Resemblance of First Cousins

UNIVERSITY OF LONDON
FRANCIS GALTON LABORATORY FOR NATIONAL EUGENICS

EUGENICS LABORATORY MEMOIRS. IV.

ON THE MEASURE OF THE RESEMBLANCE OF FIRST COUSINS

BY

ETHEL M. ELDERTON,
GALTON RESEARCH SCHOLAR IN NATIONAL EUGENICS,
UNIVERSITY OF LONDON

ASSISTED BY

KARL PEARSON, F.R.S.

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University of London, University College, Gower Street, W.C.

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Some reconstruction of the Francis Galton Laboratory having taken place, it seemed desirable to provide the workers associated with it with a direct channel of publication of their own, in which their more extended memoirs should appear. It is hoped that the present series may be issued at short intervals. Subscribers should notify their intention of taking in the memoirs as they are published to Messrs Dulau & Co. Requests to exchange with similar publications, with archives and journals dealing with demographic and sociological problems, or with census reports, should be directed to The Editor, Eugenics Laboratory, University College, Gower Street, London, W.C.

On a Measure of the Resemblance of First Cousins in Man.

By Ethel M. Elderton, Galton Research Scholar in National Eugenics in the University of London; assisted by Karl Pearson, F.R.S.

1. *Introductory.* While a very large amount of data has been collected, reduced and published relating to the degree of resemblance in physical and psychical characters of a considerable number of pairs of relatives in man—especially in the direct line and between collaterals of the first degree—but little has yet been done with regard to collaterals in higher degrees. As far as we are aware the only quantitative measures yet determined are those for eye colour in man between uncle or aunt and nephew or niece*. No measure of resemblance has yet been determined for cousins. Yet it is precisely among collaterals of the second degree that the question of consanguineous marriages becomes in practical life of great importance, inequality of age being here less marked, and thus the degree of resemblance between such collaterals has not only scientific but eugenic value. According to local law and religious custom cousin marriages are permitted or forbidden; thus it would appear that we are here concerned with divergent human experiences, unconsciously formulated, as to the relative value of endogamy and exogamy. If we take a character which is detrimental to the individual, it will, at least in primitive communities, be in the bulk of cases a hindrance to mating. Hence, as a rule, we must classify such a detrimental character as recessive in the Mendelian sense†, otherwise selection would have weeded it out. Now consider for a moment a population of dominants with notation DD, and suppose one of these to mate with an individual of detrimental attribute and constitution RR. The result will be the hybrid sibship marked by DR, in which the recessive character R will be latent. If brother-sister mating is forbidden the next generation will be obtained (assuming the recessive individuals RR to be extremely rare) by mating with the population of dominant character, and the result will be equal numbers of DD and DR. Thus the generation of cousins would consist of 50 p. c. of dominants and 50 p. c. apparent dominants with the detrimental character recessive. It therefore follows that it would be as detrimental for *some* cousins to marry as for *all* brothers and sisters of the first hybrid sibship. That is to

* Pearson and Lee: *Phil. Trans.* Vol. 195, A, p. 114 *et seq.*

† Thus albinism and the tuberculous diathesis are, if not true and complete recessives in the Mendelian sense, still more nearly recessive than dominant characteristics. But there are other abnormalities, e.g. certain digital deformations, which are nearer to, if perhaps not true, dominants.

say while a brother and sister marriage would lead to 25 p. c. of the offspring having the harmful character patent and another 50 p. c. having it latent, the intermarriage of the cousins of the *DR* class among themselves would lead to the same baneful results as this brother-sister marriage, while the intermarriage of the *DR* class of cousin with the *DD* would also lead to 50 p. c. with the latent detrimental character. In other words endogamy as far as brothers and sisters are concerned would lead to:

25 p. c. hale. 50 p. c. latent evil. 25 p. c. patent evil.

while endogamy in the cousinship would give us:

56·25 p. c. hale. 37·5 p. c. latent evil. 6·25 p. c. patent evil.

The explanation therefore of the wide-spread social feeling against endogamy in the first degree, even between apparently hale individuals, is on the surface of it explicable on the Mendelian theory; also we see that, whether we look upon cousin marriage as producing on the average more than six per cent. of patent evil, or in the other aspect, that *some* cousin marriages are as detrimental as brother-sister marriages, reasons can be found for their all being forbidden by tribal custom or religious ordinance. But this is after all only to look on one side of the picture, because the *RR* characteristic might be a patent good quality suddenly introduced from outside into a population: in such a case cousin marriage is distinctly to be commended, and brother-sister marriage would be more effectual still. In this way the endogamy of many early communities receives its due sanction. As long as a species is likely to vary advantageously, endogamy between collaterals of the first degree will produce 75 p. c. with patent or latent good quality, and between collaterals of the second degree 62·5 p. c.*: even endogamy of ascendants and descendants may be advantageous. It is probable that whenever selection is extremely stringent the relative advantages of endogamy become apparent and are emphasised by tribal custom. But the Mendelian theory cannot be considered as demonstrated, and if it were, we could hardly at present apply it to man. We have no means of separating the *DR*'s from the *DD*'s, short of that experimental breeding which the Mendelians tell us is the only reliable guide to the gametic constitution. We cannot, however, afford to bring defective children into the world to test where the endogamous union will be an advantage, where a failure. The somatic characters of the individual and of his or her ancestry are at present our sole possible guide to his or her gametic constitution. From this standpoint we may ask what is the quantitative value of the cousin in the problem of inheritance? In predicting the probable offspring of an individual is the cousinship of more or less importance than the parents' brothers and sisters? Is a knowledge of the grandparents' characters of greater value than that of the cousin? It will be clear that the cousinship while generally less accessible than the sibship, is often far more accessible than the grandparentage, or in the case of orphans than even the parentage; and for the special purpose of medical diagnosis

* This supposes that endogamy in the first degree is forbidden.

may be of great relevance. The existing state of doubt as to the quantitative value of cousinship may be illustrated from such a vital problem as that of the hereditary predisposition to mental disease where some medical authorities would exclude entirely evidence drawn from the cousinship*, while they retain the inquiry as to the direct line and as to collaterals in the first degree. As the cousinship often combines many lines, it requires of course careful handling, but its size and relative accessibility may be factors which give it equal importance with the grandparentage or the parental sibships.

2. With the object of throwing light on the value of the record of cousinship, an inquiry as to the physical and psychological resemblance of first cousins was set on foot by Karl Pearson some five years ago and a grant obtained from the Government Grant Committee to assist the investigation. The assistance derived from this source is here gratefully acknowledged. The plan followed was twofold. Two independent collections were started. The first part of the investigation was based upon very general inquiries as to the physical and psychical characteristics of families. At present about 300 families have supplied very full particulars of ancestors and collaterals as far as the personal knowledge of the recorders extend. These Family Records supply the material upon which the bulk of the present paper is based, and provide sufficient pairs of cousins to give a fair idea of the general intensity of resemblance in cousins. The family schedules asked for the following information:

(1) Present Age or Age at Death of each individual.

(2) Ailments in Life.

(3) Cause of Death, if dead.

(4) General Health under the Categories: *Very Robust*, *Robust*, *Normally Healthy*, *Delicate*, and *Very Delicate*.

(5) Ability under the categories:

A.—*Mentally Defective.*—Capable of holding in the mind only the simplest facts, and incapable of perceiving or reasoning about the relationship between facts.

B.—*Slow Dull.*—Capable of perceiving relationship between facts in some few fields with long and continuous effort; but not generally or without much assistance.

C.—*Slow.*—Very slow in thought generally, but with time understanding is reached.

D.—*Slow Intelligent.*—Slow generally, although possibly more rapid in certain fields; quite sure of knowledge when once acquired.

E.—*Fairly Intelligent.*—Ready to grasp, and capable of perceiving facts in most fields; capable of understanding without much effort.

* Bucknill and Tuke: *Psychological Medicine*, 2nd edn. p. 266.

E_2.—*Distinctly Capable.*—A mind quick in perception and in reasoning rightly about the perceived.

F.—*Very Able.*—Quite exceptionally able intellectually, as evidenced either by the person's career or by consensus of opinion of acquaintances.

During a part of the investigation E_1 and E_2 were classed together as E, but a large number of D, E and E, F entries (i.e. 'Betwixt' entries) occurring, this category of E was divided as above into E_1 and E_2.

(6) Temper under the categories: *Sullen Temper, Quick Temper, Even Temper, Weak Temper* (not 'even,' but weak good nature).

(7) Temperament—under three divisions (*a*) *Reserved, Expressive* or *Betwixt*; (*b*) *Sympathetic, Callous* or *Betwixt*; (*c*) *Excitable, Calm* or *Betwixt*.

(8) Success in Life under the categories: *Marked Success*: An individual who is not only marked above his family, but above his fellow citizens for achievement in life. One who has made a name which would find a place in the *Dictionary of National Biography*. *Prosperous Career*: An individual who has advanced beyond his family level but not necessarily marked among his fellow men. An active successful life or career. *Average Career*: An individual who has not fallen below the family standard of life, whether in profession, trade or craft. *Difficult Career*: An individual who has found it difficult to maintain the previous family standard. One who has had a struggling and unprosperous career. *Failure*: An individual who has more or less failed in life; a bankrupt, or ne'er-do-well; this letter (F.) may be used to cover the black sheep of a family.

Considerable care was taken in distributing the schedules* among those likely to be interested in the investigation and having a sense of responsibility for the frankness and fullness of the information provided. A considerable number of schedules were returned to the recorders for corrections or additions which were at once supplied. In less than two per cent. of cases was it needful to reject a schedule as untrustworthy, or so incomplete as to be useless. Each Family Record contains on the average particulars of about 40 individuals and, as it is hoped to raise the total number of records from the present 300 to 1000, we shall then possess an account of a fairly random sample of the general population of about 40,000 persons.

3. The various types of cousinship distinguished in the schedules are: (*A*) Cousins are sons of two brothers. (*B*) Cousins are sons of two sisters. (*C*) Cousins are sons of a brother and a sister. (*D*) Cousins are daughters of two brothers. (*E*) Cousins are daughters of two sisters. (*F*) Cousins are daughters of a brother and sister. (*G*) Cousins are son and daughter of two brothers. (*H*) Cousins are son and daughter of two sisters. (*I*) One cousin is daughter of a brother, the other is son of a sister. (*K*) One cousin is daughter of a sister, the other is son of a brother.

* They provided for information with regard to four generations in the direct line, and three generations of collaterals.

A, *B* and *C* are types of male, *D*, *E* and *F* are types of female, *G*, *H*, *I*, *K* of male and female cousins. There are thus ten types of simple first cousins. It was considered desirable to keep these ten types distinct in order to ascertain how far resemblance was modified by change of sex in descent from a common ancestor. Special cases of abnormal cousinship in the first degree were not included. All individuals dealt with were adults. The four characteristics: General Health, Ability, Temper and Success in Life, providing 5, 7, 4 and 5 categories, admitted at once of tables of contingency being formed of at least 4×4 groups, and these were at once reduced by the method of mean square contingency. This was done for all the ten types of cousinship. In the case of Temperament there were only the alternatives and the 'Betwixt' groups. We were thus compelled to use either contingency on a 3×3-fold grouping or else assume the material to have a Gaussian distribution and apply fourfold table divisions. In the latter case the results will vary somewhat according to the alternative with which the 'Betwixt' group is associated.

The *Temperament* results are, however, in our opinion the least reliable of the series. We believe this to be due to the fact that the ability, success, health and to some extent the temper of an individual are matters of common knowledge or repute; but that temperament as we have classified it is less generally realised. There is little doubt that some of the recorders had not previously formed a general estimate of temperament, and have taken that of a particular individual as a standard to classify other members of the family by. We should not be inclined accordingly to place much stress on the Temperament results as proving anything beyond the basal principle that temperament is an inherited character.

In the second series of investigations, it was considered that it would not be without interest to deal with an entirely novel physical character, i.e. novel from the standpoint of inheritance, and accordingly the hand was selected as easily accessible and, at any rate for some characters*, capable of fairly accurate measurement. Other physical characters readily ascertainable were eye and hair colours and general health. Accordingly a cousin schedule was issued with the directions for measurement noted below. See Appendix A, p. 21. Much time and energy had already been spent over an endeavour to reproduce in a cheap manner the eye and hair scales used as standards in the Biometric Laboratory. Ultimately we had to content ourselves with an admittedly imperfect chromolithograph of hair colours†. For the eye scale we used a hand-painted scale. Miss Mary Beeton kindly painted on a printed blank the irides of 24 eyes, painting one eye at a time in about 100 copies from a standard glass eye. To these scales was added a cheap but quite efficient hand-spanner prepared by the Cambridge Scientific Instrument Company. The scales, spanners, directions and schedules were circulated in the same manner as the similar material

* *R. S. Proc.* Vol. 65, pp. 126—151: "Data for the Problem of Evolution in Man. A First Study of the Human Hand." By M. A. Whiteley and Karl Pearson.

† Reproduced *Biometrika*, Vol. v. p. 474.

for the Family Measurements of six years ago*: they were loaned to College students, personal friends of members of the Biometric Laboratory and others. It was, however, soon obvious that we had miscalculated the ease with which pairs of cousins could be found and measured. The work went forward extremely slowly, most investigators sent in only two or three pairs; and when the question of repeating or verifying a measurement arose, the delay or even the impossibility of supplementing the data was much more common than in the case of the Family Records. In fact cousins are not like brothers and sisters, or parents and offspring, in daily touch with each other; and at the end of three or four years, we are far from having reached a sufficient supply of cousin pairs. Hardly indeed have 300 pairs been yet measured. Accordingly this side of the enquiry is incomplete and will only be used as a control series. We need scarcely say that we shall be very glad indeed to loan spanner and scales to any reader of this memoir who will undertake to measure pairs of adult cousins.

4. We now turn to the analytical methods by which the material was reduced. We have already pointed out that contingency was used throughout the whole of the first series, but that in the case of Temperament the 3×3-fold tables were not finely enough grouped to make contingency thus obtained really comparable with that found from higher-fold tables. Accordingly the temperament tables were only worked out by 3×3-fold contingency in the case of the three groups: male cousin pairs, female cousin pairs, and male and female cousin pairs. The fourfold table method† was used on the same material in thirty cases, namely the three classes of temperament in the ten classes of cousins.

The mean value of the degree of resemblance between cousins as found from 40 contingency tables was $\cdot 271 \pm \cdot 009$ with a standard deviation of $\cdot 083 \pm \cdot 006$. The mean value of the degree of resemblance in temperament as found from 30 tables by fourfold process was $\cdot 258 \pm \cdot 014$, but the variability in this case was 35 p. c. greater, the standard deviation being $\cdot 115 \pm \cdot 010$.

The temperament tables worked by contingency with three types of cousins gave the result $\cdot 238 \pm \cdot 010$, with the reduced variability indicated by $\cdot 045 \pm \cdot 007$. These results are collected in Table I. They suffice to show that mean square contingency methods give more uniform results than the fourfold tables‡. But the mean found from contingency for *Health, Ability, Temper* and *Success* does not sensibly differ from that found for the three divisions of temperament by fourfold tables leading to the coefficient of correlation. If we combine the results of both methods so as to

* Directions and form of schedule for this case are reproduced in *Biometrika*, Vol. II. pp. 359–60.

† The fourfold tables were worked for two groupings for the alternatives *Excitable or Calm*; the *Betwixts* being thrown first into one group and then into the other, the average value of the correlation coefficient is that given in Table III. In the case of the alternatives *Reserved* and *Expressive* the *Betwixts* were thrown into the *Reserved*, and in that of the alternatives *Sympathetic* and *Callous* into the latter group. This was done after some consideration and enquiry as to the popular weight of terming an individual 'reserved' or 'callous.'

‡ The corresponding nine fourfold tables were somewhat erratic and gave a mean of only ·19.

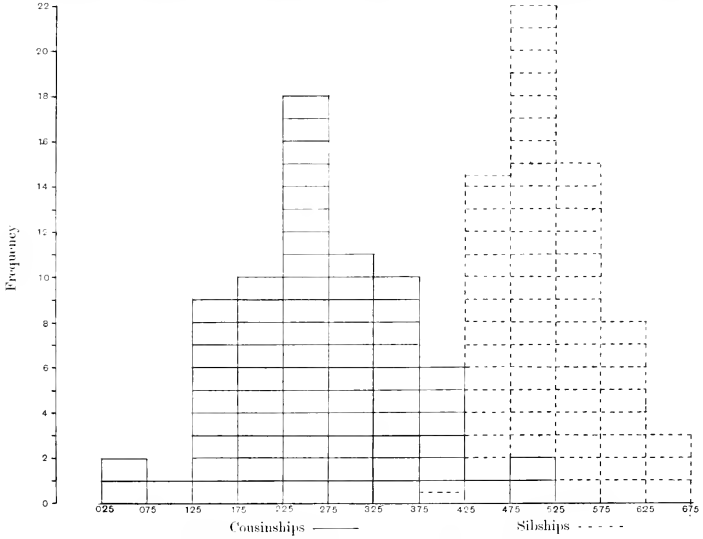
obtain a general average degree of resemblance between the ten types of cousins for seven characters, we find for the whole seventy tables:

Mean value ·267 ± ·008. Standard Deviation = ·093 ± ·006. Accordingly we may conclude that the average degree of resemblance of cousins lies between ·25 and ·30, say at ·27.

TABLE I. *Mean Results by Different Methods.*

Characters	Method	No. of Cases	Mean	Standard Deviation
Three Phases of Temperament	Fourfold Division	30	·258 ± ·014	·115 ± ·010
Ditto	Mean Square Contingency 3 × 3-fold Table	9	·238 ± ·010	·045 ± ·070
Health Ability Temper Success	Mean Square Contingency 4 × 4-fold and higher-fold Tables	40	·271 ± ·009	·083 ± ·006
Whole Series	Contingency	40	·267* ± ·008	·093 ± ·005
	Fourfold Division	30		

Diagram of Frequency of Coefficients of Resemblance in Cousins and Brethren.



* Mean from grouped values; ungrouped value = ·265.

The fluctuation is no doubt considerable in our results. But we think that it lies far more in the difficulty of estimating psychical characters, than in any real variation in the degree of resemblance. The fluctuation is greatest precisely in those characters where personal bias and sex bias make the judgment more difficult.

We are now in a position to compare the intensity of resemblance between cousins with that between brethren. Diagram I, p. 9, shows graphically the distribution of the degree of resemblance of the 70 cases of cousins in this first series and of 65 cases of brethren, physical and psychical. The cases were numerically distributed as follows:

TABLE II.

	·025—·075	·075—·125	·125—·175	·175—·225	·225—·275	·275—·325	·325—·375	·375—·425	·425—·475	·475—·525	·525—·575	·575—·625	·625—·675	Totals
Cousinship	2	1	9	10	18	11	10	6	1	2	—	—	—	70
Sibship	—	—	—	—	—	—	2	5	14·5	22	15	8	3	65

Mean Cousinship: ·27 ± ·008. Standard Deviation: ·093 ± ·005.
Mean Sibship: ·51 ± ·006. Standard Deviation: ·068 ± ·004.

An examination of the graph shows that the cousinship group clusters at ·25 and the sibship group at ·5. These may, we think, safely be taken as working values for cousinship and sibship resemblance for either sex, and we may safely assert that brethren are on the average twice as closely related as cousins. This halving of the degree of resemblance corresponding to the fact that normal first cousins have two common grandparents, whole sibs have four.

It must be noted: (*a*) that our data for cousins are not drawn from the same records as those for brothers and sisters. While the Family Records here used for cousins enable us also to deal with brothers, these have not yet been tabled and reduced, except in the one instance of *Intelligence*. Here the adult brothers gave ·54 as against the average of three cases of adult male cousins giving ·34. Schuster found ·56 from adult Oxford graduates for ability. Pearson found ·52 for brothers at school and Schuster for schoolboys ·56. The half of these fraternal values would be ·27, which agrees well with the general cousin average, but not so well with the ·34 which is a definitely higher value.

(*b*) that our data for cousins and sibs are neither from the same records, nor for the same range of characters. In the case of the sibships 21 values were for definitely measurable characters, a much more reliable class of material; while the cousinships of the first series do not present a single measurable character, and only one definitely physical estimate, that of Health. The characters which are common to

both series are: Health, Ability and Temper in adult cousins, and in sibships of school children; the following table gives the results for three classes:

TABLE II A.

Type	Intelligence		Health		Temper	
	Cousinship	Sibship	Cousinship	Sibship	Cousinship	Sibship
Male and Male	·34	·46	·31	·52	·18	·51
Female and Female	·34	·47	·33	·51	·19	·49
Male and Female	·34	·44	·30	·57	·25	·51
Mean	·34	·46	·31	·53	·20	·50

Mean Cousinship ·28. Half Mean Sibship ·25.

Treated alone these cases would show a definitely larger degree of resemblance for the cousinship, than for half the sibship, but this is not borne out for the whole material. The differences also of the ages of the subjects, adults and school children, and the methods of recording, by relatives and by school teachers, must also be borne in mind.

We consider on the basis of this first series that ·25 is a good round working number for the cousinship. This denotes on the assumptions of linear regression and the equal variability of the cousins, that *two* cousins of an individual selected from unrelated stocks (i.e. maternal and paternal cousins) will give the same probable value for the character of an individual, as a brother of that individual with the same character as the mean of the cousins*. On the other hand the accuracy of the estimate will not be so great. In the first case it is $\sigma_1\sqrt{1-(\cdot5)^2}$ and in the second case $\sigma_1\sqrt{1-(\cdot25)^2-(\cdot25)^2}$, which measures the variability of the array; these are as 8·66 to 9·35. Thus the prediction from the brother would be somewhat better than from two mutually unrelated cousins. It is clear, however, that a knowledge of two such cousins may be very useful indeed, especially if facts as to the sibship are not forthcoming.

If we turn to other collateral relationships, the avuncular worked out for the eight possible cases in eye colour†, is, as far as we know, the only one yet published. The mean value of the eight cases is ·265. We should accordingly conclude from this that for purposes of inheritance a knowledge of the cousin is equally important with a knowledge of the parental sibships. For example, there is no justification in medical histories of lunacy for including the facts as to the parents' brothers and sisters and

* Regression equation for 1 on 2 and 3, the latter being independent, is

$$h_1=\frac{r_{12}\sigma_1}{\sigma_2}h_2+\frac{r_{13}\sigma_1}{\sigma_3}h_3=r_{12}h_2+r_{13}h_3,\ \text{if}\ \sigma_1=\sigma_2=\sigma_3,\ =\cdot50\sim\tfrac{1}{2}(h_1+h_2),\ \text{if}\ r_{12}=r_{13}=\cdot25.$$

† *Phil. Trans.* Vol. 195, A, p. 114.

omitting the cousins from the record. On the same ground the marriage of niece or nephew with uncle or aunt seems to be a marriage of exactly the same degree of kinship as a marriage between first cousins.

The only grandparental data at present reduced for man* are those for eye-colour and the eight cases give a mean value of ·32†. This is somewhat higher than the value (·27) for cousins, and pigmentation data in horses have given an almost equal value. Still other species show rather smaller intensity, and until further data are reduced for the case of man, especially for psychical characters, we are not convinced that the grandparental relationship is definitely more important than the cousinship. At any rate, even with our present values (·27 as against ·32) it will be seen that it is not reasonable for the purposes of medical or actuarial diagnosis to neglect the cousins, and make a considerable point as to the grandparental constitution. The grandparent, the uncle or aunt and the cousin are practically on the same footing with regard to relationship or intensity of kinship as measured by degree of likeness of character; and it seems probable that any scientific marriage enactments would equally allow or equally forbid marriage between grandparent and grandchild, uncle and niece, aunt and nephew and between first cousins. This conclusion is reached on the assumption that the undesirability of marriage depends on the closeness of likeness in the gametic constitution, and that on the average the resemblance of the somatic characters may be taken as a measure of the average gametic resemblance between any two classes.

5. We now turn to the details of Table III.

We first ask whether there is any sensible difference between the intensity of inheritance in males and females. We note that the probable error of any individual result runs from about ·02 for cousins of same sex to ·03 for cousins of different sexes. Our table shows us that the average for pairs of male cousins is the same as that for pairs of female cousins, i.e. ·26. If we could lay any stress on the difference ·02, we should assert that cousins of different sexes were more alike than cousins of the same sex. But we certainly cannot, and thus, as far as our data go, we can only conclude that difference of sex makes no difference in degree of likeness.

In the next place we may consider whether type of cousinship makes any difference in the intensity of resemblance. Our mean values for all the characters range from ·22 to ·31 according to the type, and it might be thought that this offered sufficient range to answer the question. As defining the types there are two considerations to be noted, (i) a difference of sex in either generation, parental or cousinal, and (ii) a change of sex in descent. Neglecting the first we have:

No change of sex in descent in: *A* (·30), *E* (·27) or *K* (·29);
One change of sex in descent in: *C* (·23), *F* (·28), *G* (·24) or *H* (·31);
Two changes of sex in descent in: *B* (·24), *D* (·22), or *I* (·29).

* The Family Records of the present series provide unreduced material for seven characters, and this will shortly be dealt with.

† *Phil. Trans.* Vol. 195, A, p. 115.

The means for the three groups are ·287, ·265 and ·250 respectively. It may possibly be therefore that change of sex slightly weakens the intensity of inheritance in the stock. If we turn to the first consideration the change of sex in the same generation, the connected parents are of the same sex and the cousins of the same sex in *A* and *E*, but in *K* the connected parents are of different sexes and the cousins of different sexes. *K* is not, however, the least of the three. In *C* and *F* there is a

TABLE III. *General Results of First Series. Characters of Cousins.*

Type of Cousins		Health	Intelligence	Success	Temper	Temperament						Means
						Reserved or Expressive		Sympathetic or Callous		Excitable or Calm		
Method →		M.S.C.	M. S. C.	M.S.C.	M.S.C.	F. T.	M.S.C.	F. T.	M.S.C.	F. T.	M.S.C.	
Male.	Type A	·34	·41	·24	·23	·38		·31		·21		·30
,,	,, B	·32	·30	·15	·16	·06	(·20)	·36	(·24)	·36	(·34)	·24
,,	,, C	·26	·32	·19	·15	·23		·30		·17		·23
	Mean	·31	·34	·19	·18	·22	(·20)	·32	(·24)	·25	(·34)	·26
Female.	Type D	·51	·34	·16	·14	·21		·03		·15		·22
,,	,, E	·24	·38	·27	·24	·30	(·19)	·42	(·20)	·04	(·22)	·27
,,	,, F	·23	·31	·35	·18	·26		·37		·23		·28
	Mean	·33	·34	·26	·19	·26	(·19)	·27	(·20)	·14	(·22)	·26
Male & Female.	Type G	·23	·36	·19	·20	·23		·22		·24		·24
,, ,,	,, H	·32	·27	·33	·30	·28	(·24)	·52	(·24)	·14	(·28)	·31
,, ,,	,, I	·29	·38	·27	·24	·22		·44		·16		·29
,, ,,	,, K	·37	·34	·26	·25	·42		·19		·18		·29
	Mean	·30	·34	·26	·25	·29	(·24)	·34	(·24)	·18	(·28)	·28
General Means		·31	·34	·24	·21	·26	(·21)	·32	(·23)	·19	(·28)	·265

M. S. C. = Mean Square Contingency. F. T. = Fourfold Table.

difference of sex in the connecting parents, but not in cousins; in *G* and *H*, there is no difference in the connecting parents but one in the cousins. We might therefore expect no difference in the four values. But we find *C* and *G* contrasted in magnitude with *F* and *H*. In other words two males related by a male and female go with a male and female related by two males; and again two females related by a male and female go with a male and female related by two females. We can throw no light on this point, and it may only be a strange result of random sampling. In the third group there are no sex differences in the types *B* and *D* for either parental or cousinal generations.

For I there are such changes for both generations; and yet I is larger than B and D. We must thus consider that a difference of sex in the same generation makes no difference in the intensity of resemblance so far as our present data go. Accordingly, if change of sex in descent does to some extent weaken inheritance*, it does not appear connected with sex differences in the *same* generation. The differences noted are, however, too slender and the whole system of values too fluctuating to build up any hypothesis as to sex influence in heredity.

If we now turn to the separate characters, and compare irrespective of cousin type the general means of each, we find an even wider range of results (·19 to ·34). We attribute this only in part to real differences in the intensity of resemblance; we consider it more due to (*a*) difficulties of estimating some of the characters dealt with, especially as in the case of cousins they are usually not in daily contact with each other; (*b*) differences of method employed, and the assumption that temperament follows a normal distribution of frequency.

Accordingly we shall draw no conclusions as to divergences in resemblance, believing our data may be relied upon to give a "general average resemblance" of cousins, but cannot be pressed beyond such a result to discriminate between individual classes of character.

6. We now turn to the results of the second series of quantitative measurements. These measurements as we have already noted are far from complete. They give for the four measurements 107 pairs of female cousins, 34 pairs of male cousins, and 111 pairs of male and female cousins, the two first sets giving 214 and 68 pairs in the symmetrical table.

The following table gives the statistical constants of the series of measurements. It will be observed that we have two series for each sex, but not all the individuals in each series are different.

This table shows at once considerable irregularities, which may be due to the paucity of data, or to the defective handling of the spanners. While the finger joint measurements give a sex-ratio for the absolute lengths = ·91, very nearly the usual 11/12 of stature and of bone measurements in man, the widths of hand and wrist (involving a good deal more care in determination and allowing of more personal equation) give ratios of about 11·5/12. For these also the man is both absolutely and relatively more variable than the woman. For the joint measurements the woman is equally variable absolutely with the man, and relatively more variable. It seems improbable that this equal absolute variability is correct. It is not true for the majority of bone measurements in man and woman. It is further to be noted that in the Male and Female Cousins series, where there was a much larger return of measure-

* The influence of change of sex has been very elusive; it would appear to have some bearing on the inheritance of eye-colour in man (*Biometrika*, Vol. II. pp. 237–40), but we have failed to find it in coat-colour in horses (*Ibid.* Vol. II. pp. 229–34). It is doubtfully significant in the cases of coat-colour of Greyhounds (*Ibid.* Vol. III. pp. 257–8), and of Shorthorns (*Ibid.* Vol. IV. pp. 449–51).

ments made by male students than in the case of the Female and Female Cousins series, the absolute variabilities of the women are in every case *less* than in the latter series. In a certain number of cases it was actually found that the user of the hand-spanner had read from the sliding edge and not from the index point, but the difference amounting to about 20 mm. was obvious on the face of the measurements and at once allowed for by measuring the particular hand-spanner which had been used. It is believed that no residual error has crept in in this manner, but the point will be again dealt with below.

TABLE IV. *Statistical Constants of Measurements of Hand in Man and Woman.*

Sex	Series	Width of Hand			Width of Wrist			Joint, Index Finger			Joint, Little Finger		
		M.	S. D.	C. of V.	M.	S. D.	C. of V.	M.	S. D.	C. of V.	M.	S. D.	C. of V.
Male	Male with Male	83·2	6·20	7·45	58·2	3·90	6·70	62·5	2·87	4·59	51·0	2·72	5·33
,,	Male with Female	82·1	5·77	7·03	57·9	4·17	7·20	62·0	3·23	5·21	50·9	3·01	5·91
,,	Mean	82·6	5·98	7·24	58·0	4·04	7·00	62·2	3·05	4·90	51·0	2·87	5·63
Female	Female with Female	72·5	4·79	6·61	51·8	3·38	6·53	57·2	3·47	6·07	46·4	2·94	6·34
,,	Female with Male	71·4	3·64	5·10	51·0	2·78	5·45	56·3	3·06	5·44	46·1	2·70	5·86
,,	Mean	72·0	4·21	5·84	51·4	3·08	5·99	56·8	3·26	5·74	46·3	2·82	6·09
Sex Ratio, Male and Female		·87	·70	·81	·89	·76	·86	·91	1·07	1·17	·91	·98	1·08

The measurements are in mm.

The correlations as found by the product moment method without grouping are given in Table V. Now if we looked simply at the general mean ·336 of all 12 results, we might conclude that the intelligence and health characters of our first series had given us the more reliable results, the temperament and temper being more difficult of estimate, and thence conclude that the average resemblance of cousinship was 1/3.

TABLE V. *Correlation of Measured Characters in Pairs of Cousins.*

Character	Male and Male	Male and Female	Female and Female	Means
Width of Hand	·33	·21	·40	·314
Width of Wrist	·17	·26	·43	·286
Joint, Index Finger	·19	·34	·49	·340
Joint, Little Finger	·29	·37	·56	·404
Means	·245	·295	·470	·336

This view might be confirmed possibly by noting that the less easy measurements, those on hand and wrist, gave lower results than the joint measurements. But on further inspection of the table we notice that it is the female-female series which diverges so much from our previous results. The eight cases in which a male was one of the pair, and presumably worked the spanner, give a mean of ·270, agreeing excellently with the ·267 of our much larger first series. It is the pairs of female cousins, with their excessive variabilities, which give an intensity of resemblance equal to that of a sibship, and raising the average from ·270 to ·336.

To test the matter further the following steps were taken. A formula has been given by Pearson* which is based on normal distribution of frequency and gives the correlation coefficient in terms of the sum, $S(x-y)$, of the *positive* differences of correlated variates which have the same mean and S.D. Now this is precisely the case of the 106 cousin pairs if we treat them as a symmetrical distribution of 212 pairs. The formula is:

$$r = 1 - \frac{\pi \{S(x-y)\}^2}{N^2 \sigma^2}.$$

Applied to the data for the joint of the little finger in pairs of female cousins, we find $r = ·5578$, while found by the product moment method the answer is ·5579, a very close agreement. But it will be clear that if the measurer had a personal equation of the nature of a constant error for each pair, it would drop out in the difference $x-y$ for that pair. Hence the formula above is convenient to use when such an error for the individual pair is suspected to exist, and the variability σ can be found from other considerations. If in this particular case we adopt: (*a*) the standard deviation of the women in the series of male and female cousins, (*b*) the standard deviation found for the women on the assumption that the coefficient of variation for the women ought to be (what it usually is) practically the same as for the men, i.e. if we take the two values 2·701 and 2·474, we find that the above formula gives $r = ·48$ and ·38 respectively. Thus indicating some considerable reduction from the value ·56. It is therefore possible that an adding or subtracting of a constant difference in some of the measurements is the source of the exaggerated values of the female cousins resemblance. Such an error would not only have exaggerated the standard deviation, but it would have resulted at once, if a wrong correction had been applied to the measurements of those helpers who read at the edge, and not at the index point, of the spanner. It is believed that no spanners were removed from the numbered boxes until the measurements had been corrected; but the doubt, however slight, to those who had the control of the instruments, is sufficient to make it needful to repeat as soon as possible the whole series of measurements on female-female cousins.

We are able to use this second series as a control series also for the characters, hair colour, eye colour and general health. The method used was that of contingency

* "On further methods of determining Correlation," *Drapers' Research Memoirs*, Biometric Series IV. p. 4 *et seq.* (Dulau & Co., Soho Square).

but it must be remembered that the series were short, i.e. treated as symmetrical tables we had only 68, and 218 entries, and for male and female cousins 113. The results given in the following table were reached.

TABLE VI. *Non-quantitative Characters, Second Series.*

Character	Male and Male	Male and Female	Female and Female	Means
Health	·38	·29	·18	·282
Eye Colour	·44	·48	·38	·434
Hair Colour	·34	·26	·26	·286
Means	·386	·343	·273	·334

It will be seen at once that (i) the preponderating intensity of pairs of female cousins no longer exists, (ii) the eye colour values are, however, very high, in one case at least approaching the intensity of the resemblance of siblings, and (iii) the generally higher value obtained in the case of the measurable characters of the same series is maintained. We have already noted that eye and hair scales were used in these observations, 24 eye and 24 hair tints being given. There were 6 categories in the Health graduation, but the "Very Delicate" and the "Very Robust" categories were only very slightly represented, so that for Health merely 3×3-fold contingency tables,—"Robust," "Normally Healthy," "Delicate" seemed possible. For eye colour the 24 eye tints were first classed as "Pure Blue," "Blue with some orange," "Pure Grey," "Grey with some orange," "Hazel-Green," "Hazel-Brown," "Brown"; the two greys were then clubbed together, as also the two hazels to form a 5×5-fold table for contingency. The 7×7-fold table seemed far too fine for the numbers, 68, involved in the male and male cousin tables, and it was desirable to treat all three tables alike. The 24 tints of the hair scale were first grouped into: "Very Dark," "Dark-Brown," "Brown," "Light-Brown," "Fair," "Red." But for the male data only a single "fair" and a single "red" occurred and only three "browns." Accordingly the 2nd and 3rd categories and also the 5th and 6th were grouped together and a 4×4-fold table used for the contingency of hair-colour. As samples, the Eye and Hair colour tables for pairs of female cousins are given in Appendix B as Tables LXXX and LXXXI. Now while we frankly admit that this Second Series, whether of measurable or pigmentation characters, has a much too inadequate frequency to be conclusive, still its drift is undoubtedly to confirm the view, that the average resemblance of cousins is higher than that given by the Family Record results. It approaches nearer the value indicated by the more precise of the "Record" characters, and the more accurate of the hand measurements. The numbers in the first series are large as compared with those of the second, and the second series also involves several

points of doubt and difficulty; for this reason we have not yet modified the general average of the First Series by including these higher results. But it is conceivable that we may have to raise the general measure of resemblance of cousins from ·28 to ·33, when other large series already observed have been tabulated and reduced.

7. One further point may be finally touched upon, namely the inheritance of disease. We cannot in the least hope here for accurate numerical estimates, but the data of our first series may suffice to show that cousins are of value even from the standpoint of medical diagnosis. The difficulties of accurate determination are as follows:

(*a*) While on the schedules the record of brothers and sisters, of children, of parents and of grandparents is fairly complete, that of cousins must necessarily be defective. It is quite possible—nay not infrequent—to have more than 50 first cousins. And while one or two recorders actually were patient enough to enter details of a cousinship as large or even larger than this, the bulk of recorders contented themselves with entering a much more limited number, 10 to 12, and thus we have the first limitation; our cousins, as the recorders themselves state, are a *selection*. It is probable, also, that the selection has been made more frequently of living than of dead cousins, and more frequently of accessible than possibly inaccessible cousins; thus the individuals suffering from phthisis or insanity, or having died from these diseases, may without direct intention to deceive have been more frequently omitted than in the case of relatives *all* of whom were included.

(*b*) The cousins in our family record schedules are those of the subject. In order to get full ancestral information a young adult has been very often taken as the subject and the cousins belong accordingly to the third generation, and are themselves often young adults. It follows accordingly that their medical history is in many cases incomplete. They have not passed wholly through the danger zone in the case of either tuberculosis or insanity.

In the case of tuberculosis, we have for instance among males only 206 tuberculous out of 2990 individuals, and among females only 205 out of 3242, whereas 10 p.c. would probably be affected if we had the full record.

In our records for example there are in the case of women 130 cases of individuals classed as cousins with some form of brain disease or mental defect*. These 130 individuals have 6 insane and 124 sane cousins. If in the remainder of their lives 4 persons out of those 124 sane cousins were to suffer from some form of brain attack, then our table would be as follows:

* "Insanity" for the purpose of this investigation has been taken to include the neuroses: confirmed alcoholism and marked hysteria. These were not included by Heron in using Pearson's Family Records (*Eugenics Laboratory Publications*, II. p. 33). Its use here approaches "want of mental balance."

Second Female Cousin	First Female Cousin: Insane	Sane	Totals
Insane	14	120	134
Sane	120	2996	3116
Totals	134	3116	3250

instead of the actual:

Second Female Cousin	First Female Cousin: Insane	Sane	Totals
Insane	6	124	130
Sane	124	2996	3120
Totals	130	3120	3250

The fourfold table method gives the correlation of the first table about ·33 and that of the second ·03. Now it is not suggested that four additional cases of insanity are what we have to expect in the case of 124 persons chiefly young adults of insane stock. What we wish to point out is that with a disease *so relatively rare as this*, the transference when the record is completed of comparatively few individuals from the sane to the insane category is sufficient to raise the intensity of resemblance to a value quite equal to that which we have found for other characters in cousins.

The following are the results reached for insanity and tuberculosis:

TABLE VII. *Inheritance of Pathological Condition in Cousins with incomplete Record.*

	Male Cousins	Female Cousins	Male and Female Cousins	Means
Insanity	·18	·03	·08	·10
Tuberculosis	·07	·12	·19	·13
Means	·12	·08	·13	·11

In all six series—and they number in each case about 3000 pairs—we have a positive relationship, and the value is definitely significant in all cases but possibly that of insanity in female cousins. Yet this, owing to the fact that a considerable amount of insanity in the case of women is connected with change of life, is precisely what we might have anticipated considering the ages of our cousins. The fact also that insanity has a later average incidence than tuberculosis may explain why the average value for tuberculosis is higher than for insanity. We should conclude that so far as our data go they show that the tendency to both insanity and tuberculosis runs in stocks, and that with the incompleteness of the record there is no reason to

suggest that disease tendencies are not inherited at the same rate as physical and psychological characters in cousins.

8. *General Conclusions.* Our memoir has dealt with two series of cousin records. The quantitative measure of the resemblance of cousins is of great importance —not only on account of its bearing on eugenic marriages, but because cousins form often the principal living record to assist medical diagnosis. Its determination, however, presents considerable difficulties. It is not hard to collect data as to the characters of cousins, when these characters can be judged without the actual presence of the cousins. This was done in our first series. But when we come to the quantitative measurement of cousins our experience has been unfavourable to the rapid accumulation of extensive material. The passing from brethren to cousins— although the latter are a far wider group—has more than trebled the difficulty of obtaining measurements. Further our choice of the hand as the organ to be dealt with has possibly led to difficulty, as the treatment and use of the spanner needed more care than a simple measuring tape. It was possible to explain and illustrate the use of the spanner to all the male students to whom it was loaned, but in the case of women helpers we had often to trust to written directions. This *may* be the source of the high values found for the resemblance of women cousins, but we confess frankly that we are not satisfied that it is so, and we must await the reduction of further material before settling this point. If we turn to the 70 cases dealt with on the basis of our first series, we find an average resemblance of about ·27, which tallies with the average found from the eight quantitative series involving male cousins in our second investigation. If this value be confirmed we should say that cousins have as much significance as the parental brothers and sisters. On the other hand an examination of our table shows that what may be treated as the more easily judged and reliable results, show a rather higher value than ·27, approximating rather to the ·33 of the grandparental resemblance. The pigmentation results of the second series tend to confirm this view.

We should conclude accordingly from the present results that for the purposes of eugenics cousins must be classed as equally important with uncles and aunts, and that they may eventually turn out to be as important as grandparents. For practical purposes it would hardly seem possible in the matter of marriage restrictions based solely on the gametic resemblance judged by somatic characters, to differentiate between the three classes. This equality of resemblance which may appear at first sight paradoxical will be confirmed for uncles and aunts in a forthcoming memoir. Its physiological bearing appears to us of fundamental importance as indicating that a determinantal theory of heredity, emphasising alternate inheritance, must take precedence of any theory of simple blending for the bulk of the characters here dealt with.

We do not consider that our data show any difference between the inheritance of physical, psychical and pathological characters, which could not be accounted for by (*a*) the difficulty of appreciating temperament, and (*b*) the incompleteness of the cousin record.

APPENDIX A.

HEREDITARY RESEMBLANCE OF FIRST COUSINS*.

I. OBJECT OF MEASUREMENTS AND GENERAL INSTRUCTIONS.

I.—The present state of our knowledge of the laws of inheritance in man may be summed up as follows:—

We know well for a variety of organs direct inheritance from parent to offspring, and the collateral relationship between brothers and sisters. We have less complete, but still valuable data for the direct line in the case of grandparent and great-grandparents, and for the collateral line in the case of uncles and aunts. To supplement our knowledge, one of the most urgent problems is the determination of the degree of resemblance between cousins. It is with a view of solving this problem of cousin relationship that I appeal for cooperative observations and issue the present paper and schedules.

II.—For the purposes of the present investigation we are to understand by the word *cousin*:

(i) Full blood *First* Cousins, that is children of two whole (not half) brothers, of two whole (not half) sisters, or of a whole (not half) sister and brother. Such cousins are to have one and only one grandparental pair in common, and we term them *normal* cousins.

(ii) "Abnormal" first cousins are to be *excluded*.

It may happen that two brothers of one family have married to two sisters of another family, or that a sister and brother of one family have married a brother and sister of a second. The issue of such marriages are "doubly" first cousins having all their grandparents in common. Again, a brother and sister in one family might marry an aunt and a nephew in a second family, or again, might marry a woman and a man who are cousins in a second family, or, two brothers may marry two half sisters in a second family. Indeed cases of abnormal cousinship occur in which the abnormal cousins have 1, 2, 3 or 4 common grandparents. All such cases are excluded from the present investigation, which is concerned only with normal cousinship as defined under (i).

(iii) Normal cousins for the purpose of this investigation must be between 18 and 45 years of age.

* Issued by Professor Pearson, 1902 and onwards.

We cannot for a longer period consider the eye and hair colour to remain even approximately constant. With a shorter period we might fail to obtain sufficient material for statistical purposes.

III.—There are ten kinds of normal first cousins. Let A and B stand for the two cousins, thus :—

Two Male Cousins
- A and B may be sons of two brothers.
- A and B may be sons of two sisters.
- A and B may be sons of a sister and brother.

Two Female Cousins
- A and B may be daughters of two brothers.
- A and B may be daughters of two sisters.
- A and B may be daughters of a brother and sister.

Male and Female Cousins
- A and B may be son and daughter of two brothers.
- A and B may be son and daughter of two sisters.
- A may be the son of a sister and B the daughter of a brother.
- A may be the son of a brother and B the daughter of a sister.

In this classification in the last group of "male and female cousins," A is taken as the male and B as the female cousin. But in the actual schedule provision is made for the case where the observer has taken A for the female and B for the male cousin.

The observer, after entering his or her own name, should fill in the names of the cousins A and B and their sex by putting a cross under male or female. Next, under type of cousinship, a cross should be put in the last column against the special type of the two cousins observed. This is very important, because we have reason to believe from the grandparental and avuncular relationships that the degree of resemblance varies a good deal with the type.

IV.—Any individual cousin A may be dealt with in any number of cases, but it is not desirable to compare one cousin A with more than four other cousins who are brothers and sisters to each other, and of these, not more than two should be of one sex. Subject to this limitation A may appear, or A's brothers and sisters, in any number of cousinships. A fresh schedule should be used for each such cousinship. It is not, however, necessary to fill in on these additional schedules all the measurements and characters. The name and sex only of the repeated cousin, and the type of cousinship, need to be inserted. A cross reference to the number of the observer's series in which the cousin is fully recorded will then suffice. A blank is left for this reference under the name and sex of cousin. For example, if P, Q, R, S be children of four different brothers and sisters, we first fill up a schedule of P and Q, then one of R referring to the schedule containing P; and another schedule referring to the schedule containing R and to the one containing Q, but giving the type of Q and R cousinship. Then we measure S and refer to P, and

finally two more schedules give merely the names of *S* and *Q*, and *S* and *R* with their types of cousinship, and refer to the proper schedules for the observations on *S*, *Q* and *R*. Or again, the observer may fill in one schedule for himself or herself, and then with simple reference to the number of that schedule and the type of cousinship, fill in separate papers for twenty or thirty of his or her cousins. Then another series of schedule papers may be filled with simple references to the individuals among these twenty or thirty persons (without repeating their measurements) who are cousins among themselves apart from their relationship to the observer. In each case the type of cousinship must be marked on the new schedule paper.

V.—Directions for recording Observations.

(1) *Hair Colour.*

On the hair-colour scale in the box, pick out the number of the hair corresponding most nearly to the colour under observation. If the hair considered falls between two tints, so exactly that you cannot say that it is nearer to the one than the other, give both tints, thus 5—6. If the hair has turned grey before 45, say so; and if the hair is of tint distinctly not on the scale, fasten a very small sample, sufficient to show colour, on the data sheet with the border of a sheet of postage stamp, or other strip of gummed paper.

(2) *Eye Colour.*

In judging eye colour, first fix the attention on the amount of orange-brown pigment in the iris. If there be no orange-brown pigment, the eye is (1) Dark Blue, (2) Blue, (3) Light Blue, (4) Light Grey. With hardly visible amounts of the orange-brown pigment we have next (5) Blue-green, (6) Dark Grey, (7) Hazel. Lastly, with clearly marked orange-brown pigment, we have (8) Light Brown, (9) Brown, (10) Dark Brown, (11) Very Dark Brown, (12) "Black." Samples of these eye types are given on the eye-colour scale. Look at the eye with the light upon it from a distance of about 18 inches and compare it with the scale. If the eye falls between two types on the scale, give the numbers of both types; if it agrees fairly well with any type, give the number of that single type only. Thus 6—7 would mean that the eye in question fell between 6 and 7 of the scale, but 7 would signify that it was closer to the 7 than to the 6 of the scale.

(3) *Health.*

Place a cross against the category under which the general health falls.

(4) *Measurements of Hand.*

These are to be made with the hand-spanner which will be found in the box. All the readings are to be taken to the *nearest* mark on the scale, and the observer need not give fractions of the units on the scale, if the length falls between two marks. If in any case the observer finds it quite impossible to determine which is the *nearer* mark, then give both units, e.g., 34—35.

Self-measurement of the LEFT HAND *by means of the hand-spanner.*

(i) *Width of Wrist.* See Figure (i).

Feel for and satisfy yourself as to the positions of the bony protuberances on either side of the main joint of the wrist. They are the sides of the ends of the two bones of the forearm. The space between the outer sides of these has to be measured with the spanner. Hold the spanner in the right hand, resting its fixed jaw against the breast, and manipulate the movable jaw with the spare fingers of the right hand. Lay the left wrist back upwards between the jaws of the spanner, so that the bony protuberances come against the jaws. Close the jaws with gentle pressure and clamp the movable jaw with the clamping nut underneath. Repeat this at least once, and if time will allow twice, taking the reading each time and entering it on the schedule. Do not be surprised if your measurements are not *exactly* the same. Only suspect something is wrong, if you find as much as two units difference in your results. If this be so, test carefully again. Do not fill in column marked "mean," but leave this to those who have to reduce the observations.

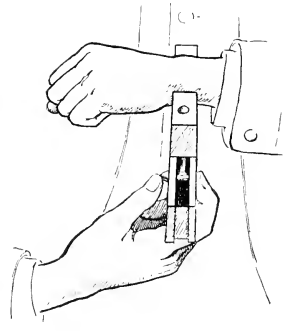


Fig. (i).

(ii) *Width of Hand.* (Left hand, as before.) See Figure (ii).

Feel for and satisfy yourself as to the positions of the outer sides of the knuckles, the one side being formed at the joint at the base of the little finger, the other at that of the forefinger. The hand is to be placed with the fingers close together, with the palm upwards, and *all the knuckles touching the spanner.* Measure the width between the outer sides with the spanner held with the fixed jaw against the breast and the scale horizontally upwards. Bring the movable jaw without pressure against the knuckle at the base of the forefinger. Clamp and read the scale. N.B.—Take care to make two or three trials.

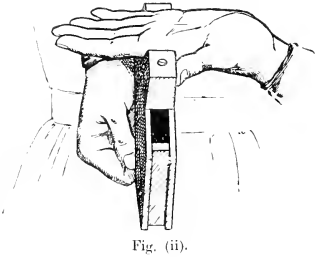


Fig. (ii).

(iii) *Length of First Joint of Index and Little Fingers.* (Left hand, as before.) See Figure (iii).

Close the fist (thumb outside) and measure in the same manner as in (ii),—thumb uppermost and spanner horizontal—the lengths from knuckle to first joint of (*a*) the Index Finger; (*b*) the Little Finger. The outside of first joint is put against the fixed jaw of the spanner, and the movable jaw is brought against the outside of the knuckle with gentle pressure. Clamp and read as before, making two or three trials.

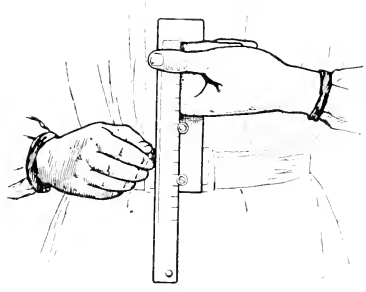


Fig. (iii).

All the measurements should be made with care. The above instructions are intended for self-measurement, but it is easy for one observer to measure both of a pair of cousins, or him or herself and then the cousin.

VI.—In case of any difficulty, please apply at once to Professor KARL PEARSON, University College, London, W.C. The Box and papers should not be kept longer than a month, unless the observer finds it possible to undertake a large series of cousins. About a thousand pairs of cousins of each type, 10,000 in all, will be required. Hence every co-operator will appreciate the necessity for rapid circulation of the boxes, of which only a limited number can be provided.

The name of the observer and address should always be given, in case it is necessary to ask questions as to any special measurement or observation. The cousins, if it be preferred, may be simply denoted by the initials of their christian and surnames, as these will suffice for the observer to identify them*.

* Spanners and schedules are still (November, 1907) being issued, and help in further cousin measurements will be gratefully accepted.

II. SCHEDULE.

Kindly make no attempt to fill this Schedule in until the General Instructions have been carefully read through.

Hereditary Resemblance of First Cousins.

Ages between 18 and 45.

Observer:

Name

Address

Number in Observer's Series	Number in whole Series*

* Leave this space blank.

Sex. (Place cross against Sex of Cousin.)

Cousin A.	Male	Female

Cousin B.	Male	Female

Name Name

Type of Cousinship. (Place cross against type in right-hand column.)

Male Cousins	(i)	A and B are sons of two brothers	
	(ii)	A and B are sons of two sisters	
	(iii)	A is son of brother, B is son of sister	
		A is son of sister, B is son of brother	
Female Cousins	(iv)	A and B are daughters of two brothers	
	(v)	A and B are daughters of two sisters	
	(vi)	A is daughter of brother, B is daughter of sister ...	
		A is daughter of sister, B is daughter of brother ...	
Male and Female Cousins	(vii)	A is daughter, B is son of two brothers	
		A is son, B is daughter of two brothers	
	(viii)	A is daughter, B is son of two sisters	
		A is son, B is daughter of two sisters	
	(ix)	A is daughter of a brother, B is son of a sister ...	
		A is son of a sister, B is daughter of a brother ...	
	(x)	A is daughter of a sister, B is son of a brother ...	
		A is son of a brother, B is daughter of a sister ...	

* A's measurements are already given on Schedule No.

* B's measurements are already given on Schedule No.

* *These are only to be used if A and B have already been scheduled for other pairs of cousinships.*

(1) HAIR-COLOUR.

	A	B
Insert number of nearest tint on hair-colour scale		

(2) EYE-COLOUR.

	A	B
Insert number of nearest tint on eye-colour scale		

(3) HEALTH.

Place a cross against the category which seems best to describe A's general health and a second in the last column for B's health.

	A	B
Very Robust ...		
Robust		
Normally Healthy		
Rather Delicate		
Delicate		
Very Delicate ...		

(4) MEASUREMENTS OF **Left** HAND.

To be made with the hand-spanner as described in the General Instructions.

MEASUREMENT	A				B			
	1st Trial	2nd Trial	3rd Trial	Mean	1st Trial	2nd Trial	3rd Trial	Mean*
(i) Width of Wrist								
(ii) Width of Hand								
(iii) Length of First Joint, Index Finger								
(iv) Length of First Joint, Little Finger								

* This column is to be left blank.

To ensure accuracy it is desirable that two or three trials should be made of these measurements, if they are not taken by an independent observer who has measured already a considerable number of pairs.

Kindly return this Schedule when filled in to Professor KARL PEARSON, University College, London, W.C.

APPENDIX B.

TABLES OF DATA.

HEALTH. MALE COUSINS.

TABLE I. *Type A.*

First Male Cousin

Second Male Cousin	Very Robust	Robust	Normally Healthy	Rather Delicate	Delicate	Totals
Very Robust	—	21	5	2	3	31
Robust	21	64	77	5	22	189
Normally Healthy	5	77	206	17	79	384
Rather Delicate	2	5	17	—	2	26
Delicate	3	22	79	2	26	132
Totals	31	189	384	26	132	762

TABLE II. *Type B.*

First Male Cousin

Second Male Cousin	V. R.	R.	N. H.	R. D.	D.	Totals
V. R.	30	31	28	1	5	95
R.	31	98	77	5	25	236
N. H.	28	77	196	13	35	349
R. D.	1	5	13	—	2	21
D.	5	25	35	2	14	81
Totals	95	236	349	21	81	782

TABLE III. *Type C.*

First Male Cousin

Second Male Cousin	V. R.	R.	N. H.	R. D.	D.	Totals
V. R.	18	52	45	2	18	135
R.	52	156	136	13	28	385
N. H.	45	136	314	15	70	580
R. D.	2	13	15	4	2	36
D.	18	28	70	2	28	146
Totals	135	385	580	36	146	1282

Health. Female Cousins.

Table IV. *Type D.*

Second Female Cousin \ First Female Cousin	V. R.	R.	N. H.	R. D.	D.	Totals
V. R.	24	7	10	—	4	45
R.	7	44	99	5	48	203
N. H.	10	99	272	9	127	517
R. D.	—	5	9	8	3	25
D.	4	48	127	3	74	256
Totals	45	203	517	25	256	1046

Table V. *Type E.*

Second Female Cousin \ First Female Cousin	V. R.	R.	N. H.	R. D.	D.	Totals
V. R.	—	6	15	—	6	27
R.	6	46	60	1	14	127
N. H.	15	60	200	4	78	357
R. D.	—	1	4	—	—	5
D.	6	14	78	—	22	120
Totals	27	127	357	5	120	636

Table VI. *Type F.*

Second Female Cousin \ First Female Cousin	V. R.	R.	N. H.	R. D.	D.	Totals
V. R.	8	31	22	—	14	75
R.	31	66	123	1	66	287
N. H.	22	123	354	17	136	652
R. D.	—	1	17	—	2	20
D.	14	66	136	2	58	276
Totals	75	287	652	20	276	1310

Health. Male and Female Cousins.

Table VII. *Type G.*

Male Cousin

Female Cousin	V. R.	R.	N. H.	R. D.	D.	Totals
V. R.	4	20	8	—	5	37
R.	10	66	85	12	27	200
N. H.	15	86	231	22	82	436
R. D.	—	7	10	2	2	21
D.	10	57	92	2	29	190
Totals	39	236	426	38	145	884

Table VIII. *Type H.*

Male Cousin

Female Cousin	V. R.	R.	N. H.	R. D.	D.	Totals
V. R.	18	6	22	—	2	48
R.	19	52	45	2	21	130
N. H.	27	63	163	14	58	325
R. D.	1	3	4	—	1	9
D.	16	31	84	1	33	165
Totals	81	155	318	17	106	677

Table IX. *Type I.*

Male Cousin

Female Cousin	V. R.	R.	N. H.	R. D.	D.	Totals
V. R.	8	8	13	—	6	35
R.	18	55	67	2	26	168
N. H.	17	82	217	13	38	367
R. D.	—	4	9	4	1	18
D.	7	33	55	2	18	115
Totals	50	182	361	21	89	703

Table X. *Type K.*

Male Cousin

Female Cousin	V. R.	R.	N. H.	R. D.	D.	Totals
V. R.	14	13	9	—	5	41
R.	25	46	41	2	16	130
N. H.	11	95	219	18	47	390
R. D.	—	—	5	2	—	7
D.	17	34	81	1	24	157
Totals	67	188	355	23	92	725

Intelligence. Male Cousins.

Table XI. *Type A.*

Second Male Cousin \ First Male Cousin	F & E_2	E	E_1 & D	C, B & A	Totals
F & E_2	14	42	36	5	97
E	42	208	55	14	319
E_1 & D	36	55	108	20	219
C, B & A	5	14	20	18	57
Totals	97	319	219	57	692

Table XII. *Type B.*

Second Male Cousin \ First Male Cousin	F & E_2	E	E_1 & D	C, B & A	Totals
F & E_2	26	47	31	3	107
E	47	246	57	23	373
E_1 & D	31	57	54	19	161
C, B & A	3	23	19	6	51
Totals	107	373	161	51	692

Table XIII. *Type C.*

Second Male Cousin \ First Male Cousin	F & E_2	E	E_1 & D	C, B & A	Totals
F & E_2	26	87	40	8	161
E	87	448	147	26	708
E_1 & D	40	147	118	30	335
C, B & A	8	26	30	30	94
Totals	161	708	335	94	1298

Intelligence. Female Cousins.

Table XIV. *Type D.*

Second Female Cousin \ First Female Cousin	F & E_2	E	E_1 & D	C, B & A	Totals
F & E_2	6	23	29	1	59
E	23	336	133	14	506
E_1 & D	29	133	198	37	397
C, B & A	1	14	37	8	60
Totals	59	506	397	60	1022

Table XV. *Type E.*

Second Female Cousin \ First Female Cousin	F & E_2	E	E_1 & D	C, B & A	Totals
F & E_2	8	9	17	1	35
E	9	262	97	22	390
E_1 & D	17	97	56	10	180
C, B & A	1	22	10	18	51
Totals	35	390	180	51	656

Table XVI. *Type F.*

Second Female Cousin \ First Female Cousin	F & E_2	E	E_1 & D	C, B & A	Totals
F & E_2	8	37	15	4	64
E	37	606	155	21	819
E_1 & D	15	155	160	24	354
C, B & A	4	21	24	8	57
Totals	64	819	354	57	1294

Intelligence. Male and Female Cousins.

Table XVII. *Type G.*

Female Cousin \ Male Cousin	F & E_2	E	E_1 & D	C, B & A	Totals
F & E_2	11	30	15	—	56
E	69	266	60	34	429
E_1 & D	63	93	124	50	330
C, B & A	2	12	21	13	48
Totals	145	401	220	97	863

Table XVIII. *Type H.*

Female Cousin \ Male Cousin	F & E_2	E	E_1 & D	C, B & A	Totals
F & E_2	13	46	12	2	73
E	29	279	74	20	402
E_1 & D	25	107	50	5	187
C, B & A	4	6	10	7	27
Totals	71	438	146	34	689

Table XIX. *Type I.*

Female Cousin \ Male Cousin	F & E_2	E	E_1 & D	C, B & A	Totals
F & E_2	9	23	13	5	50
E	55	285	67	17	424
E_1 & D	22	60	77	9	168
C, B & A	4	14	12	13	43
Totals	90	382	169	44	685

Table XX. *Type K.*

Female Cousin \ Male Cousin	F & E_2	E	E_1 & D	C, B & A	Totals
F & E_2	17	23	9	1	50
E	34	334	93	19	480
E_1 & D	12	67	70	13	162
C, B & A	6	11	8	4	29
Totals	69	435	180	37	721

Success. Male Cousins.

Table XXI. *Type A.*

First Male Cousin

Second Male Cousin	Marked & Prosperous	Average	Difficult	Failure	Totals
Marked & Prosperous	39	102·25	27·75	15	184
Average	102·25	196·5	40·25	16	355
Difficult	27·75	40·25	28	6	102
Failure	15	16	6	10	47
Totals	184	355	102	47	688

Table XXII. *Type B.*

First Male Cousin

Second Male Cousin	M. & P.	A.	D.	F.	Totals
M. & P.	90	96	35	14·5	235·5
A.	96	139	47·5	14·5	297
D.	35	47·5	22	7	111·5
F.	14·5	14·5	7	8	44
Totals	235·5	297	111·5	44	688

Table XXIII. *Type C.*

First Male Cousin

Second Male Cousin	M. & P.	A.	D.	F.	Totals
M. & P.	79	147·75	47·25	26	300
A.	147·75	272	80·75	24	524·5
D.	47·25	80·75	51·5	6	185·5
F.	26	24	6	10	66
Totals	300	524·5	185·5	66	1076

Success. Female Cousins.

Table XXIV. *Type D.*

Second Female Cousin \ First Female Cousin	M. & P.	A.	D.	F.	Totals
M. & P.	21	59·75	6·25	—	87
A.	59·75	450·5	30·25	8	548·5
D.	6·25	30·25	—	—	36·5
F.	—	8	—	—	8
Totals	87	548·5	36·5	8	680

Table XXV. *Type E.*

Second Female Cousin \ First Female Cousin	M. & P.	A.	D.	F.	Totals
M. & P.	4	44	6	5	59
A.	44	227	27	6	304
D.	6	27	3	4	40
F.	5	6	4	4	19
Totals	59	304	40	19	422

Table XXVI. *Type F.*

Second Female Cousin \ First Female Cousin	M. & P.	A.	D.	F.	Totals
M. & P.	64	94	6·5	12	176·5
A.	94	604·5	33·5	4	736
D.	6·5	33·5	5·5	—	45·5
F.	12	4	—	—	16
Totals	176·5	736	45·5	16	974

Success. Male and Female Cousins.

Table XXVII. *Type G.*

Female Cousin \ Male Cousin	M. & P.	A.	D.	F.	Totals
M. & P.	20	32·25	23·75	17	93
A.	104·5	224·75	83·75	43	456
D.	6·5	21	8·5	4	40
F.	4	1	—	—	5
Totals	135	279	116	64	594

Table XXVIII. *Type H.*

Female Cousin \ Male Cousin	M. & P.	A.	D.	F.	Totals
M. & P.	23·5	24·5	5	11	64
A.	78·75	148·75	44	10	281·5
D.	6·25	21·25	24	6	57·5
F.	5	6	1	2	14
Totals	113·5	200·5	74	29	417

Table XXIX. *Type I.*

Female Cousin \ Male Cousin	M. & P.	A.	D.	F.	Totals
M. & P.	20·5	35·5	31·5	9	96·5
A.	91·75	228·25	54·5	9	383·5
D.	8·75	9·25	5	—	23
F.	1	—	—	—	1
Totals	122	273	91	18	504

Table XXX. *Type K.*

Female Cousin \ Male Cousin	M. & P.	A.	D.	F.	Totals
M. & P.	38	24·75	12·75	9·5	85
A.	80·75	191·75	75	17	364·5
D.	5·75	7·5	5·75	1·5	20·5
F.	3	2	4	2	11
Totals	127·5	226	97·5	30	481

Temper. Male Cousins.

Table XXXI. *Type A.*

Second Male Cousin	First Male Cousin: Even	Quick	Sullen	Weak	Totals
Even	239	68	28·5	20·5	356
Quick	68	65	16·25	12·75	162
Sullen	28·5	16·25	6·5	3·75	55
Weak	20·5	12·75	3·75	4	41
Totals	356	162	55	41	614

Table XXXII. *Type B.*

Second Male Cousin	First Male Cousin: Even	Quick	Sullen	Weak	Totals
Even	202	84·5	17·5	17·5	321·5
Quick	84·5	29	9·5	7·5	130·5
Sullen	17·5	9·5	—	5	32
Weak	17·5	7·5	5	2	32
Totals	321·5	130·5	32	32	516

Table XXXIII. *Type C.*

Second Male Cousin	First Male Cousin: Even	Quick	Sullen	Weak	Totals
Even	419·5	179	43·5	24	666
Quick	179	96·5	22	17	314·5
Sullen	43·5	22	11	8·5	85
Weak	24	17	8·5	5	54·5
Totals	666	314·5	85	54·5	1120

Temper. Female Cousins.

Table XXXIV. *Type D.*

First Female Cousin

Second Female Cousin	Even	Quick	Sullen	Weak	Totals
Even	361	118·25	61·25	18·5	559
Quick	118·25	77·5	27·75	8·5	232
Sullen	61·25	27·75	10	5·5	104·5
Weak	18·5	8·5	5·5	—	32·5
Totals	559	232	104·5	32·5	928

Table XXXV. *Type E.*

First Female Cousin

Second Female Cousin	Even	Quick	Sullen	Weak	Totals
Even	269·5	75·5	16·5	6	367·5
Quick	75·5	64·5	7·5	4	151·5
Sullen	16·5	7·5	3	—	27
Weak	6	4	—	—	10
Totals	367·5	151·5	27	10	556

Table XXXVI. *Type F.*

First Female Cousin

Second Female Cousin	Even	Quick	Sullen	Weak	Totals
Even	545·5	194·5	49·5	11·5	801
Quick	194·5	116·5	22	6·5	339·5
Sullen	49·5	22	4	6	81·5
Weak	11·5	6·5	6	—	24
Totals	801	339·5	81·5	24	1246

Temper. Male and Female Cousins.

Table XXXVII. *Type G.*

Female Cousin \ Male Cousin	Even	Quick	Sullen	Weak	Totals
Even	265·5	98·5	50·0	23	437
Quick	104·25	72·25	29·0	19	224·5
Sullen	33	8·5	9·5	2	53
Weak	12·75	6·75	3	7	29·5
Totals	415·5	186	91·5	51	744

Table XXXVIII. *Type H.*

Female Cousin \ Male Cousin	Even	Quick	Sullen	Weak	Totals
Even	206·5	74	25·5	25·5	331·5
Quick	89	49	26	7·5	171·5
Sullen	13·5	6·5	6	1	27
Weak	2	1	—	5	8
Totals	311	130·5	57·5	39	538

Table XXXIX. *Type I.*

Female Cousin \ Male Cousin	Even	Quick	Sullen	Weak	Totals
Even	230	78	21	11·5	340·5
Quick	108·25	64·75	21	9·5	203·5
Sullen	14·25	10·75	4	2	31
Weak	6	5	—	—	11
Totals	358·5	158·5	46	23	586

Table XL. *Type K.*

Female Cousin \ Male Cousin	Even	Quick	Sullen	Weak	Totals
Even	273·5	65·25	20·75	12	371·5
Quick	100·25	61·25	11	14·5	187
Sullen	14·25	14·5	5·25	3·5	37·5
Weak	10	3	1	2	16
Totals	398	141	38	32	612

TEMPERAMENT—RESERVED OR EXPRESSIVE. MALE COUSINS.

TABLE XLI. *Type A.*

Second Male Cousin \ First Male Cousin	Reserved	Betwixt	Expressive	Totals
Reserved	100	47	46	193
Betwixt	47	58	31	136
Expressive	46	31	68	145
Totals	193	136	145	474

TABLE XLII. *Type B.*

Second Male Cousin \ First Male Cousin	Reserved	Betwixt	Expressive	Totals
Reserved	32	44	62	138
Betwixt	44	64	27	135
Expressive	62	27	50	139
Totals	138	135	139	412

TABLE XLIII. *Type C.*

Second Male Cousin \ First Male Cousin	Reserved	Betwixt	Expressive	Totals
Reserved	202	105	107	414
Betwixt	105	108	68	281
Expressive	107	68	112	287
Totals	414	281	287	982

TEMPERAMENT—RESERVED OR EXPRESSIVE. FEMALE COUSINS.

TABLE XLIV. *Type D.*

Second Female Cousin \ First Female Cousin	Reserved	Betwixt	Expressive	Totals
Reserved	94	83	100	277
Betwixt	83	110	62	255
Expressive	100	62	122	284
Totals	277	255	284	816

TABLE XLV. *Type E.*

Second Female Cousin \ First Female Cousin	Reserved	Betwixt	Expressive	Totals
Reserved	32	34	53	119
Betwixt	34	74	50	158
Expressive	53	50	134	237
Totals	119	158	237	514

TABLE XLVI. *Type F.*

Second Female Cousin \ First Female Cousin	Reserved	Betwixt	Expressive	Totals
Reserved	86	111	117	314
Betwixt	111	120	110	341
Expressive	117	110	240	467
Totals	314	341	467	1122

Temperament—Reserved or Expressive. Male and Female Cousins.

Table XLVII. *Type G.*

Female Cousin \ Male Cousin	Reserved	Betwixt	Expressive	Totals
Reserved	87	50	53	190
Betwixt	57	87	41	185
Expressive	106	47	96	249
Totals	250	184	190	624

Table XLVIII. *Type H.*

Female Cousin \ Male Cousin	Reserved	Betwixt	Expressive	Totals
Reserved	26	26	27	79
Betwixt	72	69	33	174
Expressive	105	31	89	225
Totals	203	126	149	478

Table XLIX. *Type I.*

Female Cousin \ Male Cousin	Reserved	Betwixt	Expressive	Totals
Reserved	77	35	35	147
Betwixt	64	36	61	161
Expressive	100	29	105	234
Totals	241	100	201	542

Table L. *Type K.*

Female Cousin \ Male Cousin	Reserved	Betwixt	Expressive	Totals
Reserved	63	59	25	147
Betwixt	70	72	45	187
Expressive	71	27	83	181
Totals	204	158	153	515

TEMPERAMENT—RESERVED OR EXPRESSIVE. COUSINS. ALL TYPES.

TABLE LI. *Male Cousins.*

Second Male Cousin	First Male Cousin: Reserved	Betwixt	Expressive	Totals
Reserved	334	196	215	745
Betwixt	196	230	126	552
Expressive	215	126	230	571
Totals	745	552	571	1868

TABLE LII. *Female Cousins.*

Second Female Cousin	First Female Cousin: Reserved	Betwixt	Expressive	Totals
Reserved	212	228	270	710
Betwixt	228	304	222	754
Expressive	270	222	496	988
Totals	710	754	988	2452

TABLE LIII. *Male and Female Cousins.*

Female Cousin	Male Cousin: Reserved	Betwixt	Expressive	Totals
Reserved	253	170	140	563
Betwixt	263	264	180	707
Expressive	382	134	373	889
Totals	898	568	693	2159

TEMPERAMENT—SYMPATHETIC OR CALLOUS. MALE COUSINS.

TABLE LIV. *Type A.*

Second Male Cousin	First Male Cousin: Symp.	Betwixt	Callous	Totals
Symp.	91	28	2	121
Betwixt	35	36	5	76
Callous	31	15	2	48
Totals	157	79	9	245

TABLE LV. *Type B.*

Second Male Cousin	First Male Cousin: Symp.	Betwixt	Callous	Totals
Symp.	67	33	9	109
Betwixt	24	49	5	78
Callous	6	7	10	23
Totals	97	89	24	210

TABLE LVI. *Type C.*

Second Male Cousin	First Male Cousin: Symp.	Betwixt	Callous	Totals
Symp.	170	67	18	255
Betwixt	74	84	19	177
Callous	39	20	2	61
Totals	283	171	39	493

TEMPERAMENT—SYMPATHETIC OR CALLOUS. FEMALE COUSINS.

TABLE LVII. *Type D.*

Second Female Cousin	First Female Cousin: Symp.	Betwixt	Callous	Totals
Symp.	133	59	11	203
Betwixt	102	61	8	171
Callous	30	12	2	44
Totals	265	132	21	418

TABLE LVIII. *Type E.*

Second Female Cousin	First Female Cousin: Symp.	Betwixt	Callous	Totals
Symp.	151	40	7	198
Betwixt	26	27	1	54
Callous	15	7	7	29
Totals	192	74	15	281

TABLE LIX. *Type F.*

Second Female Cousin	First Female Cousin: Symp.	Betwixt	Callous	Totals
Symp.	321	82	14	417
Betwixt	53	46	6	105
Callous	25	11	4	40
Totals	399	139	24	562

TEMPERAMENT—SYMPATHETIC OR CALLOUS. MALE AND FEMALE COUSINS.

TABLE LX. *Type G.*

Female Cousin \ Male Cousin	Symp.	Betwixt	Callous	Totals
Symp.	257	113	42	412
Betwixt	85	87	25	197
Callous	28	9	2	39
Totals	370	209	69	648

TABLE LXI. *Type H.*

Female Cousin \ Male Cousin	Symp.	Betwixt	Callous	Totals
Symp.	205	91	15	311
Betwixt	41	92	12	145
Callous	13	4	12	29
Totals	259	187	39	485

TABLE LXII. *Type I.*

Female Cousin \ Male Cousin	Symp.	Betwixt	Callous	Totals
Symp.	293	66	43	402
Betwixt	50	53	16	119
Callous	11	8	3	22
Totals	354	127	62	543

TABLE LXIII. *Type K.*

Female Cousin \ Male Cousin	Symp.	Betwixt	Callous	Totals
Symp.	225	100	33	358
Betwixt	70	67	9	146
Callous	14	5	1	20
Totals	309	172	43	524

TEMPERAMENT—SYMPATHETIC OR CALLOUS. COUSINS. ALL TYPES.

TABLE LXIV. *Male Cousins.*

Second Male Cousin \ First Male Cousin	Symp.	Betwixt	Callous	Totals
Symp.	656	264	105	1022
Betwixt	264	338	71	670
Callous	105	71	28	204
Totals	1022	670	204	1896

TABLE LXV. *Female Cousins.*

Second Female Cousin \ First Female Cousin	Symp.	Betwixt	Callous	Totals
Symp.	1210	362	102	1674
Betwixt	362	268	45	675
Callous	102	45	26	173
Totals	1674	675	173	2522

TABLE LXVI. *Male and Female Cousins.*

Female Cousin \ Male Cousin	Symp.	Betwixt	Callous	Totals
Symp.	980	370	133	1483
Betwixt	246	299	62	607
Callous	66	26	18	110
Totals	1292	695	213	2200

Temperament—Excitable or Calm. Male Cousins.

Table LXVII. *Type A.*

Second Male Cousin \ First Male Cousin	Excit.	Betwixt	Calm	Totals
Excit.	48	21	60	129
Betwixt	21	68	41	130
Calm	60	41	126	227
Totals	129	130	227	486

Table LXVIII. *Type B.*

Second Male Cousin \ First Male Cousin	Excit.	Betwixt	Calm	Totals
Excit.	40	18	42	100
Betwixt	18	90	34	142
Calm	42	34	94	170
Totals	100	142	170	412

Table LXIX. *Type C.*

Second Male Cousin \ First Male Cousin	Excit.	Betwixt	Calm	Totals
Excit.	78	56	122	256
Betwixt	56	166	93	315
Calm	122	93	224	439
Totals	256	315	439	1010

TEMPERAMENT EXCITABLE OR CALM. FEMALE COUSINS.

TABLE LXX. *Type D.*

Second Female Cousin	First Female Cousin: Excit.	Betwixt	Calm	Totals
Excit.	58	30	110	198
Betwixt	30	70	99	199
Calm	110	99	226	435
Totals	198	199	435	832

TABLE LXXI. *Type E.*

Second Female Cousin	First Female Cousin: Excit.	Betwixt	Calm	Totals
Excit.	70	37	73	180
Betwixt	37	36	47	120
Calm	73	47	82	202
Totals	180	120	202	502

TABLE LXXII. *Type F.*

Second Female Cousin	First Female Cousin: Excit.	Betwixt	Calm	Totals
Excit.	136	54	163	353
Betwixt	54	110	76	240
Calm	163	76	322	561
Totals	353	240	561	1154

TEMPERAMENT—EXCITABLE OR CALM. MALE AND FEMALE COUSINS.

TABLE LXXIII. *Type G.*

Female Cousin \ Male Cousin	Excit.	Betwixt	Calm	Totals
Excit.	45	39	81	165
Betwixt	12	70	54	136
Calm	47	82	163	292
Totals	104	191	298	593

TABLE LXXIV. *Type H.*

Female Cousin \ Male Cousin	Excit.	Betwixt	Calm	Totals
Excit.	48	26	76	150
Betwixt	31	87	66	184
Calm	42	31	70	143
Totals	121	144	212	477

TABLE LXXV. *Type I.*

Female Cousin \ Male Cousin	Excit.	Betwixt	Calm	Totals
Excit.	66	27	115	208
Betwixt	23	42	49	114
Calm	51	41	135	227
Totals	140	110	299	549

TABLE LXXVI. *Type K.*

Female Cousin \ Male Cousin	Excit.	Betwixt	Calm	Totals
Excit.	44	21	87	152
Betwixt	18	65	32	115
Calm	60	50	152	262
Totals	122	136	271	529

TEMPERAMENT—EXCITABLE OR CALM. COUSINS. ALL TYPES.

TABLE LXXVII. *Male Cousins.*

Second Male Cousin	First Male Cousin: Excit.	Betwixt	Calm	Totals
Excit.	166	95	224	485
Betwixt	95	324	168	587
Calm	224	168	444	836
Totals	485	587	836	1908

TABLE LXXVIII. *Female Cousins.*

Second Female Cousin	First Female Cousin: Excit.	Betwixt	Calm	Totals
Excit.	264	121	346	731
Betwixt	121	216	222	559
Calm	346	222	630	1198
Totals	731	559	1198	2488

TABLE LXXIX. *Male and Female Cousins.*

Female Cousin	Male Cousin: Excit.	Betwixt	Calm	Totals
Excit.	203	113	359	675
Betwixt	84	264	201	549
Calm	200	204	520	924
Totals	487	581	1080	2148

Pigmentation Characters.

Table LXXX. *Eye Colour, Female Cousins.*

Second Female Cousin \ First Female Cousin	Pure Blue	Blue Orange	Pure Grey	Grey Orange	Hazel Green	Hazel Brown	Brown	Totals
Pure Blue	9	1·5	8	2·5	4·5	2·5	4·5	32·5
Blue Orange	1·5	6	7	9	3·5	3·5	8·5	39
Pure Grey	8	7	4	5	1	2	1·5	28·5
Grey Orange	2·5	9	5	6	1	6	2	31·5
Hazel Green	4·5	3·5	1	1	1·5	4·5	3	19
Hazel Brown	2·5	3·5	2	6	4·5	8·5	5·5	32·5
Brown	4·5	8·5	1·5	2	3	5·5	10	35
Totals	32·5	39	28·5	31·5	19	32·5	35	218

Table LXXXI. *Hair Colour, Female Cousins.*

Second Female Cousin \ First Female Cousin	Very Dark	Dark Brown	Brown	Light Brown	Fair	Red	Totals
Very Dark	9	11	3·5	11	1·5	—	36
Dark Brown	11	13	12	10	9	1	56
Brown	3·5	12	8	9·75	3·25	3	39·5
Light Brown	11	10	9·75	16·5	9·25	1	57·5
Fair	1·5	9	3·25	9·25	1	—	24
Red	—	1	3	1	—	—	5
Totals	56	56	39·5	57·5	24	5	218

Pathological Characters.

Table LXXXII. *Tuberculosis.*

Second Male Cousin	First Male Cousin: Tuberculous	Non-tuberculous	Totals
Tuberculous	18	188	206
Non-tuberculous	188	2596	2784
Totals	206	2784	2990

Table LXXXIII. *Insanity*.*

Second Male Cousin	First Male Cousin: Insane	Sane	Totals
Insane	38	221	259
Sane	221	2510	2731
Totals	259	2731	2990

Table LXXXIV. *Tuberculosis.*

Second Female Cousin	First Female Cousin: Tuberculous	Non-tuberculous	Totals
Tuberculous	20	185	205
Non-tuberculous	185	2852	3037
Totals	205	3037	3242

Table LXXXV. *Insanity*.*

Second Female Cousin	First Female Cousin: Insane	Sane	Totals
Insane	6	124	130
Sane	124	2996	3120
Totals	130	3120	3250

Table LXXXVI. *Tuberculosis.*

Female Cousin	Male Cousin: Tuberculous	Non-tuberculous	Totals
Tuberculous	20	148	168
Non-tuberculous	237	2698	2935
Totals	257	2846	3103

Table LXXXVII. *Insanity*.*

Female Cousin	Male Cousin: Insane	Sane	Totals
Insane	12	128	140
Sane	187	2791	2978
Totals	199	2919	3118

* Includes marked neuroses, alcoholism and hysteria.

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