object one had in view. So far as I am aware no such complete arrangements exist among any other section of human beings, for the attainment of intermarriage of the members of an abnormal class, as those which exist among the deaf. And yet these arrangements were made with very different and far higher motives than those hinted at here.

Marriages of the Deaf.

For the reasons already stated, the records of the Institutions for the Education of the Deaf make these the most valuable material for the study of hereditary deafness. Twenty years ago I began this study at the Glasgow Institution, and with the help and by the courtesy of the Superintendents of the Institutions of the United Kingdom, was able to show in what direction heredity operated amongst the deaf of the United Kingdom. Nearly ten years before that, Dr. Alexander Graham Bell published his classical memoir on the Formation of a Deaf Variety of the Human Race. And shortly after my book was

written, Dr. Fay of Washington published his monumental work on the "Marriages of the Deaf" in America. I cannot discuss all these figures at length, but I shall have to refer to Dr. Fay's work in some detail, for it is, and for a long time must remain, the record by which any theory of hereditary deafness will be tested. Dr. Fay's figures are best seen in the following table, which is a summary of his work.

SUMMARY OF STATISTICS ON WHICH DR. FAY'S CONCLUSIONS ARE BASED.

No.	(American Annals of the Deaf February, 1897.) Marriages of the Deaf. Characters of the Partners.	Number of Marriages.		Number of Children.		Percentage.	
		Total.	Resulting in Deaf Offspring.	Total.	Deaf.	Marriages resulting in Deaf Offspring.	Deaf Children.
1	One or both partners deaf	3078	300	6782	588	9·7	8·6
2	Both partners deaf	2377	220	5072	429	9·2	8·4
3	One partner deaf, the other hearing	599	75	1532	151	12·5	9·8
4	One or both partners congenitally deaf	1477	194	3401	413	13·1	12·1
5	One or both partners adventitously deaf	2212	124	4701	199	5·6	4·2
6	Both partners congenitally deaf	335	83	779	202	24·7	25·9
7	One congenitally, the other adventitously deaf	814	66	1820	119	8·1	6·5
8	Both partners adventitously deaf	845	30	1720	40	3·5	2·3
9	One partner congenitally deaf, the other hearing	191	28	528	63	14·6	11·9
10	One partner adventitously deaf, the other hearing	310	10	713	16	3·2	2·2
11	Both partners had deaf relatives	437	103	1060	222	23·5	20·9
12	One had deaf relatives, the other had not	541	36	1210	78	6·6	6·4
13	Neither partner had deaf relatives	471	11	1044	13	2·3	1·2

No.	(American Annals of the Deaf February, 1897.) Marriages of the Deaf. Character of the Partners.	Number of Marriages.		Number of Children.		Percentage.	
		Total.	Resulting in Deaf Offspring.	Total.	Deaf.	Marriages resulting in Deaf Offspring.	Deaf Children.
14	Both partners congenitally deaf, both had deaf relatives	172	49	429	130	28·4	30·3
15	Both congenitally deaf, one having deaf relatives, the other not	49	8	105	21	16·3	20·0
16	Both congenitally deaf, neither having deaf relatives	14	1	24	1	7·1	4·1
17	Both adventitiously deaf, both with deaf relatives	57	10	114	11	17·5	9·6
18	Both adventitously deaf, one had deaf relatives, the other not	167	7	357	10	4·1	2·8
19	Both adventitously deaf, neither with deaf relatives	284	2	550	2	0·7	0·3
20	Partners consanguineous	31	14	100	30	45·1	30·0

There is a striking phrase occurring in the second half of Dr. Fay's table, viz., "had deaf relatives." Wherever this occurs one finds a high percentage of marriages resulting in deaf offspring and a high percentage of deaf offspring. Congenital deafness alone, even when both partners are so affected, does not tend much towards deaf offspring. Dr. Fay says: "When neither of the partners has deaf relatives, even though both of them are congenitally deaf, the liability to have deaf offspring seems to be slight, perhaps not greater than in ordinary marriages. Fourteen of this class are reported resulting in 24 children (see item 16 in the table). "Of these children one was deaf, but in this case the statement of the marriage record that neither of the partners had deaf relatives is not well authenticated." But when both partners are congenitally deaf and both have deaf relatives the percentage

of marriages resulting in deaf offspring is 28·4 per cent., and the percentage of deaf children is 30·3 per cent (see item 14). There is one combination possible in which a higher deaf rate is produced than in the one just quoted; that is, when the deaf enter into consanguineous marriage. Here 45·1 per cent. of the marriages result in deaf offspring, and 30 per cent. of the children are deaf. And it would seem probable that were a number of persons who were not only congenitally deaf but hereditarily deaf to enter into consanguineous marriage, Dr. Graham Bell's deaf variety of the human race would be within sight. I would point out here that Dr. Fay's figures form the strongest possible argument for the abandonment in scientific inquiry of the classification of the deaf into congenital and adventitious or acquired deafness, and the adoption of the classification I have suggested in these lectures– Acquired Deafness, Sporadic Congenital Deafness, and Hereditary Deafness.

It would seem that deaf relatives are a very common possession of deaf people. Dr. Fay's Table XXXVII shows that of the married people concerning whom it was reported whether they had deaf relatives or not, 2420 had deaf relatives and 2081 had none. This gives 53·766 per cent. with deaf relatives and 46·24 per cent. with no deaf relatives. And he points out that of 17,883 pupils who attended American Schools for the Deaf up till 1890, 7514 or 42 per cent. were reported to have deaf relatives. I have already referred to the alteration I would make in the handling of the figures dealing with the possession of deaf relatives. I would restrict it to deaf-mute relatives and to deaf born ones at that. If I refer to it here when I am dealing with Dr. Fay's figures, it is not because I differ from him in my conclusions about the heredity of deafness, but because I think, were the above indications acted on, the conclusions would be reinforced. Further, they would render the application of any theory of heredity much easier. Dr. Fay divided this thesis in four heads. Only three of these concern this inquiry into the prevention of deafness. The fourth deals with the happiness of deaf people who marry deaf and hearing partners respectively, a subject I may have to refer to later.

The first three heads are:—

1 Are marriages of deaf persons more liable to result in deaf offspring than ordinary marriages?

2 Are marriages in which both of the partners are deaf more liable to result in deaf offspring than marriages in which one of the partners is deaf and the other a hearing person.

3 Are certain classes of the deaf, however they may marry, more liable than others to have deaf children? If so, how

are these classes respectively compared and what are the conditions that increase or diminish this liability?

The answer to Question 1 was in the affirmative, and was in the direction of expectation. That to Question 2 was in the negative, and was against expectation. That to No. 3 was again in the affirmative, and in accordance with expectation.

There are four factors which have to be taken into account in dealing with the above figures.

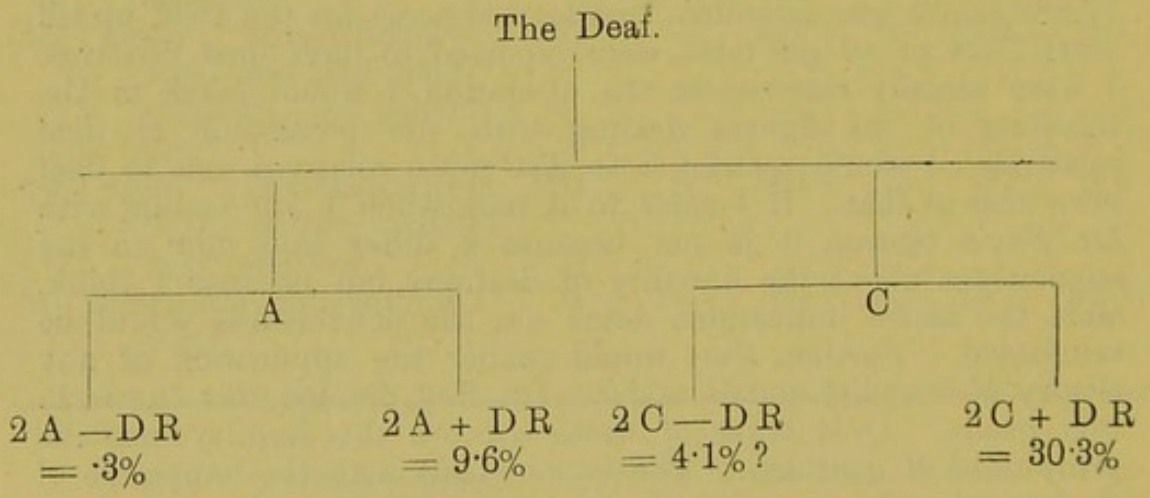
1 The absence of hearing in one or both partners.

2 The character of the deafness, congenital or acquired.

3 The possession of deaf relatives by one or two partners.

4 Consanguinity.

The term "factor" here is not used in the Mendelian sense, but in the sense of something which makes for the perpetuation of deafness. It is to be dissociated here from any special theory of heredity.



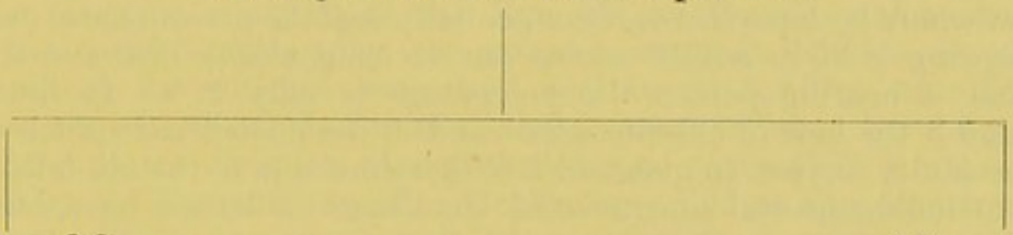
A = adventitious, or acquired deafness. C = congenital deafness. D R = deaf relatives. The figures represent the percentage of deaf offspring.

The above tree constructed from Dr. Fay's figures, shows that adventitious or acquired deafness, so long as there be no hereditary deafness, means practically no deaf offspring. It shows further that where hereditary deafness exists, the marriage of two adventitiously deaf people results in a large percentage of deaf offspring. We shall see that the latter is true even when hearing people of deaf descent marry. The other side of the tree

is even more striking. One would expect two congenitally deaf people to have a considerable deaf progeny. Unless this be supported by the possession of deaf relatives, the proportion of deaf offspring is small; when it is so supported, the deaf offspring rate is very high, 30·3. *It is the family history that counts, not the condition of the patient, even when the latter is a congenitally deaf-mute.*

One could contrast many similar trees out of Dr. Fay's tables. I content myself with only one more. The first tree answers Dr. Fay's Questions 1 and 3. The tree I now give attempts to answer Question 2, and answers it not only against expectation, but against the principle of the heredity of deafness. The answer is, therefore, wrong, and the fault must be sought for.

Marriages with 1 and 2 deaf partners.



1 D = 9·8. 2 D = 8·4.

According to expectancy 2 D should have been greater than 1 D, and it is less.

Dr. A. Graham Bell has given one reason for the anomaly, the present writer has given another. As both were given before Dr. Fay's book appeared, and as both have been quoted by him, I shall restate them. And as neither nor both cover the whole ground, I shall examine the case in detail (see figures of the Rev. W. W. Turner, p. 95).

Dr. Bell suggested that in the majority of such marriages the deaf partner was probably congenitally deaf, and married the hearing member of a deaf fraternity. I have no doubt that this accounts for the unexpected deaf offspring ratio in many individual cases, because it accounts for it in many cases where two hearing people marry.

The writer's reason, as quoted by Dr. Fay, is that when the anomaly does occur, "it is probably because the parents do not represent correctly the tendency to deafness in their respective families. For example, two hearing members representing families in which the tendency to heredity is strong will, if they marry, have a larger percentage of deaf progeny than two deaf

persons representing families in which the tendency is less strongly marked. It is the family history extending through many generations, not the personal history of the parents, which must guide us when we estimate the chances of the occurrence of deafness in the offspring."

This glaring anomaly in Dr. Fay's statistics, similar to the anomaly attaching to my own, points to a serious fault in our handling facts regarding the deaf. Had Dr. Fay's question been "Are marriages in which both of the partners are hereditarily deaf more liable to result in deaf offspring than marriages in which one of the partners is hereditarily deaf and the other a hearing person without deaf relatives?" the answer, even over a smaller number than 599 would have been, in my opinion, in the affirmative. Indeed, two of Dr. Fay's items in Table XCII., items 6 and 9, give an answer approaching accuracy. It is there shown that where both partners are congenitally deaf the percentage of deaf offspring is 25·9, whilst where one is congenitally deaf and the other a hearing person the percentage is only 11·9. In items 2 and 3 the lack of classification renders the deductions valueless. The faulty answer to question 2 is therefore due to the old fallacy of including several unconnected conditions under the term deafness. It was not to be expected that, extensive as Dr. Fay's figures are, he would be able to bring together a large number of instances in which a single factor producing hereditary deafness is known to operate. The nearest approach to this is where consanguineous marriages occur between deaf people. Here the proportion of deaf children and of marriages resulting in deaf children is always very high, the highest in Dr. Fay's tables. But the number of such marriages—the total is only 31—is too small to warrant further criticism here, and it will be better to reserve this discussion till that on consanguinity is taken up.

A Deaf Variety of the Human Race.

Perhaps the most interesting work on congenital deafness which has ever been published, is Dr. Graham Bell's classical memoir on "The Formation of a Deaf Variety of the Human Race." Dr. Bell deals chiefly with one class of the congenitally deaf, the deaf with deaf relatives. His work is, therefore, chiefly on hereditary deafness. Dr Bell first establishes the fact that "a considerable portion of the deaf-mutes of the country (America) belong to families containing more than one deaf-mute, and hence possess hereditary tendencies to deafness. Dr. Bell's second conclusion is that "of 2,262 congenital deaf-mutes, more than one half or 54·5 per cent. had deaf-mute relatives; and in the cases of those pupils who became deaf from apparently accidental causes, 13·8 per cent. had other members of their

family deaf and dumb." Dr. Bell further emphasizes, and rightly so, the tendency of the hearing members of deaf fraternities to have, when they marry, deaf offspring. He says, "In addition, therefore, to the 20,474 deaf-mutes in whom the deafness would probably tend to become hereditary by intermarriage, we must include the hearing and speaking members of their families, before we can form an adequate conception of the number of persons who possess a predisposition towards deafness." Dr. Bell then deals with the marriages of the deaf, and concludes: "(1) that there is a tendency among deaf-mutes to select deaf-mutes as their partners in marriage; (2) that this tendency has been continuously exhibited during the last 40 or 50 years; and (3) that, therefore, there is every probability that the selection of the deaf by the deaf in marriage will continue in the future." The third chapter of Dr. Bell's memoir is given to "The Deaf-Mute Offspring of Deaf-Mute Marriages," and opens by giving the Hertford statistics of the Rev. W. A. Turner, which show, "that in 86 families with one parent a congenital deaf-mute, one-tenth of the children were deaf, and in 24 families with both parents congenital deaf-mutes, about one-third were born deaf." This is in the direction of expectation, and contradicts the results got by Dr. Fay and myself. Mr. Turner's figures approach much more closely the conditions of a scientific experiment than Dr. Fay's or mine do. For in the former both the parents were congenitally deaf, and unions between the hereditarily deaf would be the rule, and not the exception. In Dr. Fay's figures and in mine no attempt was made to separate adventitious from congenital deafness.

In Chapter IV. Dr. Bell next goes on to give examples of individual families of deaf-mutes, some of which I hope to throw on the screen. In Chapter V. he deals with the growth of the deaf-mute population of the United States from the end of the 18th till the latter part of the 19th century, and concludes that "the indications are that the congenital deaf-mutes of the country are increasing at a greater rate than the population at large; and the deaf-mute children of deaf-mute parents at a greater rate than the congenital deaf-mute population." Chapter VI. deals with the causes which determine the selection of the deaf by the deaf in marriage. Briefly stated, these are the segregation of the deaf-mutes in institutions, the "mission" in one form or other to the adult deaf, and the use of a conventional sign language used by the deaf and dumb, and never understood by the hearing world. Dr. Bell admits that many of his records are imperfect, and judged by the standards adopted in experimental breeding they must ever remain so. I should not produce a family containing more than one deaf-mute as an actual proof of the heredity of the deafness. On the other hand, there is little reference to hardness of hearing as a proof of the heredity

of deaf-mutism. On the whole, Dr. Bell's statistics confirm Dr. Fay's figures, and it must be clear to any reader that these inquirers have given us a basis for the prevention of deafness on which we may quite safely build. It is otherwise with Dr. Bell's main thesis, "that a deaf variety of the human race is in process of formation." I shall examine this when discussing Mendelism and deafness.

In the pre-Mendelian period, like Dr. Fay and Dr. Bell, the writer dealt with the medical and statistical aspects of the subject. He collected statistics from British Institutions which showed that from 50 to 60 per cent. of the children then attending these schools had been born deaf, and that from 40 to 50 per cent. had deafness which was acquired. From the records of the Glasgow Institution alone, and chiefly from the children then in attendance, he was able to quote 45 families in which deaf-born children had deaf-mute relatives, and in many of which the hereditary character of the deafness was quite clearly proved. Various teachers in the country sent family trees illustrating the hereditary of deafness, and the writer published the "Ayrshire" family, which shows that 41 deaf-mutes occurred in less than a hundred years in a single family. No attempt was made to separate hereditary from merely congenital deafness in these statistics, but the distinction was clearly indicated. "It is the family history extending through many generations, not the personal history of the parents which must guide us when we estimate the chances of the occurrence of deafness in the offspring." Further, consanguineous marriage was shown to be an important factor in the production and continuance of deaf-mutism.

Deafness and Mendelism.

It is now necessary to consider whether the facts brought out in this study of hereditary deafness fit in with any existing theory of heredity.

Before discussing this subject, it should be stated that a theory of heredity cannot do much in the way of helping us to prevent deafness. Although deafness has been almost entirely ignored by Mendelians, and indeed by all hereditarians since the resurrection of Mendelism, a good deal of pre-Mendelian work was done on the heredity of deafness, and the main lines on which prevention must proceed were laid down.

Mendelism, or any theory of heredity, can do little more than express in new terms what we already know. The great want of to-day is not a theory of heredity but more careful clinical examin-

ation of the material exhibiting the phenomena of deafness. When we speak of deafness we must have in mind not the absence of hearing but one or other cause of that absence. Although the Mendelians have ignored the deaf child, the student of the latter owes a debt to the former—the Mendelians have shown how necessary it is to deal with single factors in discussion and how disastrous it is to include several factors under a generic name like deafness. Several writers, the present included, had in pre-Mendelian days emphasized the importance of this point; none saw how fatal to truth any deviation from this narrow path must be. It required Mendelism to teach us that.

The only theory of heredity which is quite specific in the statement of the conditions required for its acceptance is Mendelism. Starting with a single character in the edible pea, Mendel found that, given a large number of individuals, he was able to predict after crossing, the proportion in the offspring which would exhibit the character in question. This principle he was able to apply to many other characters in the edible pea. Since Mendel's time, the principle has been applied to many characters in plants and animals, and more recently to many characters in man. I have noticed the attempts made by the American Eugenists to apply the principle to epilepsy and feeble-mindedness in children. Does it apply to hereditary deafness? Referring to the Trait Book issued by the American Office, deafness is put down as a single trait. Now deafness is not a trait at all. It is no more a trait than cough or vomiting is. Like these, it is a symptom due to many pathological or abnormal conditions, and whether the term "trait" should ever be applied to it or not it is clear that the application of the term is useless and even misleading unless the abnormal condition giving rise to it be first defined. This, then, is the first difficulty met with in applying the Mendelian hypothesis to deafness. On the other hand, by excluding all forms of deafness which are clearly acquired and by further excluding all forms of deafness which, though congenital, are probably due to the presence of a poison such as syphilis, we reach a type of deafness which is undoubtedly present at birth, which is not accompanied by any other peculiarity either in the individual or his family, and which either as an expressed or latent condition may be present in every generation of his family. We thus get a type of deafness which may depend on a single cause and which may, for the purposes of this inquiry, be called a trait. This is true hereditary deafness. Further than this we cannot get in the meantime in the direction of exclusion, although it is possible that pathology may show us that this true hereditary deafness may depend on more than one cause. Assuming, however, that it is always due to one cause, or, as the Mendelians would say, due to the disturbance of, or absence of, a single factor, does the Mendelian theory fit the facts of hereditary deafness?

In attempting to answer this question one is met by the difficulty which presents itself in applying the principle of Mendelism to any human feature at all. The individual human family is too small and the ratios are apt to come out all wrong. And if, with the purpose of enlarging the family one turns to the biometric method and applies the Mendelian hypothesis to all the deaf or even to all the congenitally deaf, the old fallacy crops up again, more than one trait creeps into the discussion, and the result is valueless. Apart from the question of ratio or the proportion of the deaf to the hearing what are the features which should characterize hereditary deafness if it be regulated by the Mendelian principle?

1.—It is either transmitted wholly or not at all. Now if it be meant by this that the hereditarily deaf are totally deaf this condition is not fulfilled. All the hereditarily deaf have some hearing. But if it be meant that the amount of deafness, or in other words the remaining hearing is a fairly constant quantity, *the condition is fulfilled.* I have seldom examined a hereditarily deaf child who was just hard of hearing, and I have scarcely ever examined a hereditarily deaf child who had not some remains of hearing—some islands of hearing in a surrounding sea of deafness. Now this is a fact worth noting. Scarlet fever, measles, syphilis, and other causes of acquired deafness may either cause slight deafness or wipe out hearing altogether. The fact that hereditary deafness is a fairly constant quantity makes one suspect at least that it is due to a single cause and that its incidence may be Mendelian.

2.—Being hereditary and arising during the process of the laying down of the cell layers of the organism, this type of deafness should be due to abnormality of one part of the ear, *and this we find to be the case.* As we have seen, the organ of hearing is derived from two layers of the blastoderm, the epiblast and the mesoblast, and we scarcely ever find both of these divisions of the organ of hearing affected in a deaf-born child. Hereditary deafness is always due to an affection of the internal ear, and the internal ear is derived from the epiblast. When hereditary deafness is associated with another defect, that too is usually an affection of the epiblast — epilepsy, feeble-mindedness, mental deficiency, albinism, etc.

3.—If hereditary deafness be Mendelian it must be recessive and not dominant. I turn here to Professor Bateson for guidance. "Dominant characters," he says, "will in general be recognised as such from the fact that they are transmitted through affected persons only." Recessive characters will

be recognized by the fact that they may appear in the children of parents not exhibiting such characters, and especially amongst people born of consanguineous marriages. Complete proof of the recessive nature of a characteristic will only be obtained by evidence that all the children of affected parents exhibit the characteristic." It will be seen that *all these conditions demanded by recessiveness are supplied by hereditary deafness.*

I take the following examples from Dr. Bell's paper, from my own cases, and from the families at various institutions for the education of the deaf in Britain.

The Hoagland Family of Kentucky.

In 1853 this family was stated to consist of a father, himself deaf and dumb, with seven deaf-mute children. He had two deaf-mute nephews, one of whom was married and had two deaf-mute children. He had also a hearing sister who had two sons, both deaf-mutes, one of whom had three children, all deaf-mutes.

In this family the hereditary character of the deafness is clear, and a hearing hybrid produces a deaf recessive all of whose children may have the recessive character.

The Grisson Family of Kentucky.

There were three or four deaf-mute brothers and sisters of this family, who were pupils at the Kentucky Institution about the year 1828; one of them, William, married a deaf mute lady, and had a numerous family, all of whom could hear. One of his sons married his cousin, also a hearing person, and all of their five children are deaf-mutes.

On Mendelian lines, this family may be explained by calling deafness recessive, and as the partners were related, the cause of the deafness was the same in both, hence all the children were deaf.

The Fullarton Family of Nelson, N.Y.

Sayles Works, born in 1806 (a presumed congenital deaf-mute of the New York Institution), married Jane Fullarton, born 1806 (a congenital deaf-mute educated in the same institution), who had six brothers and sisters deaf and dumb. All of their six children were deaf and dumb.

Here again, deafness on Mendelian principles may be considered recessive, and the cause of the deafness the same in the partners though they were not related, hence all the children were deaf and dumb.

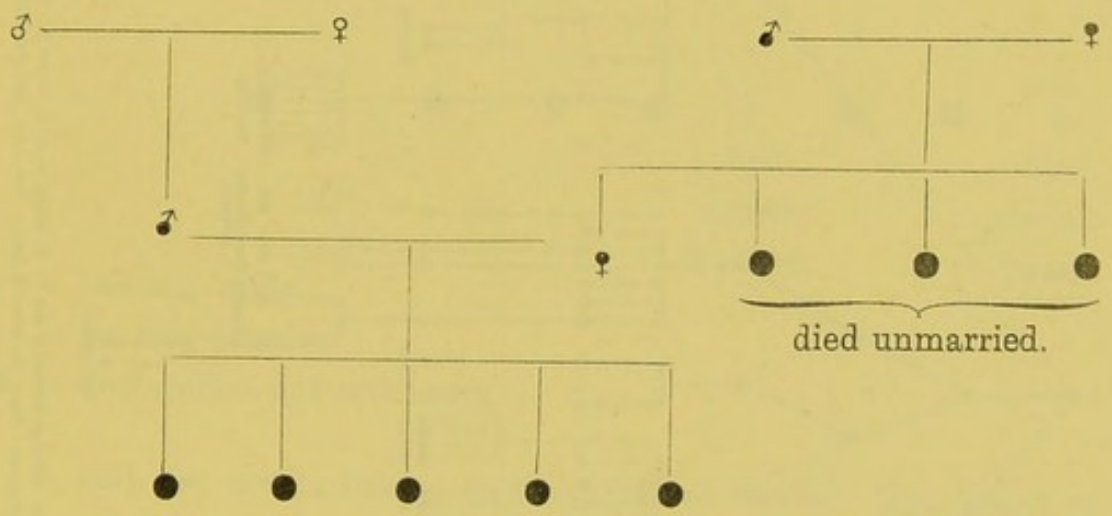
The Huston Family of Iowa.

> There have been ten children in the family, of whom the third and the eighth lost their hearing by disease, whilst the sixth, ninth, and tenth, were born deaf. Mr. Huston's grandmothers were sisters, and the grandfather and grandmother of this family were first cousins. Mr. Huston's brothers, like himself, were healthy and long lived, but like him, they all became deaf, or at least hard of hearing, comparatively early in life.

Here there are clearly several factors at work making for the common symptom—deafness, but not necessarily reinforcing one another. The disease referred to in the early part of the history is not defined. The deafness or hardness of hearing, noted as occurring early in life, is probably due to otosclerosis, a condition which has never been proved to have caused deaf-mutism, but which, as it is a fairly common disease, must occur in some deaf-mute families.

I give the following cases collected or reported by myself :—

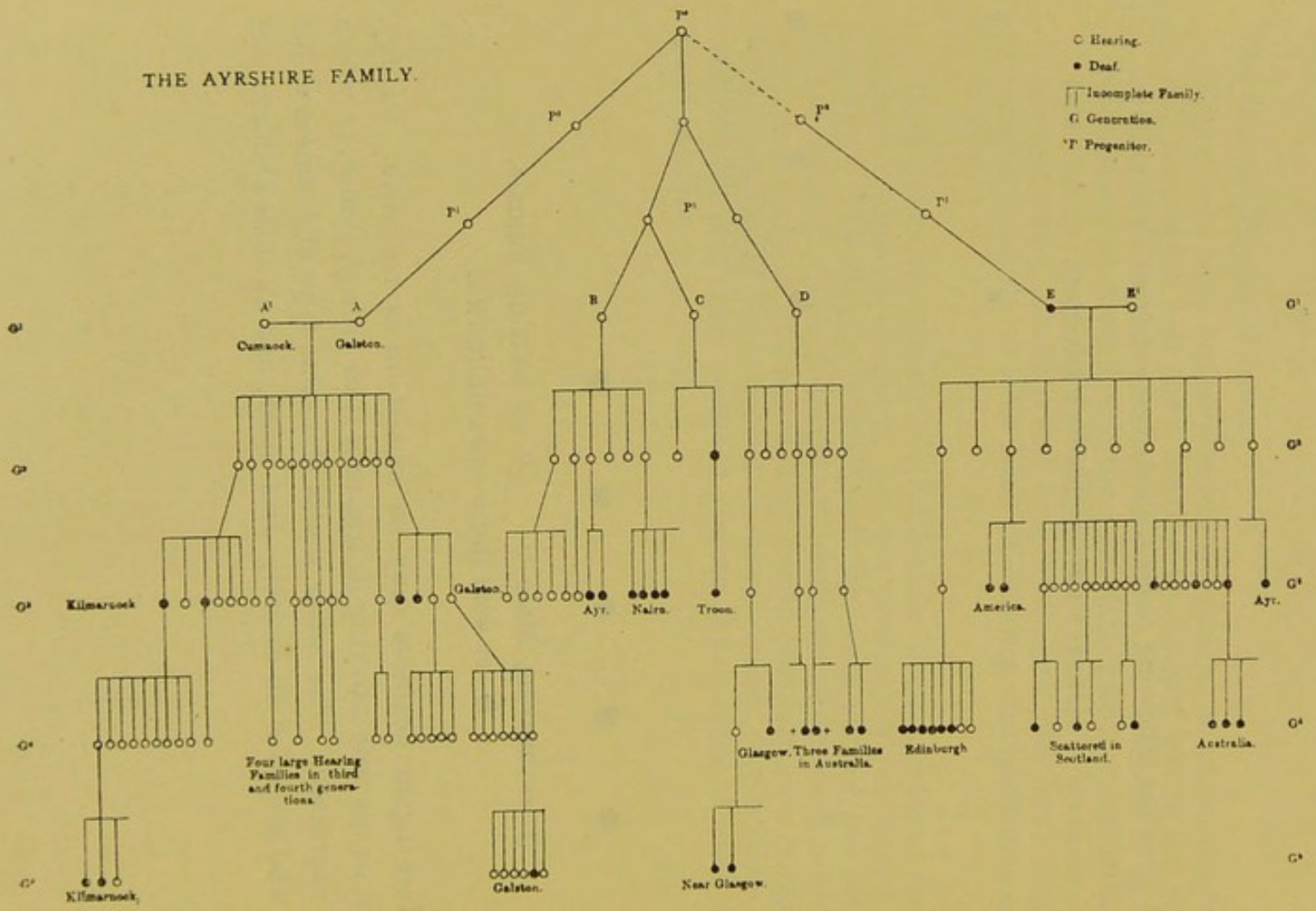
G—y Family (Halifax District).



♂ = hearing Male. ♀ = hearing Female.
● = deaf mute—sex unknown.

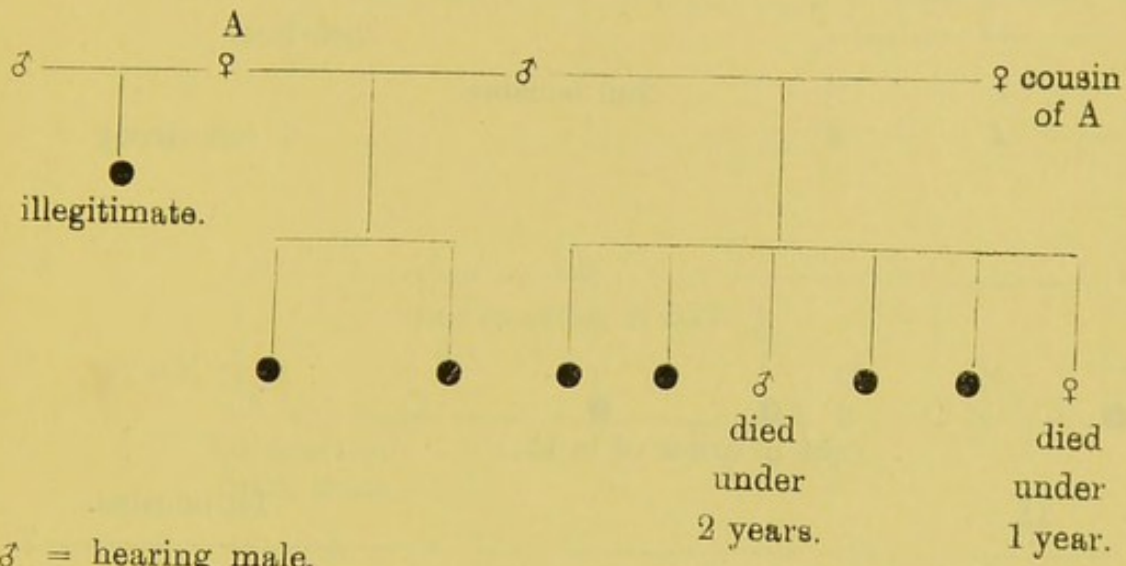
Here again deafness may be looked on as recessive. Gilroy, senior, or his wife carrying it, transmit it to Gilroy, junior, in whom it is expressed. The latter meets the same type of deafness in his wife, who comes of an entirely deaf stock, and all their children are deaf.

THE AYRSHIRE FAMILY.



A, possibly related to A¹ (his wife); A, second cousin to B, C, and D; D, cousin to brothers B and C; E, related to A, B, C, and D. The tree shows 41 deaf mutes.
See *Deaf Mutism* by J. K. Love and W. H. Addison. (Glasgow: James MacLehose & Sons. New York: The Macmillan Co., 1896.)

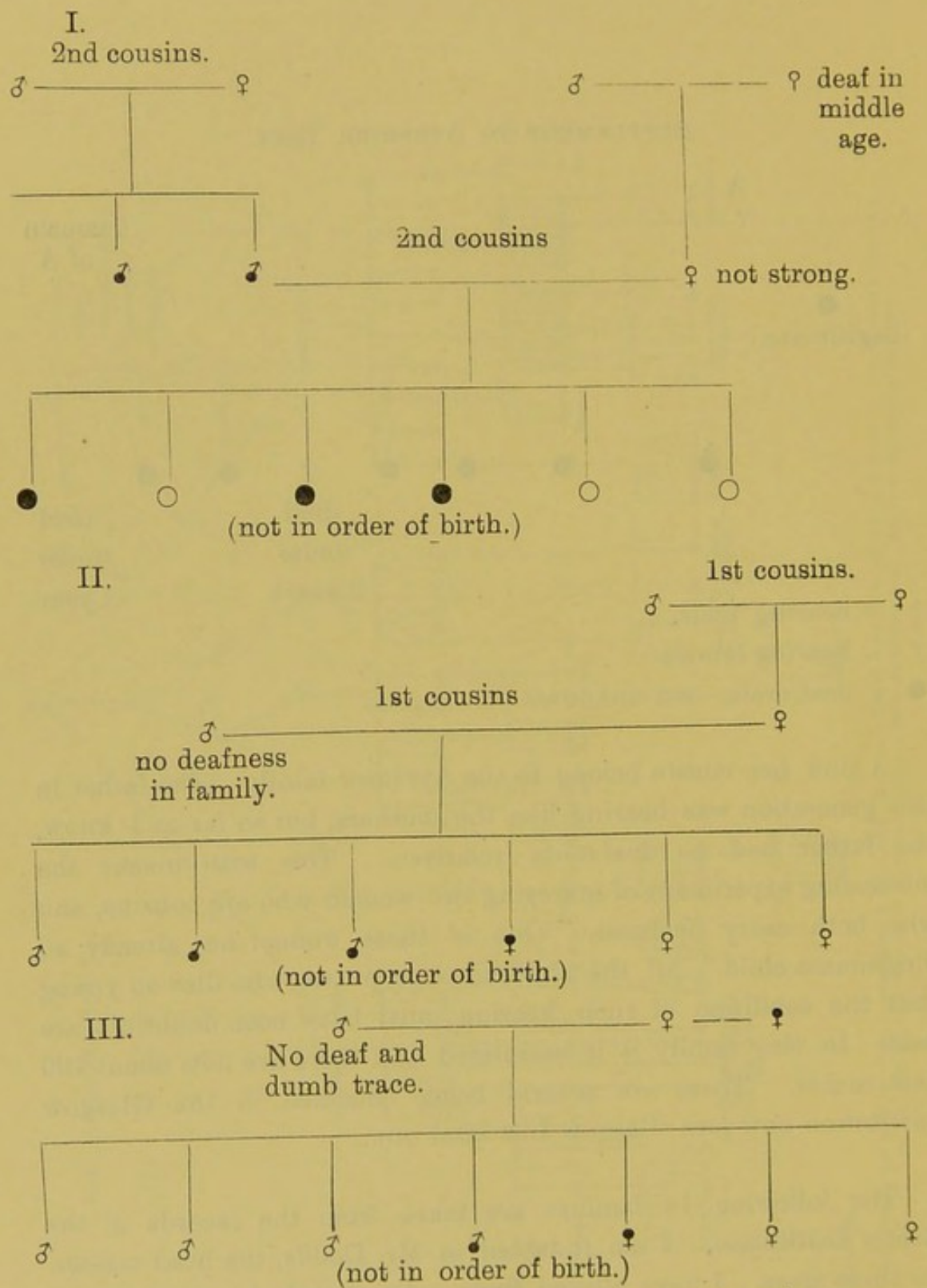
SUPPLEMENT TO AYRSHIRE TREE.



♂ = hearing male.
♀ = hearing female.
● = deaf-mute—sex unknown.

A and her cousin belong to the Ayrshire family. The father in this generation was hearing like the mothers, but so far as I know, the father had no deaf-mute relatives. This man makes the interesting experiment of marrying two women who are cousins, and who both carry deafness. One of these women has already an illegitimate child. All the children—except two who died so young that the condition of their hearing must have been doubtful—are deaf. In this family it is calculated that there are now about 100 deaf mutes. There are several being educated in the Glasgow Institution now (see Glasgow List later on).

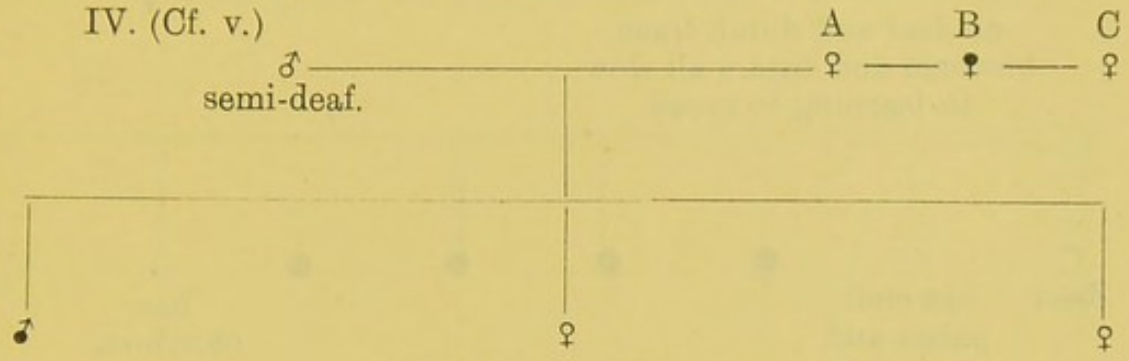
The following 14 families are taken from the records of the Exeter Institution. I am indebted to Mr. Dodds, the head master, for these trees. I have altered their order slightly for the purposes of grouping.



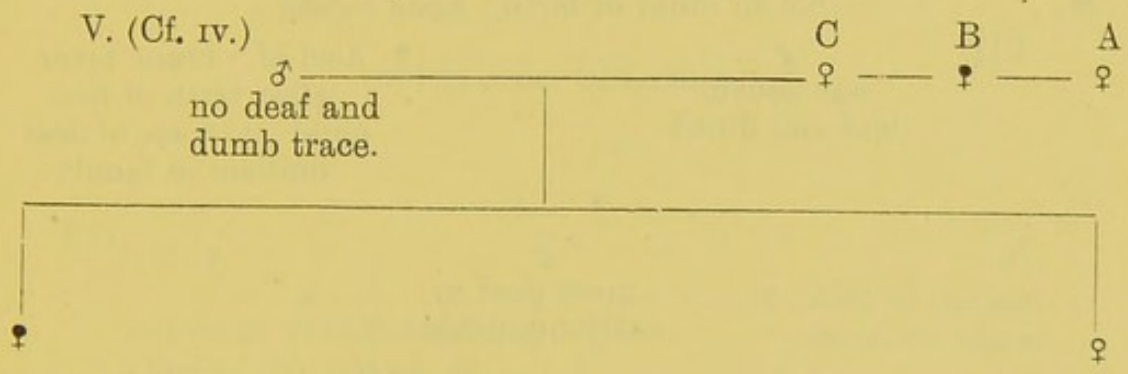
♂ = hearing male.
♀ = hearing female.
● = deaf-mute, sex unknown.
○ = hearing, sex unknown.

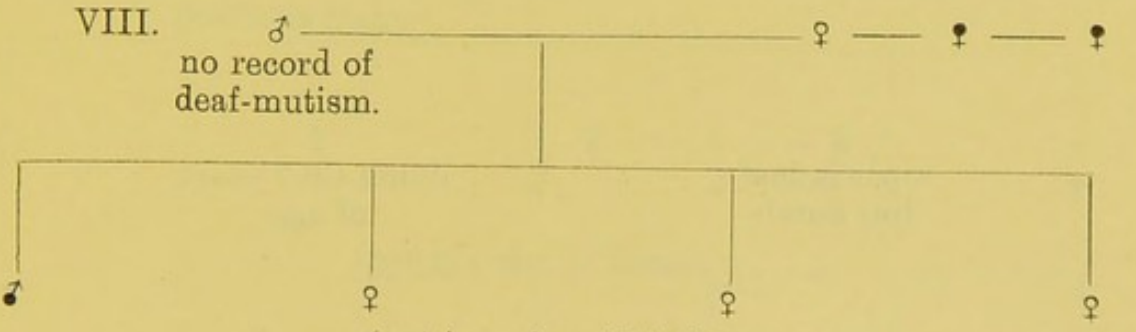
Trees I. and II. illustrated the effect of consanguinity in the initiation or reappearance of deafness. In Tree III. a deaf-mute aunt indicates the hereditary character of the deafness.

In Trees IV. and V. two hearing husbands marry the hearing sisters of a deaf-mute woman, and in both cases deaf offspring result. I have ignored the partial deafness.

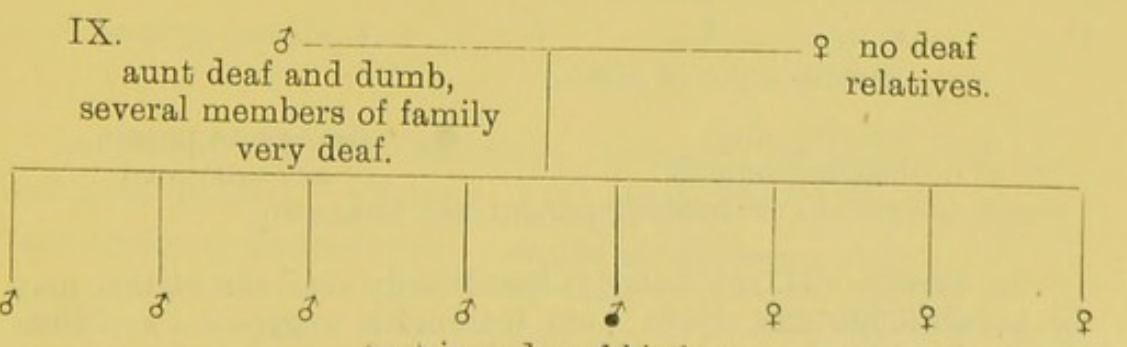


(not in order of birth.)





(not in order of birth.)

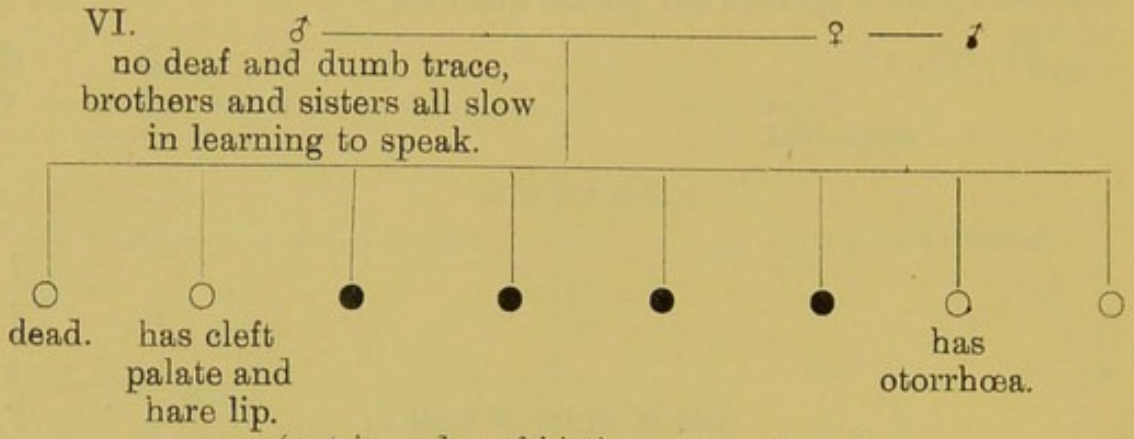


(not in order of birth.)

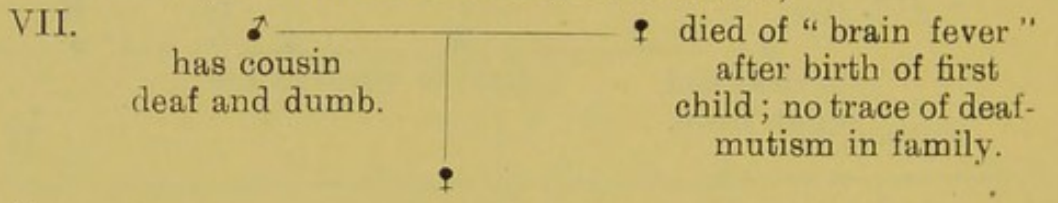
♂ = hearing male. ♀ = hearing female.

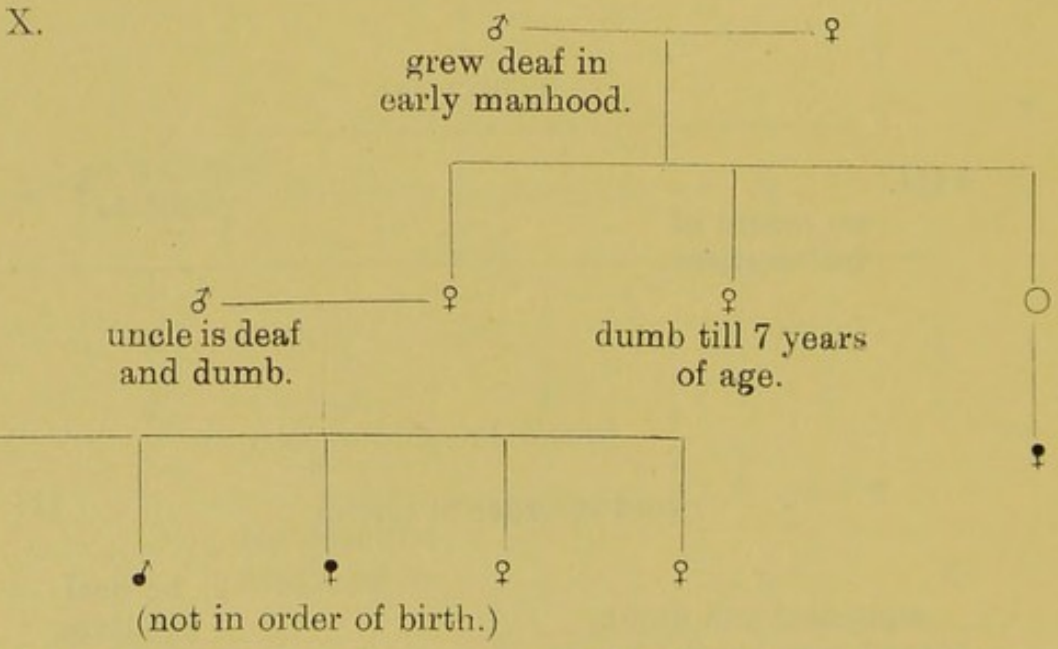
In Families VIII. and IX., as in IV. and V., the recessive character of the hereditary deafness is similarly indicated.

In Family VI. the deafness is hereditary, but there is a larger defect as shown by the lateness in acquiring speech and the palatal defect.



(not in order of birth ; none robust.)



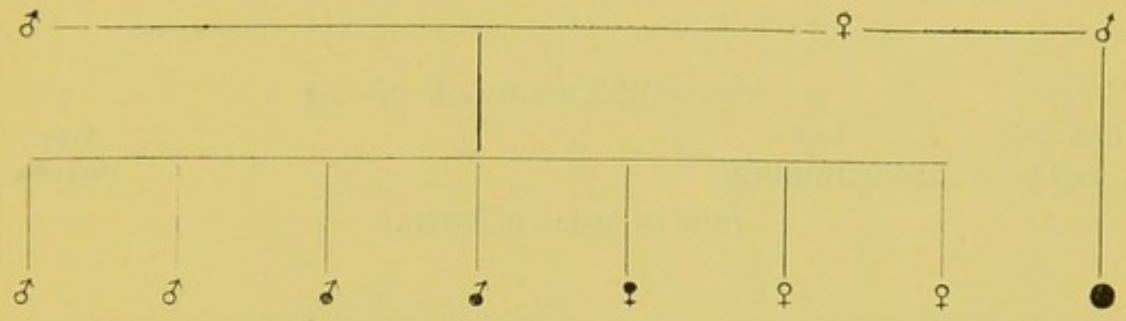


(not in order of birth.)

♂ = hearing male. ● = deaf-mute person,
♀ = hearing female. sex unknown.
○ = hearing person, sex unknown.

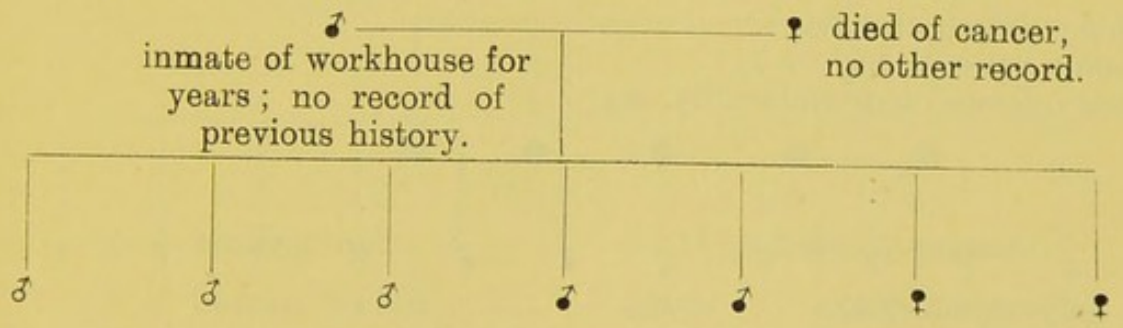
In Family VII. the father is hereditarily deaf, the mother may be so, although her death from meningitis suggests a syphilitic origin for her deafness. The child's deafness almost certainly comes through the father. In Family X, deafness is recessive, coming through hearing parents. Syphilis or a separate factor may be operating in the maternal grandfather.

XI.



(not in order of birth.)

XII.

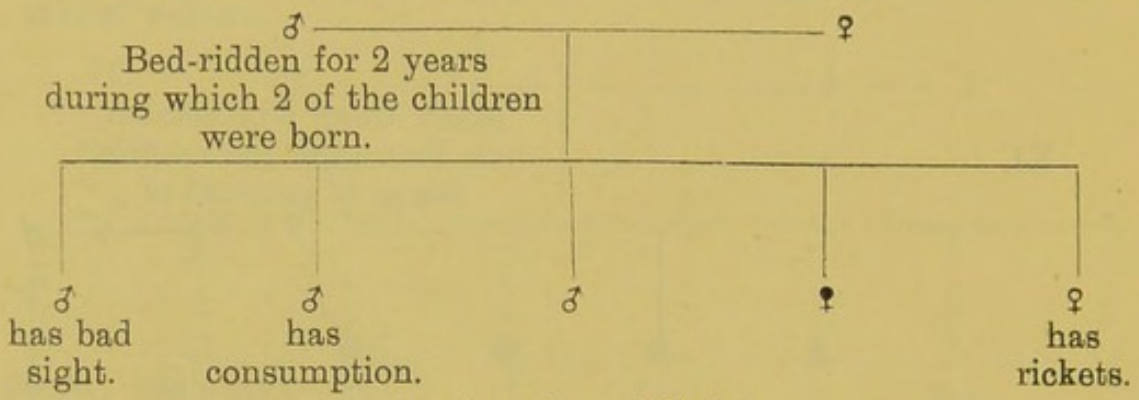


(not in order of birth.)

♂ = hearing male.
♀ = hearing female.
● = deaf-mute person, sex unknown.

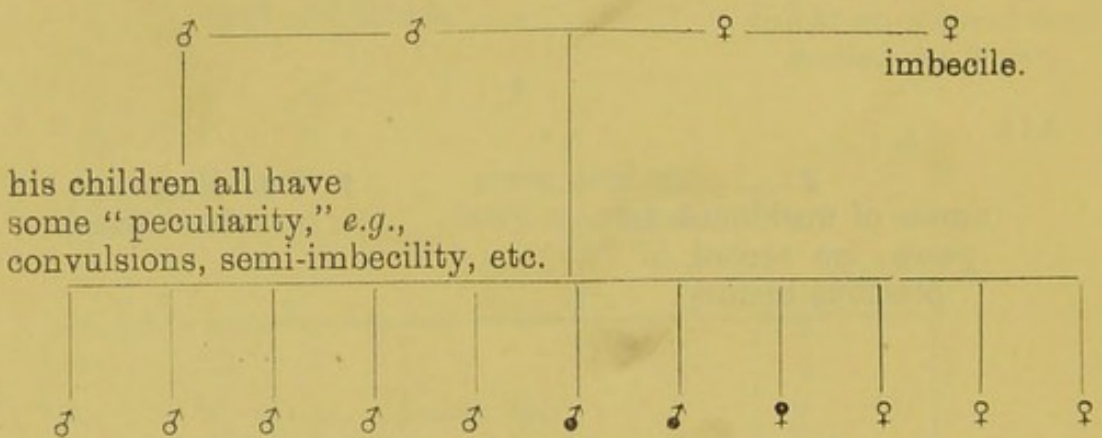
In Family XI. the hereditary character is shown by the deaf-mute cousins. Family XII. shows the probable direct transmission of deafness from parents to children.

XIII.



(not in order of birth.)

XIV.



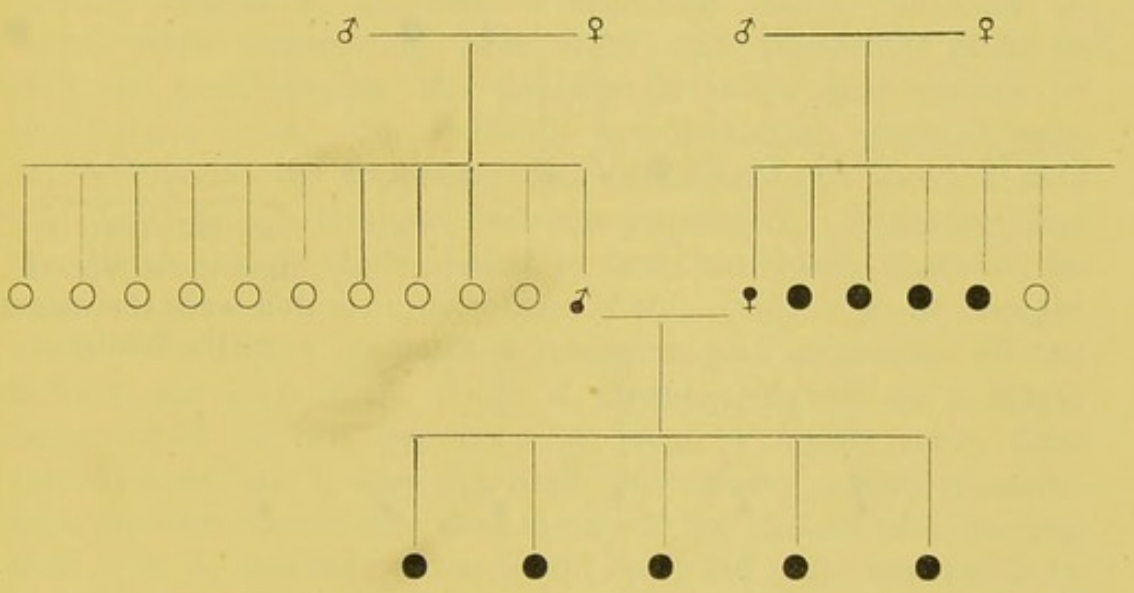
(not in order of birth.)

♂ = hearing male.

♀ = hearing female.

In Family XIII. the deafness may be syphilitic, but without a family history extending further back hereditary deafness cannot be eliminated. In Family XIV. there may be true hereditary deafness, but there is a larger defect than that which usually causes true hereditary deafness.

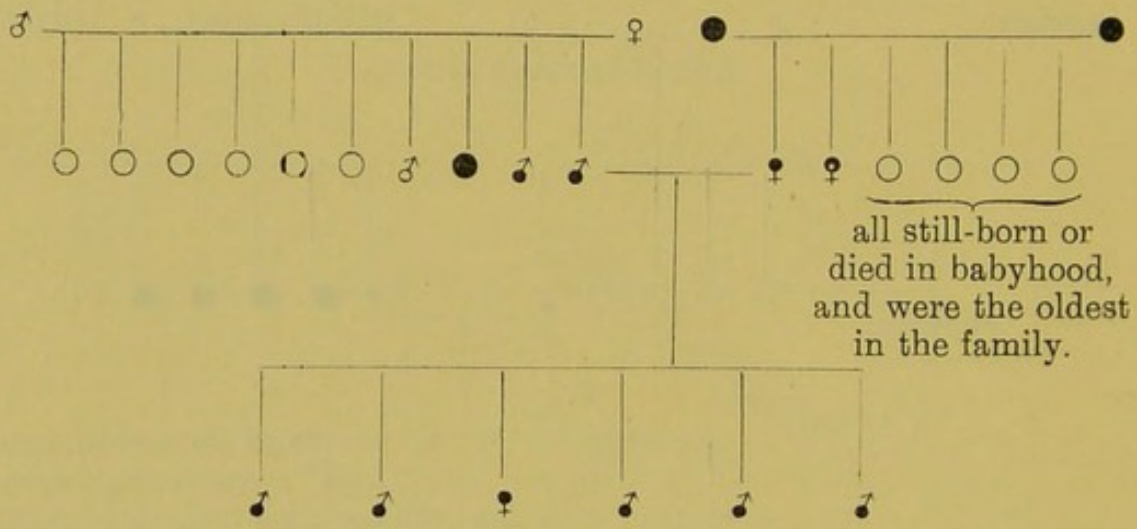
C—G Family (Edinburgh).



♂ = hearing male. ○ = hearing person,
♀ = hearing female. sex unknown.
● = deaf-mute person, sex unknown.

For the above case, I am indebted to Mr. Illingworth, of Edinburgh. No doubt all the children are deaf. But even if they be pure recessives, which is quite uncertain, they must each marry pure recessives if no hearing children are to follow.

Sc—t Family (Glasgow Institution).



♂ = hearing male.
♀ = hearing female.
● = deaf-mute person, sex unknown.

There is probably hereditary deafness in both father and mother. The father is said to have lost hearing at two years of age, but the combination of deaf sister and brother and deaf children makes heredity probable. On the mother's side, the history of four still-births, or infants' deaths, followed by two congenitally deaf children makes syphilis probable in the maternal grandparents. The mother would not have her blood tested.

Some attempt must be made to account for the few cases of semi-deafness which are congenital, and which occur amongst the relatives of congenital deaf-mutes. Such cases are not common. In Lecture II. I have given charts of the hearing islands which exist in the ears of deaf-born children. Should these islands occur low down on the scale and be of fair extent, that is, should large hearing islands occur in the speech area of the scale, the hearing for speech will be better than if the islands occur only high above the speech area. The child will be a vowel hearing deaf-mute, or even a semi-deaf child. It may be worth while considering here from the Mendelian point of view the possibility of the development of a deaf variety of the human race. In 1896—in pre-Mendelian days—I gave several reasons for supposing that this result put forward as a probability by Dr. Graham Bell was impossible. Assuming that the Mendelian principle applies to true hereditary deafness, let us see what conditions must obtain if this result is to be brought about. Hereditary deafness is recessive, and sometimes all the children are born deaf. Only if deafness depend on a single factor could all the deaf-born in such a family carry pure recessiveness, and if they did each must marry a pure recessive from another hereditarily deaf family if the chance of a hearing child is to be avoided. This would be found quite impossible in practice, even were a deliberate attempt made to bring it about. Deliberate inbreeding amongst the hereditarily deaf might sometimes do it, but such deliberate inbreeding is surely never likely to be practised.

In 1896 I also dealt at some length with the question of consanguinity and deafness.

With regard to the probable effect of consanuginity in the production or perpetuation of heredity in the light of the Mendelian Hypothesis. I here quote from Professor Bateson :—

> "In regard to diseases which may be recessive, there are several records which are suggestive, but little that amounts to proof. Naturally, as evidence of direct transmission is not to be expected, the likliest place to look for recessives will be amongst those conditions which have been noticed with special frequency in families resulting from consanguineous matings. In such matings, and particularly in those of first cousins, bearers of similar recessive characters may come

together, and thus, by the meeting of two similar germs in fertilization, offspring exhibiting the recessive character may be formed. The comparatively frequent appearance of a variation amongst such unions is thus prima facie a suggestion that it is recessive to the normal. This has been observed very noticeably in regard to retinitis pigmentosa, a degenerative disease of the retina. In Herlinger's collection of records, amongst 761 cases 228 are said to have been the offspring of consanguineous marriages. It is not in dispute that the condition may be produced by various specific causes also, but the heredity through consanguineous marriages creates a presumption that a group of cases may be of a recessive nature. It should perhaps be pointed out categorically that nothing in our present knowledge can be taken with any confidence as a reason for regarding consanguineous marriages as improper or specially dangerous. All that can be said is that such marriages give extra chances of the appearance of recessive characteristics amongst the offspring. Some of those are doubtless bad qualities, but we do not yet know that amongst the recessives there may not be valuable qualities also."

Now all that Professor Bateson has said above is in agreement with my own observations on the subject of deafness and consanguinity. But I think there is one effect of consanguinity which is not noticed in Professor Bateson's statement of the case; that is, that consanguinity *per se* tends to deterioration and defect. In the case of the famous Mellindean herd of sheep, where only the best specimens were used, Mr. Paterson, the shepherd, told me that the union of cousins, especially when it occurs for more than one generation, invariably results in diminutive offspring; and he stated that his father, so long in charge of the Polwarth herd, had the same experience. In consanguineous marriages then, the chances of developing good and bad qualities are not equal. Inbreeding tends to deterioration. It is a generally accepted principle amongst breeders that when size and strength are wanted, crossing is the best means of getting these. Taking then Professor Bateson's view of the effect of consanguinity in the emphazising of bad qualities, and remembering that inbreeding in itself tends to diminutive offspring and to deterioration, does Mendelism throw light on the origin of hereditary deafness? I think it does. We have seen that the class of sporadic congenital deafness forms the largest class amongst the deaf. We have seen too that some of these cases are syphilitic. But we have not accounted for the whole class, and we know that there are many cases in the class from which syphilis can certainly be excluded. Many of them are isolated cases in otherwise healthy families, healthy not only in the general sense but in the sense that they have good hearing. No deaf relative is known for several genera-

tions. The blood in every member gives a negative Wassermann reaction. But the family history is not known in every detail. A deaf-born relative may have existed many generations back, but because crossing has been the rule "the meeting of two similar germs in fertilization" has never occurred, and offspring exhibiting the recessive character has never been formed. A deaf-born child occurs at such long intervals that deafness is never recognized as a family characteristic. But let now a consanguineous marriage occur in such a family, the two similar germs have now a greater chance of meeting, and if they do the deafness is now so frequent in the family that we recognize the defect as hereditary. Or let the very rare deaf-mute in such a family marry a congenital deaf-mute from another and unrelated family, and the same result is likely to follow. For, although in Mendelian language hereditary deafness may depend on more than one factor, it need not depend on a large number and probably depends on a very few. Hence the danger of consanguineous marriage in every case and the very great danger amongst the deaf.

There are two points which must be made clear here. The first is that because of imperfect data I have not been able to discuss hereditary deafness as a Mendelian phenomenon in the strictest sense, and have therefore used the terms Mendelism, etc., in their looser sense. The second arises out of this first and is, that we do not know whether hereditary deafness, if it be Mendelian, is due to an absence or disturbance of a single factor or of more than one. No figures in my possession tend to a solution of this latter question.

Before applying any theory to the heredity of deafness, a plain synopsis of the facts may be given. The theory must, of course, fit the facts.

Surdism, or that degree of deafness which prevents the development of speech, is, when congenital, a fairly constant quantity. It may be due to congenital syphilis, but as a rule it is not so. It may appear in several members of the same family, brothers and sisters, and then may be hereditary; but it often appears in the direct line and in the collateral branches of a family, and then we are sure it is hereditary. Cases of congenital semi-deafness sometimes occur, or even cases of congenital hardness of hearing, but they are rare and when they occur it may be that the apparent greater degree of hearing is due to the accident that the remaining hearing is in the speech area of the scale. It has not been proved that congenital surdism is connected etiologically with any form of hardness of hearing which occurs in adult life. Many cases of congenital deafness seem to be sporadic, at least so far as enquiry into the family tree extending back-

wards for two or three generations shows. When people affected with hereditary deafness intermarry the deaf offspring tend to increase, and when the relatives of the hereditarily deaf marry, the children, even when the parents hear, show a considerable portion of deaf offspring. The tendency to deaf offspring is greatest, other things being equal, when the parents are related by blood, and even in the absence of any known cases of congenital deafness, the marriage of blood relations is followed by a larger number of deaf offspring than when the parents are quite unrelated.

This is not an *ex parte* statement. There is nothing pro-Mendelian about it. With the single exception of the fact that congenital syphilis is sometimes the cause of congenital deafness—a fact only recently demonstrated—it is a synopsis of the facts as ascertained by the writer in 1897 in pre-Mendelian days. Further, it is a fair statement of the facts as stated by other writers—Fay, Graham Bell, etc.—in pre-Mendelian days. How does the Mendelian hypothesis fit in with these facts? Again, with the single exception of the syphilitic origin of some cases of congenital deafness, there is not a single fact in the statement which is not covered by the Mendelian hypothesis. The latter teaches us to go further back with our family trees, and could we do so in every case of sporadic congenital deafness, there is no doubt, in my mind, that many of these would turn out to be hereditary. Mendelism tells us why consanguinity increases the deafness in deaf fraternities, and it shows us how consanguinity may apparently originate congenital deafness. It teaches us to make sure of the type of deafness in any two cases before we associate them etiologically. Except for the proof of absolute Mendelian ratios—a proof that it is not likely to be forthcoming—nothing is wanting to establish the thesis that hereditary deaf-mutism may be Mendelian.

In Lecture II. I gave as an estimate the proportion of the hereditarily deaf to the whole of the deaf as 24 or 25 per cent. By rejecting the mere presence of deaf brothers and sisters as a proof of heredity, I threw grave suspicion on the accuracy of this estimate. The following figures taken from the Glasgow and Exeter Institutions point to a smaller percentage as at least nearer the truth. I have chosen these institutions for two reasons. They represent almost the extremes of latitudes amongst schools for the education of the deaf in our country, and the returns from them are the most complete in my possession. For the Exeter returns, I am indebted to Mr. Dodds, the Head Master; for the Glasgow returns, I have to acknowledge the co-operation of Dr. Addison. The Exeter cases have been given in the form of fourteen trees. The following are Mr. Dodds' comments on the returns. (For the trees, see pp. 104–108.)

One hundred and twenty families were considered in 16 years, from 1896–1912, and out of these families 14 showed distinct hereditary taint in the children. These are the 14 trees I submit. This gives a percentage of 11·65 for hereditary deafness during the last 16 years. At the time these statistics were got out (1912) 111 families were sending 125 children. Of these 125, 11 (not counting brothers and sisters) instances are recorded in the trees I submit. So we have, at present, a proportion of hereditarily deaf families of 10 per cent.

To save space I present the Glasgow statistics in the form of a Table. All the cases given are, at present, in the institution, or have very recently left it.

Name.	Consanguinity.	Deaf-mute Relatives.	Remarks.
J. S. ...	None	Great grandfather deaf mute	
A. L. ...	None	Father has deaf cousins	
J. W. ...	None	Half-cousin deaf mute	
J. McA. ...	None	Two paternal uncles were in the Glasgow Institution	
J. McG. ...	Parents second cousins	Two brothers deaf	
A. P. ...	Parents cousins		
J. F. ...	Parents cousins		
H. R. ...	None	Paternal grandfather deaf mute	
H. S. ...	None	Father's cousin deaf mute	
R. N. ...	Parents cousins		
E. T. ...	None	Mother and father deaf and dumb, also aunts on both are deaf mute	
A. McB. ...	Parents cousins	Sister in institution	
J. R. ...	None	Two uncles deaf mute	
A. B. ...	None	Mother, brother, and sister deaf and dumb	
D. C. ...	Parents cousins	Brother deaf	
A. G. ...	None	Some cousins deaf mute	Ayrshire Family

Name.	Consanguinity.	Deaf-mute Relatives.	Remarks.
J. McD. P.	None	Mother, grandfather, and uncles deaf mute	
A. J. C. ..	None	One sister, four cousins, and an aunt are deaf mute	Ayrshire Family
M. W. ...	None	Cousin deaf	
T. C. ...	None	Two sisters deaf mute	
W. M. ...	None	Brother and uncle deaf mute	
T. M. ...	None	One brother in institution and two cousins deaf mute	
J. McK ...	None	Brother, two cousins, and other relatives deaf mute	Ayrshire Family
J. P. ...	None	Grandmother is deaf mute, brother and sister are deaf mute	
D. S. ...	None	Cousins, uncle, and aunt are mute	
E. S. ...	None	All the children in the family, parents, and aunt deaf mute	See Sc—t Family (See p 110.)
R. L. ...	Parents second cousins		
G. T. ...	Parents related, degree not stated		

In addition to the families noted in this list there are 19 cases in the Institution in which the evidence of family deafness is confined to the presence of one or more deaf brothers or sisters. Some of these have been shown to be syphilitic, in others there is no probability of syphilis as an explanation of the deafness. In one or two instances in the above list the children have recently left the School. With regard to the children at present in attendance, Mr. Addison says, "We calculate there are 19 children, representing 16 families, who have deaf relatives, other than brothers and sisters. This gives a percentage of 9·3 hereditary deafness. There is a roll of 203."

I have eliminated brothers and sisters as an evidence of heredity for several reasons.

1 I have shown that this fraternal deafness is sometimes due to syphilis, and that then it is not hereditary.

2 It has been taken in times past as the chief evidence of hereditary deafness. Now, fraternal deafness is not nearly so valuable as evidence as cousin deafness is. The same poison may act in the children of a family, but it is quite unlikely to act in the children of two brothers.

3 Repressive measures and operative measures have been proposed for the prevention of hereditary deafness. I do not think these are likely to be adopted, but if they are even to be discussed, the class to which it is proposed to apply them must be reduced as far as possible. A verdict of not proven will not do here. Only the guilty must be admitted to the list of the condemned.

These restrictions about the heredity of deafness are necessary both in the interests of scientific accuracy and of humanitarianism. But I do not reject the presence of deaf brothers and sisters as evidence of the heredity of deafness. Indeed, I do not reject a single case of sporadic congenital deafness as evidence. All I say is that neither the one nor the other can be admitted till they are supported by other evidence of heredity. I am sure such evidence would sometimes be forthcoming were more careful inquiry made. We are using living material to which we want to apply a scientific theory, and to which we may have to apply disagreeable restrictions, and we must admit nothing which is of doubtful character. Having made this point clear, I think we may take other 5 per cent of all the deaf out of the sporadic class and add them to the hereditary class. This would give us about 15 per cent of all the deaf as cases of true hereditary deafness.

I shall assume therefore that one of every seven deaf-mutes in our Institutions carries hereditary deafness, and I shall assume also that this is true of all the deaf-mutes who have passed through our Institutions and who are now adults. We have seen that there are 24,000 deaf-mutes in Britain. We have therefore about 3,600 deaf-mutes in Britain carrying deafness, that is, able to transmit their deafness. Now, could you shut up for life these 3,600 people, or could you get them all to pass on themselves a self-denying ordnance that they would never marry, or could you, in euphemistic phrase, sterilise them, would you stamp out hereditary deafness? You would not. Each of these has hearing brothers and sisters, many of whom carry deafness, and will transmit it with the same certainty as the deaf-mutes. The figures I have given may be incorrect or only approximately correct. The figures I am about to give may be wrong altogether. That does not hurt the argument. The argument is this, "what-

ever you do to the deaf brothers and sisters, however you restrict them, whatever you teach them about the duties of life, must also apply to the hearing ones, and, if it is to be effective, must be adopted by the latter." I am assuming, remember, that your object is to stamp out all hereditary deafness.

How far then must we widen this number of those who carry deafness, and who may transmit it? Well, if deafness be Mendelian, and if it be recessive, we must multiply it by three, which gives us over 10,000 people in Britain who carry deafness. If you refer to the Ayrshire family tree, you will find that the deaf progeny are almost exactly one in four of the entire family. Neither the deaf nor the hearing trees are complete, but it is a curious fact that a family tree constructed in pre-Mendelian days, and exhibiting only hereditary deafness, should, on the whole, give Mendelian ratios. These figures would point to the conclusion that for every hereditarily deaf person there are two or three who carry deafness. We have, therefore, to deal with an interest which, in Great Britain, affects over 10,000 people. Two-thirds of these people hear, and are indistinguishable from other citizens, and only an insignificant proportion is, apart from deafness, mentally or physically inferior to the average citizen.

Now I am going to advise those of you who want to get through life smoothly, and without offence, not to touch the question of the prevention of hereditary deafness. In the year 1897 (the exact date was May 15th) I brought this matter before the Royal Society of Edinburgh. Almost every speaker spoke very strongly against the proposals of my paper. There was little argument used, but the society refused to print my paper unless I altered it. Needless to say, I refused to do so. Instead of this, I read the paper to the National Association of Teachers of the Deaf, which met in Glasgow during the following summer, and hardly a word was raised against it. It met with a chorus of approval. The transactions of the National Association of Teachers of the Deaf were never published, so I am in possession of my paper till this day, and have it before me as I write.

My proposal was, that as certain classes of the deaf, the deaf who were mentally defective, the deaf who carried idiocy or imbecility or epilepsy as well as deafness, were unfit to marry, a government inquiry should be held to consider how best to prevent their marriage. I made no proposal with regard to the merely hereditarily deaf. Yet this simple proposal was voted cruel and brutal by the Royal Society of Edinburgh. This leads me to notice the two classes of the hereditarily deaf, and, in spite of past discouragement, to attempt to deal with them again.

1 Those who carry deafness and nothing more.

2 Those who carry deafness plus mental deficiency or imbecility or epilepsy.

I shall take the latter first.

Could I detect by some means, e.g. a blood test, the presence of latent epilepsy, idiocy or feeble-mindedness, I should prohibit marriage to persons thus affected, even were they apparently sound. But there are two principles which must be observed before we apply repressive measures, or measures involving operation—the so-called sterilization methods—to any class of the community. The affection in question must be demonstrable by some clinical method, and the affection in question must render them unfit for ordinary citizenship. Exact clinical diagnosis must precede repressive measures. The active, capable, self-supporting citizen must not have his civil rights interfered with. If these two principles be admitted, we cannot interfere with those who merely carry these defects but do not express them in their own persons. But I should have no hesitation in applying repressive measures to all who have these defects expressed in their own persons, and *a fortiori* to those who show these defects, plus deafness. The form of repression I should introduce is segregation of the mentally defective deaf and the epileptic deaf during the whole of their lives.

Secondly, those who carry deafness and nothing more, the true hereditarily deaf.

These people give a little extra trouble during the period of education, and their education is rather costly, but when the latter is finished they seldom ask help from their neighbours. They are quiet, peaceable, capable citizens, and to apply preventive measures to, or practice sterilisation on, them would be unjust and even cruel. But they owe a good deal more to the State than hearing people do. The State, therefore, has a right to some say in their future, and I think the State should insist on their being taught what the future is sure to bring if they marry. Deaf children will follow. All the deaf should know this. And if the deaf tend more and more to marry the deaf, as Dr. Bell has shown, none of of the deaf should marry the deaf, and the hereditarily deaf should not marry at all. The only exception to this rule is when the deaf whose deafness is acquired, e.g. from scarlet fever or measles marry their like. The State should see that this teaching is given to every deaf child, and this teaching can only be given by those who teach the deaf. It would be an easy matter to extend the

teaching to the relatives of the deaf, and thus to include all who carry deafness. This teaching should be given during the last year of school life. At present deaf children must attend school till they are 16 years old. They should attend till they are 18 years old. Already there is foreshadowed an extension of the school period in the case of hearing children, and the deaf child is not likely to be left out of this movement. He is four years behind his hearing fellow, by whatever method he is educated, and it would be but bare justice to extend his school period to 18 years. Before this period a separation of the sexes might take place and special teaching be given to both young men and women on the responsibilities of the life they are about to enter. I do not believe such teaching would always go unheeded. I know several deaf mutes who think about this matter, and I believe many more would think and act prudently were the whole situation made plain to them. A few lessons on Mendelism would serve as an introduction to the subject of heredity, and from the presence or absence of tallness to the presence or absence of hearing is a short gulf that could easily be bridged.

There are two objections which may be raised to this proposal—

1 You cannot always distinguish between the hereditarily deaf and the merely congenitally deaf.

2 In the light of what we know of the motives which lead to marriage, the teaching would be almost always ignored.

The first objection is of some weight, and in practice it would be better did the congenitally deaf not marry the congenitally deaf at all. This involves hardly any hardship, for there are still the hearing and the adventitiously deaf to choose from.

The second objection raises the whole question of our present arrangements for the education of the deaf. Why do the deaf tend to marry the deaf? Having worked for nearly a quarter of a century for the welfare and happiness of the deaf and dumb, I hope I shall not be suspected of lack of sympathy with this class. These lectures, however, are on the prevention of deafness, and the prevention of hereditary deafness must be discussed just as the prevention of adventitious deafness or sporadic congenital deafness was. In these latter cases the simple plan was followed of defining, as far as possible, the causes of the deafness, and of making recommendations for their removal. No sentiment was brought into the discussion. The prevention of the exanthemata, the notification of meningitis and of congenital syphilis were urged because these diseases killed children, and made other

children deaf. The better housing of the poor was urged from the same motive. It may be a fact, as Dr. Fay states, that marriages in which both of the partners are deaf are more likely, other things being equal, to result happily than those in which one of the partners is deaf, and the other is a hearing person; but to admit the fact into this discussion is to obscure the issue. It is certainly not a fact that the second class of marriages is always, or generally, unhappy. And even if Dr. Fay's statement be true, the fact is not one to be set against attempts to prevent deafness, provided these latter are likely to be successful, and do not involve harshness and cruelty. For there is another side to the picture. To be deaf and to marry a deaf person is not the way to happiness. Added to the ordinary difficulties of family life, there are the sense of restriction and narrowness imposed by the deafness itself, the more limited income as compared with that of hearing people on which to bring up a family, the anxiety as to whether the children who follow the marriage will be deaf or hearing, and the knowledge when a deaf child does come that the child will be handicapped in the race of life. In asking the congenitally deaf not to marry each other, I am not attacking family life; I am trying to establish it and brighten it, to make it less harrassing, less dull, and more interesting. It is not maternity and children I am fighting against. These I love and would cultivate. It is deafness I want to get rid of. To return to the question then, Why do the deaf marry the deaf? To quote again from Dr. Fay, the reasons are "the strong bond of mutual fellowship growing out of their similar condition, the ease and freedom with which they communicate with each other, the identity of their social relations and sympathies outside the domestic circle."

Now I do not think any words in our language could describe the motives which the deaf have for marrying the deaf, or, as Dr. Fay puts it, "the more favourable conditions for happiness" better than these. What we have to distinguish here is the extent to which these motives are primary and essential to deafness, and to what extent, if any, they are secondary or dependeut on the arrangements which society has made for the welfare of the deaf. Only to the latter extent have we any power over them. But to that extent at least is society bound to reconsider its methods, and if they tend to increase or perpetuate hereditary deafness, to remodel them, Until society has done this, it is not likely that any effort to prevent the deaf-born from intermarrying will be of much avail.

This is not the place to compare or even to discuss the value of methods of education. I have done that elsewhere. But there are two features of our educational arrangements which cannot escape criticism in discussing the prevention of hereditary deafness.

These are—

1 The segregation of the deaf in residential institutions.

2 The acquisition by the deaf and its use amongst themselves of a language which is not and never will be understood by the average person—the language of signs.

The remedies for these defects of our present arrangements are—

1 The spread of the day school system, so that the deaf out of school will not associate so much with each other.

2 The use of speech and lip-reading as the ordinary means of communication between teacher and scholar and between the deaf and their friends amongst the hearing.

Whatever in our social system renders these alterations difficult must be patiently but thoroughly removed. Fortunately, removal of difficulties has begun. The wages of the workers are rising, the housing of the poor is improving, the people are becoming more sober, knowledge about the deaf is spreading amongst all classes, teachers are being better equipped and better paid, and the deaf child is being better studied and understood. The new science of eugenics, like the new science of psychology, is dealing less in extravagances and more in common sense. And the time will come when the deaf child will be part of, and not apart from, the hearing world. But the cart must not go before the horse. We must not legislate against the marriage and the intermarriage of the congenitally deaf till we have removed the conditions we have set up, and which invite them to do the thing we would prevent. The strength of a family does not depend on money or position. It depends on the presence of healthy and normal, and the absence of unhealthy and abnormal children. And the strength of a state is just the strength of the sum of its families. The strongest state is the state with the largest number of healthy and fit men and women. The greatest danger to our country to-day is the relative decrease of the fit and the relative increase of the unfit. The absolute number of all the deaf is diminishing, the number of the congenitally deaf is probably increasing, and the blame that this is so is not theirs, it is ours! I have said a good deal about the fitness of the hereditarily deaf, because their unfitness has been taken for granted and has been greatly exaggerated. But it is better to have five senses than four, it is better to hear than to be deaf, and alike from the standpoint of the individual, of the family, and of the State, it is worth while preventing hereditary deafness.

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APPENDIX.

Statistics and replies received in connection with Circular addressed to Teachers of the Deaf, *see* p. 25.

BRITISH SCHOOLS.

School.	Class I.	Class II.	Class III.	Specific Teeth.	Stigmata Eyes	Remarks on Mental and Physical Condition.
Preston ...	12 / 80 — 15 p.c.	38 / 80 — 47·5 p.c.	30 / 80 — 37·5 p.c.	...	...	The largest number both of mental and physically poor cases seem to be amongst the hereditary cases.
Derby ...	61 / 170 — 36 p.c.	101 / 170 — 59 p.c.	8 / 170 — 4·7 p.c.	20 / 161	2 / 161	Mentally defective : $\frac{6}{61}$ acquired, $\frac{15}{101}$ congenital, $\frac{1}{8}$ hereditary. Physically poor : $\frac{0}{61}$,, $\frac{8}{101}$,, $\frac{1}{8}$,,
Belfast ...	30 / 74 — 40·5 p.c.	28 / 74 — 37·8 p.c.	16 / 74 — 21·6 p.c.	...	...	The largest percentage both of physical and mental defect seem to be in the sporadic congenital class.
Jews' Home, London	16 / 52 — 30·8 p.c.	36 / 52 — 69·2 p.c.	0 / 52 — 0 p.c.	...	...	Backward children seem about equally distributed between the acquired and congenital cases.
Leeds	41 / 142 — 28·8 p.c.	98 / 142 — 69 p.c.	3 / 142 — 2·1 p.c.	...	...	The only three hereditary cases in the school are very intelligent. There are 118 taught orally and 24 by the silent method, and almost all the latter are either congenitally deaf or deaf from brain diseases.

BRITISH SCHOOLS—*continued*

School.	Class I.	Class II.	Class III.	Specific Teeth.	Stigmata Eyes.	Remarks on Mental and Physical Condition.
Donaldson's, Edinburgh	44 / 119 = 37 p.c.	75 / 119 = 63 p.c.	0 / 119 = 0 p.c.	1 / 119	...	No distinction is made between the congenitally deaf and the hereditary deaf.
Henderson Rd., Edinburgh	9 / 70 = 12·8 p.c.	33 / 70 = 47·1 p.c.	28 / 70 = 40 p.c.	4 / 70	...	Both physical and mental defect are most marked amongst the hereditarily deaf.
Doncaster ...	43 / 124 = 34·7 p.c.	42 / 124 = 34 p.c.	39 / 124 = 31·4 p.c.	1 / 124	...	There does not seem much difference in the percentage of mentally weak in the three classes.
Exeter ...	46 / 121 = 38 p.c.	31 / 121 = 25·6 p.c.	44 / 121 = 36·3 p.c.	...	7 / 121	The mentally defective and backward cases are chiefly from cases of scarlet, convulsions, and meningitis. The physically weak are certainly from the congenital cases.
Liverpool ..	41 / 156 = 26·3 p.c.	99 / 156 = 63·4 p.c.	16 / 156 = 10·2 p.c.	1 / 156	1 / 156	The greatest percentage of mentally weak or backward children are in the Hereditary Class.
Stoke-on-Trent	Of 108 children, 13 can be classed as backward mentally or physically or both. Of these 13, 1 undoubtedly became deaf after birth, 4 have sufficient deaf relatives to indicate a family tendency to deafness, and 8 are isolated cases of congenital deafness without record of deaf relatives.					

DUTCH SCHOOLS.

School.	Class I.	Class II.	Class III.	Specific Teeth.	Stigmata Eyes.	Remarks on Mental and Physical Condition.
Groningen ...	14 —- 7·5 p.c. 185	106 — 57·3 p.c. 185	65 —- 35·1 p.c. 185	5 —- 185	0 —- 185	Only 1 in 14 acquired cases is mentally backward. 15 of 17 backward cases in the sporadic class have blind, idiotic, or epileptic relatives. 9 of 65 hereditary cases are backward. The 65 belong to 54 households, and there are 11 pairs of brothers and sisters.
Geobel ...	30 - -19 p.c. 159	93 —- 58·5 p.c. 159	36 —- 22·6 p.c. 159	1 —- 159	...	Mentally defective: $\frac{6}{30}$ acquired, $\frac{30}{93}$ congenital, $\frac{10}{36}$ hereditary. Physically poor: $\frac{2}{30}$,, $\frac{10}{93}$,, $\frac{2}{36}$,,
Dordrecht ...	8 — 20 p.c. 40	26 — 65 p.c. 40	6 — 15 p.c. 40	...	...	Mentally defective: $\frac{0}{8}$,, $\frac{4}{26}$,, $\frac{0}{6}$,, Physically poor: $\frac{0}{8}$,, $\frac{2}{26}$,, $\frac{0}{6}$,,

AMERICAN SCHOOLS.

School.	Class I.	Class II.	Class III.	Specific Teeth.	Stigmata Eyes.	Remarks on Mental and Physical Condition.
Columbus, Ohio	186 —- 42·4 p.c. 438	152 —- 34·7 p.c. 438	100 —- 22·8 p.c. 438	1 —- 438	...	Mentally defective: 13 of the acquired, 14 of the congenitals, and 5 of the hereditary.
Horace Mann School, Boston, U.S.A.	71 —-50·3 p.c. 141	56 —-39·7 p.c. 141	14 —-10 p.c. 141	8 —- positive 141 9 —- probable 141	5 —-positive 141 1 —- probable 141	Mentally defective: $\frac{7}{71}$ acquired, $\frac{10}{56}$ congenital, $\frac{1}{14}$ hereditary. Physically poor: $\frac{10}{71}$,, $\frac{16}{56}$,, $\frac{3}{14}$,, The highest death rate amongst brothers and sisters is in Class I.

OPINIONS WITHOUT FIGURES SENT IN RESPONSE TO CIRCULAR.

Birmingham, England	Most mentally defective and physically poor children belong to the class of sporadic congenital deafness.
Margate, England ...	The congenital and hereditary cases supply the greater proportion of mentally defective or backward children. The born deaf with deaf relatives at home come to school at admission brighter and ahead of those with no such direct deaf relatives
Clarke School, Northampton, Mass., U.S.A.	The child who becomes deaf at a year or two could not be classed with those who were deaf from birth. The mental stimulus which they receive before deafness supervened would be, in our judgment, considerable.
Columbia Institution, Washington, D.C., U.S.A.	The very severe illnesses which cause deafness after birth often leave a marked effect on either the body or mind in its after development. Those congenitally deaf who show physical or mental defects are, according to our records, largely those born from related parents.
California Institution, U.S.A.	The children of deaf-mute parents always rank higher mentally and in respect to obedience than other (deaf) children.
Kentucky School, Danville, Ky., U.S.A.	We find most of the mentally defective among children who are congenitally deaf from families in which there is no record of deaf members. Also more children in poor physical condition than the same class.