THE HISTORY OF TWINS, AS A CRITERION OF THE RELATIVE POWERS OF NATURE AND NURTURE.[1]

By Francis Galton, F.R.S.

THE exceedingly close resemblance attributed to twins has been the subject of many novels and plays, and most persons have felt a desire to know upon what basis of truth those works of fiction may rest. But twins have many other claims to attention, one of which will be discussed in the present memoir. It is, that their history affords means of distinguishing between the effects of tendencies received at birth, and of those that were imposed by the circumstances of their after lives; in other words, between the effects of nature and of nurture. This is a subject of especial importance in its bearings on investigations into mental heredity, and I, for my part, have keenly felt the difficulty of drawing the necessary distinction whenever I tried to estimate the degree in which mental ability was, on the average, inherited. The objection to statistical evidence in proof of its inheritance has always been: 'The persons whom you compare may have lived under similar social conditions and have had similar advantages of education, but such prominent conditions are only a small part of those that determine the future of each man's life. It is to trifling accidental circumstances that the bent of his disposition and his success are mainly due, and these you leave wholly out of account—in fact, they do not admit of being tabulated, and therefore your statistics, however plausible at first sight, are really of very little use.' No method of enquiry which I have been able to carry out—and I have tried many methods—is wholly free from this objection. I have therefore attacked the problem from the opposite side, seeking for some new method by which it would be possible to weigh in just scales the respective effects of nature and nurture, and to ascertain their several shares in framing the disposition and intellectual ability of men. The life history of twins supplies what I wanted. We might begin by enquiring about twins who were closely alike in boyhood and youth, and who were educated together for many years, and learn whether they subsequently grew unlike, and, if so, what the main causes were which, in the opinion of the family, produced the dissimilarity. In this way we may obtain much direct evidence of the kind we want; but we can also obtain yet more valuable evidence by a converse method. We can enquire into the history of twins who were exceedingly unlike in childhood, and learn how far they became assimilated under the influence of their identical nurtures; having the same home, the same teachers, the same associates, and in every other respect the same surroundings.

My materials were obtained by sending circulars of enquiry to persons who were either twins themselves or the near relations of twins. The printed questions were in thirteen groups; the last of them asked for the addresses of other twins known to the recipient who might be likely to respond if I wrote to them. This happily led to a continually widening circle

[1] In my *English Men of Science*, 1874, p. 12, I treated this subject in a cursory way. It subsequently occurred to me that it deserved a more elaborate enquiry, which I made, and of which this paper is a result.

of correspondence, which I pursued until enough material was accumulated for a general reconnaissance of the subject.

There is a large literature relating to twins in their purely surgical and physiological aspect. The reader interested in this should consult *Die Lehre von den Zwillingen*, von L. Kleinwächter, Prag. 1871; it is full of references, but it is also disfigured by a number of numerical misprints, especially in p. 26. I have not found any book that treats of twins from my present point of view.

The reader will easily understand that the word 'twins' is a vague expression, which covers two very dissimilar events; the one corresponding to the progeny of animals that have usually more than one young one at a birth, and the other corresponding to those double-yolked eggs that are due to two germinal spots in a single ovum. The consequence of this is, that I find a curious discontinuity in my results. One would have expected that twins would commonly be found to possess a certain average likeness to one another; that a few would greatly exceed that degree of likeness, and a few would greatly fall short of it; but this is not at all the case. Twins may be divided into three groups, so distinct that there are not many intermediate instances; namely, strongly alike, moderately alike, and extremely dissimilar. When the twins are a boy and a girl, they are never closely alike; in fact, their origin never corresponds to that of the above-mentioned double-yolked eggs.

I have received about eighty returns of cases of close similarity, thirty-five of which entered into many instructive details. In a few of these not a single point of difference could be specified. In the remainder, the colour of the hair and eyes were almost always identical; the height, weight, and strength were generally very nearly so, but I have a few cases of a notable difference in these, notwithstanding the resemblance was otherwise very near. The manner and address of the thirty-five pairs of twins is usually described as being very similar, though there often exists a difference of expression familiar to near relatives but unperceived by strangers. The intonation of the voice when speaking is commonly the same, but it frequently happens that the twins sing in different keys. Most singularly, that one point in which similarity is rare is the handwriting. I cannot account for this, considering how strongly handwriting runs in families, but I am sure of the fact. I have only one case in which nobody, not even the twins themselves, could distinguish their own notes of lectures, &c.; barely two or three in which the handwriting was undistinguishable by others and only a few in which it was described as closely alike. On the other hand, I have many in which it is stated to be unlike, and some in which it is alluded to as the only point of difference.

One of my enquiries was for anecdotes as regards the mistakes made by near relatives, between the twins. They are numerous, but not very varied in character. When the twins are children, they have commonly to be distinguished by ribbons tied round their wrist or neck; nevertheless the one is sometimes fed, physicked, and whipped by mistake for the other, and the description of these little domestic catastrophes is usually given to me by the mother, in a phraseology that is somewhat touching by reason of its seriousness. I have one case in which a doubt remains whether the children were not changed in their bath, and the presumed A is not really B, and *vice versâ*.' In another case an artist was engaged on the portraits of twins who were between

three and four years of age; he had to lay aside his work for three weeks, and, on resuming it, could not tell to which child the respective likenesses he had in hand belonged. The mistakes are less numerous on the part of the mother during the boyhood and girlhood of the twins, but almost as frequent on the part of strangers. I have many instances of tutors being unable to distinguish their twin pupils. Thus, two girls used regularly to impose on their music teacher when one of them wanted a whole holiday; they had their lessons at separate hours, and the one girl sacrificed herself to receive two lessons on the same day, while the other one enjoyed herself. Here is a brief and comprehensive account: 'Exactly alike in all, their schoolmasters never could tell them apart; at dancing parties they constantly changed partners without discovery; their close resemblance is scarcely diminished by age.' The following is a typical schoolboy anecdote: Two twins were fond of playing tricks, and complaints were frequently made; but the boys would never own which was the guilty one, and the complainants were never certain which of the two he was. One head master used to say he would never flog the innocent for the guilty, and another used to flog both. No less than nine anecdotes have reached me of a twin seeing his or her reflection in a looking-glass, and addressing it, in the belief it was the other twin in person. I have many anecdotes of mistakes when the twins were nearly grown up. Thus: 'Amusing scenes occurred at college when one twin came to visit the other; the porter on one occasion refusing to let the visitor out of the college gates, for, though they stood side by side, he professed ignorance as to which he ought to allow to depart.'

Children are usually quick in distinguishing between their parent and his or her twin; but I have two cases to the contrary. Thus, the daughter of a twin says: 'Such was the marvellous similarity of their features, voice, manner, &c., that I remember, as a child, being very much puzzled, and I think, had my aunt lived much with us, I should have ended by thinking I had two mothers.' The other, a father of twins, remarks: 'We were extremely alike, and are so at this moment, so much so that our children up to five and six years old did not know us apart.'

I have four or five instances of doubt during an engagement of marriage. Thus: 'A married first, but both twins met the lady together for the first time, and fell in love with her there and then. A managed to see her home and to gain her affection, though B went sometimes courting in his place, and neither the lady nor her parents could tell which was which.' I have also a German letter, written in quaint terms, about twin brothers who married sisters, but could not easily be distinguished by them.[2] In the well-known novel by Mr. Wilkie Collins of *Poor Miss Finch*, the blind girl distinguishes the twin she loves by the touch of his hand, which gives her a thrill that the touch of the other brother does not. Philosophers have not, I believe, as yet investigated the conditions of such thrills; but I have a case in which Miss Finch's test would have failed. Two persons, both friends of a certain twin lady, told me that she had frequently remarked to them that 'kissing her twin sister was not like kissing her other sisters, but like kissing herself—her own hand, for example.'

It would be an interesting experiment for twins who were closely alike, to try how far dogs could distinguish between them by scent.

I have a few anecdotes of strange mistakes made between twins in adult life. Thus, an officer writes: 'On one occasion when I returned from foreign service my father turned to me and said, "I thought you were in London," thinking I was my brother—yet he had not seen me for nearly four years—our resemblance was so great.'

The next and last anecdote I shall give is, perhaps, the most remarkable of those that I have: it was sent me by the brother of the twins, who were in middle life at the time of its occurrence: 'A was again coming home from India, on leave; the ship did not arrive for some days after it was due; the twin brother B had come up from his quarters to receive A, and their old mother was very nervous. One morning A rushed in, saying, "Oh, mother, how are you?" Her answer was, "No, B, it's a bad joke; you know how anxious I am!" and it was a little time before A could persuade her that he was the real man.'

Enough has been said to prove that an extremely close personal resemblance frequently exists between twins of the same sex; and that, although the resemblance usually diminishes as they grow into manhood and womanhood, some cases occur in which the resemblance is lessened in a hardly perceptible degree. It must be borne in mind that the divergence of development, when it occurs, need not be ascribed to the effect of different nurtures, but that it is quite possible that it may be due to the appearance of qualities inherited at birth, though dormant, like gout, in early life. To this I shall recur.

There is a curious feature in the character of the resemblance between twins, which has been alluded to by a few correspondents: it is well illustrated by the following quotations. A mother of twins says: 'There seemed to be a sort of interchangeable likeness in expression, that often gave to each the effect of being more like his brother than himself.' Again, two twin brothers, writing to me, after analysing their points of resemblance, which are close and numerous, and pointing out certain shades of difference, add: 'These seem to have marked us through life, though for a while, when we were first separated, the one to go to business, and the other to college, our respective characters were inverted; we both think that at that time we each ran into the character of the other. The proof of this consists in our own recollections, in our correspondence by letter, and in the views which we then took of matters in which we were interested.' In explanation of this apparent interchangeableness, we must recollect that no character is simple, and that in twins who strongly resemble each other every expression in the one may be matched by a corresponding expression in the other, but it does not follow that the same expression should be the dominant one in both cases. Now it is by their dominant expressions that we should distinguish between the twins; consequently when one twin has temporarily the expression which is the dominant one in his brother, he is apt to be mistaken for him. There are also cases where the development of the two twins is not strictly *pari passu*; they reach the same goal at the same time, but not by identical stages. Thus: A is born

[2] I take this opportunity of withdrawing an anecdote, happily of no great importance, published in *Men of Science*, p. 14, about a man personating his twin brother for a joke at supper, and not being discovered by his wife. It was told me on good authority; but I have reason to doubt the fact, as the story is not known to the son of one of the twins. However, the twins in question were extraordinarily alike, and I have many anecdotes about them sent me by the latter gentleman.

the larger, then B overtakes and surpasses A, and is in his turn overtaken by A, the end being that the twins become closely alike. This process would aid in giving an interchangeable likeness at certain periods of their growth, and is undoubtedly due to nature more frequently than to nurture.

Among my thirty-five detailed cases of close similarity, there are no less than seven in which both twins suffered from some special ailment or had some exceptional peculiarity. One twin writes that she and her sister 'have both the defect of not being able to come down stairs quickly, which, however, was not born with them, but came on at the age of twenty.' Another pair of twins have a slight congenital flexure of one of the joints of the little finger: it was inherited from a grandmother, but neither parents, nor brothers, nor sisters show the least trace of it. In another case, one was born ruptured, and the other became so at six months old. Two twins at the age of twenty-three were attacked by toothache, and the same tooth had to be extracted in each case. There are curious and close correspondences mentioned in the falling off of the hair. Two cases are mentioned of death from the same disease; one of which is very affecting. The outline of the story was that the twins were closely alike and singularly attached, and had identical tastes; they both obtained Government clerkships, and kept house together, when one sickened and died of Bright's disease, and the other also sickened of the same disease and died seven months later.

In no less than nine out of the thirty-five cases does it appear that both twins are apt to sicken at the same time. This implies so intimate a constitutional resemblance, that it is proper to give some quotations in evidence. Thus, the father of two twins says: 'Their general health is closely alike; whenever one of them has an illness, the other invariably has the same within a day or two, and they usually recover in the same order. Such has been the case with whooping-cough, chicken-pox, and measles; also with slight bilious attacks, which they have successively. Latterly, they had a feverish attack at the same time.' Another parent of twins says: 'If anything ails one of them, identical symptoms *nearly always* appear in the other: this has been singularly visible in two instances during the last two months. Thus, when in London, one fell ill with a violent attack of dysentery, and within twenty-four hours the other had precisely the same symptoms.' A medical man writes of twins with whom he is well acquainted: 'Whilst I knew them, for a period of two years, there was not the slightest tendency towards a difference in body or mind; external influences seemed powerless to produce any dissimilarity.' The mother of two other twins, after describing how they were ill simultaneously up to the age of fifteen, adds, that they shed their first milk teeth within a few hours of each other.

Trousseau has a very remarkable case (in the chapter on Asthma) in his important work *Clinique Médicale.* (In the edition of 1873, it is in vol. ii., p. 473.) It was quoted at length in the original French, in Mr. Darwin's *Variation under Domestication*, vol. ii. p. 252. The following is a translation:

'I attended twin brothers so extraordinarily alike, that it was impossible for me to tell which was which without seeing them side by side. But their physical likeness extended still deeper, for they had, so to speak, a yet more remarkable pathological resemblance. Thus, one of them, whom I saw at the Néothermes at Paris, suffering from rheumatic ophthalmia, said to me, "At this instant my brother must be having an ophthalmia like mine;" and, as I had exclaimed against such an assertion, he showed me a few days afterwards a letter just received by him from his brother, who was at that time at Vienna, and who expressed himself in these words: "I have my ophthalmia; you must be having yours." However singular this story may appear, the fact is none the less exact: it has not been told to me by others, but I have seen it myself; and I have seen other analogous cases in my practice. These twins were also asthmatic, and asthmatic to a frightful degree. Though born in Marseilles, they never were able to stay in that town, where their business affairs required them to go, without having an attack. Still more strange, it was sufficient for them to get away only as far as Toulon in order to be cured of the attack caught at Marseilles. They travelled continually, and in all countries, on business affairs, and they remarked that certain localities were extremely hurtful to them, and that in others they were free from all asthmatic symptoms.'

I do not like to pass over here a most dramatic tale in the *Psychologie Morbidè* of Dr. J. Moreau (de Tours), Médecin de l'Hospice de Bicêtre. Paris, 1859, p. 172. He speaks 'of two twin brothers who had been confined, on account of monomania, at Bicêtre. . . . Physically the two young men are so nearly alike that the one is easily mistaken for the other. Morally, their resemblance is no less complete, and is most remarkable in its details. Thus, their dominant ideas are absolutely the same. They both consider themselves subject to imaginary persecutions; the same enemies have sworn their destruction, and employ the same means to effect it. Both have hallucinations of hearing. They are both of them melancholy and morose; they never address a word to anybody, and will hardly answer the questions that others address to them. They always keep apart and never communicate with one another. An extremely curious fact which has been frequently noted by the superintendents of their section of the hospital, and by myself, is this: From time to time, at very irregular intervals of two, three, and many months, without appreciable cause, and by the purely spontaneous effect of their illness, a very marked change takes place in the condition of the two brothers. Both of them, at the same time, and often on the same day, rouse themselves from their habitual stupor and prostration; they make the same complaints, and they come of their own accord to the physician, with an urgent request to be liberated. I have seen this strange thing occur, even when they were some miles apart, the one being at Bicêtre and the other living at Saint-Anne.'

Dr. Moreau ranked as a very considerable medical authority, but I cannot wholly accept this strange story without fuller information. Dr. Moreau writes it in too off-hand a way to carry the conviction that he had investigated the circumstances with the sceptic spirit and scrupulous exactness which so strange a phenomenon would have required. If full and precise notes of the case exist, they certainly ought to be published at length. I sent a copy of this passage to the principal authorities among the physicians to the insane in England, asking if they had ever witnessed any similar case. In reply, I have received three noteworthy instances, but none to be compared in their exact parallelism with that just given. The details of these three cases are painful, and it is not necessary to my

general purpose that I should further allude to them.

There is another curious French case of insanity in twins, which was pointed out to me by Professor Paget, described by Dr. Baume in the *Annales Médico-Psychologiques*, 4 série, vol. i., 1863, p. 312, of which the following is an abstract. The original contains a few more details, but is too long to quote: François and Martin, fifty years of age, worked as railroad contractors between Quimper and Châteaulin. Martin had twice had slight attacks of insanity. On January 15 a box in which the twins deposited their savings was robbed. On the night of January 23-4 both François (who lodged at Quimper) and Martin (who lived with his wife and children at St. Lorette, two leagues from Quimper) had the same dream at the same hour, three A.M., and both awoke with a violent start, calling out, 'I have caught the thief! I have caught the thief! they are doing mischief to my brother!' They were both of them extremely agitated, and gave way to similar extravagances, dancing and leaping. Martin sprang on his grandchild, declaring that he was the thief, and would have strangled him if he had not been prevented: he then became steadily worse, complained of violent pains in his head, went out of doors on some excuse, and tried to drown himself in the River Steir, but was forcibly stopped by his son, who had watched and followed him. He was then taken to an asylum by gendarmes, where he died in three days. François, on his part, calmed down on the morning of the 24th, and employed the day in enquiring about the robbery. By a strange chance, he crossed his brother's path at the moment when the latter was struggling with the gendarmes; then he himself became maddened, giving way to extravagant gestures and making incoherent proposals (similar to those of his brother). He then asked to be bled, which was done, and afterwards, declaring himself to be better, went out on the pretext of executing some commission, but really to drown himself in the River Steir, which he actually did, at the very spot where Martin had attempted to do the same thing a few hours previously.

The next point which I shall mention, in illustration of the extremely close resemblance between certain twins, is the similarity in the association of their ideas. No less than eleven out of the thirty-five cases testify to this. They make the same remarks on the same occasion, begin singing the same song at the same moment, and so on; or one would commence a sentence, and the other would finish it. An observant friend graphically described to me the effect produced on her by two such twins whom she had met casually. She said: 'Their teeth grew alike, they spoke alike and together, and said the same things, and seemed just like one person.' One of the most curious anecdotes that I have received concerning this similarity of ideas was that one twin A, who happened to be at a town in Scotland, bought a set of champagne glasses which caught his attention, as a surprise for his brother B; while, at the same time, B, being in England, bought a similar set of precisely the same pattern as a surprise for A. Other anecdotes of a like kind have reached me about these twins.

The last point to which I shall allude regards the tastes and dispositions of the thirty-five pairs of twins. In sixteen cases—that is, in nearly one half of them—these were described as closely similar; in the remaining nineteen they were much alike, but subject to certain named differences. These differences belonged almost wholly to such groups of qualities as these: The one was the more vigorous, fearless, energetic; the other was gentle, clinging, and timid: or, again, the one was more ardent, the other more calm and gentle: or again, the one was the more independent, original, and self-contained; the other the more generous, hasty, and vivacious. In short, the difference was always that of intensity or energy in one or other of its protean forms: it did not extend more deeply into the structure of the characters. The more vivacious might be subdued by ill health, until he assumed the character of the other; or the latter might be raised by excellent health to that of the former. The difference is in the key-note, not in the melody.

It follows from what has been said concerning the similar dispositions of the twins, the similarity in the associations of their ideas, of their special ailments, and of their illnesses generally, that the resemblances are not superficial, but extremely intimate. I have only two cases altogether of a strong bodily resemblance being accompanied by mental diversity, and one case only of the converse kind. It must be remembered that the conditions which govern extreme likeness between twins are not the same as those between ordinary brothers and sisters (I may have hereafter to write further about this); and that it would be wholly incorrect to generalise from what has just been said about the twins, that mental and bodily likeness are invariably co-ordinate; such being by no means the case.

We are now in a position to understand that the phrase 'close similarity' is no exaggeration, and to realise the value of the evidence about to be adduced. Here are thirty-five cases of twins who were 'closely alike' in body and mind when they were young, and who have been reared exactly alike up to their early manhood and womanhood. Since then the conditions of their lives have changed; what change of conditions has produced the most variation?

It was with no little interest that I searched the records of the thirty-five cases for an answer; and they gave an answer that was not altogether direct, but it was very distinct, and not at all what I had expected. They showed me that in some cases the resemblance of body and mind had continued unaltered up to old age, notwithstanding very different conditions of life; and they showed in the other cases that the parents ascribed such dissimilarity as there was wholly, or almost wholly, to some form of illness. In four cases it was scarlet fever; in one case, typhus; in one, a slight effect was ascribed to a nervous fever: then I find effects from an Indian climate; from an illness (unnamed) of nine months' duration; from varicose veins; from a bad fracture of the leg, which prevented all active exercise afterwards; and there were three other cases of ill health. It will be sufficient to quote one of the returns; in this the father writes:

'At birth they were *exactly* alike, except that one was born with a bad varicose affection, the effect of which had been to prevent any violent exercise, such as dancing or running, and, as she has grown older, to make her more serious and thoughtful. Had it not been for this infirmity, I think the two would have been as exactly alike as it is possible for two women to be, both mentally and physically; even now they are constantly mistaken for one another.'

In only a very few cases is there some allusion to the dissimilarity being partly due to the combined action of many small influences, and in no case is it largely, much less wholly, ascribed to that cause. In

not a single instance have I met with a word about the growing dissimilarity being due to the action of the firm free will of one or both of the twins, which had triumphed over natural tendencies; and yet a large proportion of my correspondents happen to be clergymen whose bent of mind is opposed, as I feel assured from the tone of their letters, to a necessitarian view of life.

It has been remarked that a growing diversity between twins may be ascribed to the tardy development of naturally diverse qualities; but we have a right, upon the evidence I have received, to go further than this. We have seen that a few twins retain their close resemblance through life; in other words, instances do exist of thorough similarity of nature, and in these external circumstances do not create dissimilarity. Therefore, in those cases, where there is a growing diversity, and where no external cause can be assigned either by the twins themselves or by their family for it, we may feel sure that it must be chiefly or altogether due to a want of thorough similarity in their nature. Nay further, in some cases it is distinctly affirmed that the growing dissimilarity can be accounted for in no other way. We may therefore broadly conclude that the only circumstance, within the range of those by which persons of similar conditions of life are affected, capable of producing a marked effect on the character of adults, is illness or some accident which causes physical infirmity. The twins who closely resembled each other in childhood and early youth, and were reared under not very dissimilar conditions, either grow unlike through the development of natural characteristics which had lain dormant at first, or else they continue their lives, keeping time like two watches, hardly to be thrown out of accord except by some physical jar. Nature is far stronger than nurture within the limited range that I have been careful to assign to the latter.

The effect of illness, as shown by these replies, is great, and well deserves further consideration. It appears that the constitution of youth is not so elastic as we are apt to think, but that an attack, say of scarlet fever, leaves a permanent mark, easily to be measured by the present method of comparison. This recalls an impression made strongly on my mind several years ago by the sight of a few curves drawn by a mathematical friend. He took monthly measurements of the circumference of his children's heads during the first few years of their lives, and he laid down the successive measurements on the successive lines of a piece of ruled paper, by taking the edge of the paper as a base. He then joined the free ends of the lines, and so obtained a curve of growth. These curves had, on the whole, that regularity of sweep that might have been expected, but each of them showed occasional halts, like the landing places on a long flight of stairs. The development had been arrested by something, and was not made up for by after growth. Now, on the same piece of paper my friend had also registered the various infantine illnesses of the children, and corresponding to each illness was one of these halts. There remained no doubt in my mind that, if these illnesses had been warded off, the development of the children would have been increased by almost the precise amount lost in these halts. In other words, the disease had drawn largely upon the capital, and not only on the income, of their constitutions. I hope these remarks may induce some men of science to repeat similar experiments on their children of the future. They may compress two years of a child's

history on one side of a ruled half-sheet of foolscap paper if they cause each successive line to stand for a successive month, beginning from the birth of the child; and if they mark off the measurements by laying, not the 0-inch division of the tape against the edge of the pages, but, say, the 10-inch division—in order to economise space.

The steady and pitiless march of the hidden weaknesses in our constitutions, through illness to death, is painfully revealed by these histories of twins. We are too apt to look upon illness and death as capricious events, and there are some who ascribe them to the direct effect of supernatural interference, whereas the fact of the maladies of two twins being continually alike, shows that illness and death are necessary incidents in a regular sequence of constitutional changes, beginning at birth, upon which external circumstances have, on the whole, very small effect. In cases where the maladies of the twins are continually alike, the clock of life moves regularly on, governed by internal mechanism. When the hand approaches the hour mark, there is a sudden click, followed by a whirring of wheels; the moment that it touches it, the stroke falls. Necessitarians may derive new arguments from the life histories of twins.

We will now consider the converse side of our subject. Hitherto we have investigated cases where the similarity at first was close, but afterwards became less; now we will examine those in which there was great dissimilarity at first, and will see how far an identity of nurture in childhood and youth tended to assimilate them. As has been already mentioned, there is a large proportion of cases of sharply contrasted characteristics, both of body and mind, among twins. I have twenty such cases, given with much detail. It is a fact, that extreme dissimilarity, such as existed between Esau and Jacob, is a no less marked peculiarity in twins of the same sex, than extreme similarity. On this curious point, and on much else in the history of twins, I have many remarks to make, but this is not the place to make them.

The evidence given by the twenty cases above mentioned is absolutely accordant, so that the character of the whole may be exactly conveyed by two or three quotations. One parent says: 'They have had *exactly the same nurture* from their birth up to the present time; they are both perfectly healthy and strong, yet they are otherwise as dissimilar as two boys could be, physically, mentally, and in their emotional nature.' Here is another case: 'I can answer most decidedly that the twins have been perfectly dissimilar in character, habits, and likeness from the moment of their birth to the present time, though they were nursed by the same woman, went to school together, and were never separated till the age of fifteen.' Here again is one more, in which the father remarks: 'They were curiously different in body and mind from their birth.' The surviving twin (a senior wrangler of Cambridge) adds: 'A fact struck all our school contemporaries, that my brother and I were complementary, so to speak, in point of ability and disposition. He was contemplative, poetical, and literary to a remarkable degree, showing great power in that line. I was practical, mathematical, and linguistic. Between us we should have made a very decent sort of a man.' I could quote others just as strong as these, while I have not a single case in which my correspondents speak of originally dissimilar characters having become assimilated through identity of nurture. The impression that all this evidence leaves on the mind is one

of some wonder whether nurture can do anything at all beyond giving instruction and professional training. It emphatically corroborates and goes far beyond the conclusions to which we had already been driven by the cases of similarity. In these, the causes of divergence began to act about the period of adult life, when the characters had become somewhat fixed; but here the causes conducive to assimilation began to act from the earliest moment of the existence of the twins, when the disposition was most pliant, and they were continuous until the period of adult life. There is no escape from the conclusion that nature prevails enormously over nurture when the differences of nurture do not exceed what is commonly to be found among persons of the same rank of society and in the same country. My only fear is that my evidence seems to prove too much and may be discredited on that account, as it seems contrary to all experience that nurture should go for so little. But experience is often fallacious in ascribing great effects to trifling circumstances. Many a person has amused himself with throwing bits of stick into a tiny brook and watching their progress; how they are arrested, first by one chance obstacle, then by another; and again, how their onward course is facilitated by a combination of circumstances. He might ascribe much importance to each of these events, and think how largely the destiny of the stick had been governed by a series of trifling accidents. Nevertheless all the sticks succeed in passing down the current, and they travel, in the long run, at nearly the same rate. So it is with life in respect to the several accidents which seem to have had a great effect upon our careers. The one element, which varies in different individuals, but is constant in each of them, is the natural tendency; it corresponds to the current in the stream, and inevitably asserts itself. More might be added on this matter, and much might be said in qualification of the broad conclusions to which we have arrived, as to the points in which education appears to create the most permanent effect; how far by training the intellect, and how far by subjecting the boy to a higher or lower tone of public opinion; but this is foreign to my immediate object. The latter has been to show broadly, and, I trust, convincingly, that statistical estimation of natural gifts by a comparison of successes in life, is not open to the objection stated at the beginning of this memoir. We have only to take reasonable care in selecting our statistics, and then we may safely ignore the many small differences in nurture which are sure to have characterised each individual case.

THE VENTILATION OF HOSPITALS.[1]

THE subject of public and private hygiene is being daily more and more studied by medical and scientific men, and the general public also is gradually learning that here are to be found the means of preventing the fearful epidemics which in every country have devastated the world, and the many diseases which crowd our hospitals with sufferers. So much is this the case that the Council of King's College determined that henceforth hygiene, public health, and sanitary science should be duly honoured within its walls, and founded a Professorship of Hygiene. The first course of lectures was delivered by Dr. Guy, the first Professor, in 1870, and has since been published in a volume under the title of *Public Health.* It gives a history of the prevalent and fatal diseases of the English population from the earliest times to 1815, and is not only most interesting, but also enables us from experience of the past to derive the most valuable instruction for the future.

The study of this, and the numerous other publications on this subject, distinctly teaches us that, while much blame attaches to medical men for an obstinate persistence in antiquated measures and remedies, which were in many cases more injurious than the epidemics themselves, the citizens generally are still more to blame for neglecting such precautions as the most ordinary common sense would seem to dictate. All sanitary work and responsibility should not be thrown on to physicians alone; for, after all, the actual duty of the medical and surgical profession is merely to take things as it finds them, and study faithfully how to cure the sick. If it does more than that, it is a volunteer labour for humanity, for which we should be duly grateful. This does not, however, diminish the duty of all good citizens of seeing that no blame of ignorance or neglect of the plain laws of health rests on themselves. Such laws are those of cleanliness, prudence in diet, attention to clothing, exercise, ventilation, and general habits of living. The physicians will gladly furnish every facility for studying these laws by lectures, publications, and private advice; and will not grudge any consequent success resulting in good health, even though it should drive them into other professions for a living or empty the wards of the hospitals. There is no danger of any such Utopia being reached immediately. Dr. Guy well explains this as follows (p. 8):

> If the physician takes cognisance of prevention, it is only to advise the patient and his household what precautions they should adopt; but the case of the officer of health extends to the whole district or community threatened by the disease. . . . In a word, while cure or palliation is the aim of medicine, prevention is the object of hygiene; while the one studies the good of the unit, the other looks to the welfare of the mass.

Therefore it behoves the mass to know in what their welfare consists, and see that the elements of it are not lacking.

Dr. Wilson's *Handbook of Hy-*

[1] *Public Health.* By Wm. A. Guy, M.A., M.D. London, 1874.
Hospitalism and the Causes of Death after Operations. By John Eric Erichsen, F.R.C.S. London, 1874.
A Handbook of Hygiene. By Geo. Wilson, M.D. London, 1873.
Handbook for Hospital Sisters. By Florence S. Lees. London, 1874.
Illustrations of the Theory and Practice of Ventilation. By B. D. Reid. London, 1874.
Health and Comfort in House Building. By John Drysdale, M.D., and J. W. Hayward, M.D. London, 1872.