

Hapalidæ, whereas a powerful anti-serum did produce a reaction, and proved what I may be permitted to call the "blood relationship" in the absence of a better expression.

Referring to the anti-serum for human blood, I may state that I have successfully produced it in rabbits by injections of old human pleuritic exudate preserved in a bottle with chloroform for five to six months. Similarly, some old anti-diphtheritic horse serum preserved for two years and seven months in the laboratory by means of trikresol also yielded an anti-serum for horse blood. The anti-sera produced in these cases was feebler than that which is produced by injections of fresh serum. Dilutions of these old preserved fluids gave the characteristic reactions with their homologous anti-sera. I have also found that the anti-sera may be preserved for months with chloroform, although there is no denying that they lose in power. Anti-serum which had been preserved for over seven months in sealed capillary tubes was likewise still effective, although less potent.

Through the kindness of Mr. Frank E. Beddard, F.R.S., Prosector of the Zoological Society's Gardens, and numerous friends, who are generously aiding me by sending blood-samples from various parts of the world, I am gradually gathering together considerable material for study. Wherever possible the fluid sera are being sent me preserved with chloroform. Dried sera, on the other hand, are sent on slips of pure filter-paper, upon which appropriate data are noted in pencil.

The results of the investigation indicate the necessity of not limiting the work to vertebrates alone, and many questions naturally suggest themselves, the solution of which may be attained by means of the biological test.

The assumption seems justified that we may, for instance, be able at some future date to determine chemical differences in the blood of the various races of man. We no longer need to rely solely upon morphological characters for the differentiation of species.

It is impossible to enter into details concerning the nature of the reaction here described; it is a subject for further study. Suffice it to say that it is exceedingly complex, but at the same time the most delicate of tests known.

---

"On the Inheritance of the Mental Characters in Man." By  
KARL PEARSON, F.R.S., University College, London. Received  
November, 2,—Read November 21, 1901.

(1.) Mr. Francis Galton, in his 'Natural Inheritance,' first, I believe, endeavoured to give a quantitative appreciation of the inheritance of the mental characters in man. Mr. Galton's data

were not very copious, and in default of a method of dealing quantitatively with characters not capable of exact scaling, it was not possible to deduce absolutely conclusive results. Still Mr. Galton brought good evidence to show that temper and artistic instinct were inherited characters. On November 19, 1899, a paper was read to the Royal Society showing how the inheritance of characters not capable of exact quantitative measurement might be deduced. In that paper I dealt with Mr. Galton's statistics, and showed that the fraternal correlation in the matter of temper was 0.3167, and the parental correlation in the matter of artistic instinct was 0.4039. These numbers are somewhat low and not altogether satisfactory. I purpose in this preliminary notice to give only a few results from some very elaborate observations which have been made in the course of the last few years.

(2.) The material was collected in two separate ways. In the first series—the Family Measurement Series—only physical characters were observed. This series was started six years ago, and upwards of 1100 families, father, mother, and not more than two sons and two daughters, were measured. The series was closed two years ago, and last year Dr. Alice Lee completed the reduction of this very large mass of material. In its reduced form seventy-eight correlation tables have been formed, giving as many correlation coefficients bearing on direct or cross heredity. This is probably the most extensive series of inheritance coefficients—each based, as a rule, on upwards of 1000 pairs—which has yet been obtained.

My second series will be still more extensive; but it relates only to collateral—fraternal—heredity. It aims at observing a wide range of both physical and mental characters in pairs of school children. I have received most kindly aid from a great number of masters and mistresses in public schools, high schools, secondary and primary schools of all classes. This will be very fully acknowledged in the final publication of the results. But although the work has been in progress for three years, we have still only material enough to draw conclusions in the case of pairs of brothers, of whom more than 1000 cases have been observed.

The work has been carried on with the assistance from the Government Grant of a sum appropriated to this purpose in 1898. Without this aid it would not have been possible for me to purchase the necessary head-spanners or to circulate them among the schools.

(3.) Only three of the physical measurements of this extensive series have yet been reduced, and the sister-sister and sister-brother observations will have to be carried on for another year or two before they are sufficiently numerous. The whole material will then require two or three years for tabulation and calculation. But as the problem of the inheritance of the mental characters and their correlation

with the physical was occupying our attention in another field, the indefatigable Dr. Lee undertook the tabulation and calculation of the coefficients of heredity in the case of seven mental and three physical characters for pairs of brothers. The number of pairs dealt with in each case were 800 to 1000. The method adopted was that of the memoir on "The Inheritance of Characters not capable of Exact Quantitative Measurement."\* Thus, under the heading *Conscientiousness* were two divisions, Keen and Dull, and the teacher might place a cross on either of these or on the dividing line. Similar divisions occurred in the other categories, except that *Intelligence* was given six and *Temper* three subdivisions, &c. The collecting schedules will be fully described when the whole bulk of material is finally reduced and published. My sole object in the present preliminary notice is to draw attention to the following results:—

*Coefficients of Collateral Heredity.*

Correlation of Pairs of Brothers.

<i>Physical Characters.</i> (Family Measurements.)		<i>Mental Characters.</i> (School Observations.)	
Stature .....	0·5107	Intelligence .....	0·4559
Forearm .....	0·4912	Vivacity .....	0·4702
Span .....	0·5494	Conscientiousness .....	0·5929
Eye-colour .....	0·5169	Popularity .....	0·5044
		Temper .....	0·5068
		Self-consciousness .....	0·5915
		Shyness .....	0·5281
(School Observations.)			
Cephalic index .....	0·4861		
Hair-colour .....	0·5452		
Health .....	0·5203		
Mean .....	0·5171	Mean .....	0·5214

The physical characters were measured or observed on two entirely different groups of individuals—in the one case, adults, in the other, children, were examined. Both groups, however, give very like mean results, *i.e.*, 0·5170 and 0·5172. Dealing with the means for physical and mental characters we are forced to the perfectly definite conclusion: *That the mental characters in man are inherited in precisely the same manner as the physical.* Our mental and moral nature is, quite as much as our physical nature, the outcome of hereditary factors.

The probable error of the coefficients given is about 0·02 at most; the differences between the individual values and their significance will be fully considered in the final memoir.

---

\* 'Phil. Trans.,' A, vol. 195, pp. 79–150.