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A Study in the Hereditary Transmission of Finger Patterns

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A STUDY IN THE HEREDITARY TRANSMISSION OF FINGER PATTERNS.

BY A. A. VEBLEN.

By finger patterns is meant figures formed by the minute papillary ridges upon the inside surface of the last joint of the thumb and fingers. They are most conveniently studied by inking the fingers with printer's ink and making impressions on paper or any smooth light surface to which the ink will adhere. Sir Francis Galton in his work "Finger Prints" and other publications, treats the subject of these patterns exhaustively and scientifically. The patterns are of practically infinite variety. They are also persistent and unchanging through the life of the individual, and are destroyed or obliterated only by violent and deep injuries to the fingers. Finger prints therefore constitute a certain and convenient means of personal identification. Though the patterns differ so much on different fingers, they may be classified under three general types, called the arch, the loop, and whorl. In the arch the lines or ridges run in a more or less regular transverse arrangement across the finger tip. In the loop the characteristic portion of the pattern is enclosed in a gulf-like or bay-like arrangement of ridges. The bay may open toward the thumb or the little finger side of the hand, or to the radial or the ulnar side. In the present discussion we shall use the terms as Galton uses them, calling these loops ulnar or radial according to the side toward which they open. When the ridges in the characteristic portion of the pattern assume a spiral or circular, or twisted arrangement, they are said to form a whorl. In a very few patterns the arrangement of lines is so irregular or anomalous as to make it difficult to decide as to their classification; but such cases are much rarer than might be expected.

Arch. Loop. Whorl.

Figure 1. Finger patterns.

It is found that 6.5 per cent of all patterns are arches; 26 per cent are whorls; and 67.5 per cent are loops. A combination of symbols or letters denoting the class of pattern on each of the digits of an individual is called the formula of his prints. The letters used are a, l, w, for arch, loop, and whorl; and u and r are used to indicate ulnar and radial loops, particularly on the index fingers. A very large number of such formulas is possible. Some of them are much more frequent than others.

Galton devotes a chapter to the question of heredity in finger prints. He finds a "decided tendency to hereditary transmission"; and his investigations point to a preponderance of maternal over paternal influence. One method pursued by him is to note the frequency of the occurence of patterns of the same class upon the same finger of the hands of parents and their children.

By a process differing somewhat from Galton's method, I have found what seems a clear case of hereditary influence on finger patterns. The case is that of the family of Mr. and Mrs. A, as we will call them here.

I have their finger prints and those of their eight living children and thirty of their grandchildren, as well as of the husbands and wives of the children, and of a few other relatives. Mr. A has loops on all ten digits, all opening to the ulnar side. His formula would be ull ull ll ll; which by the way is one of the most common formulas to be found. The patterns are small and very regular. Mrs. A has seven whorls and three loops, all large patterns. One son has nine loops and one whorl. The three other sons and the four daughters all have the same formulas as the father; or they have nothing but loops. Their patterns are very regular, but generally larger than those of the father.

One of the daughters, I, whose husband has 7 whorls and 3 loops, has five children who have altogether 12 whorls and 38 loops; or 76 per cent of all their prints are loops. One son, N, whose wife has 6 whorls and four loops, has eight children whose prints show 3 arches, 16 whorls and 61 loops. 76.25 per cent of their patterns are therefore

loops. A daughter, M, has six children with 2, 11 and 47 arches, whorls and loops respectively; or 78.3 per cent of loops. The father of these children has 1 arch, 3 whorls and 6 loops. He is the brother of N's wife; and I have the prints of the fingers of two of their sisters. These four members of that family have 62.5 per cent of loops, which is slightly less than the average number of loops among all prints. These four have 2 arches, 13 whorls and 25 loops. They do not show any decided family tendency to depart from the normal distribution of prints.

Another daughter, B, of Mr. and Mrs. A, has eight children who have 11 arches, 2 whorls and 67 loops. 83.75 per cent of their patterns are loops. B's husband also has 10 loops. H, the fourth daughter of the A's has three children, two of whom have 2 whorls and 8 loops each; but the third has 9 whorls and only 1 loop. The percentage of loops among these children is therefore only 57 which is lower than that of any of the other groups of grandchildren. The father of these three children has 2 whorls and 8 loops.

The thirty grandchildren have 16 arches, 54 whorls and 230 loops; 76.7 per cent of their prints are loops; which is an excess of 9.2 per cent over the normal. They are quite deficient in arches, except in the cases of two individuals, and they are somewhat deficient in whorls. Arches occur but rarely in most of the families into which the children of the A's have married.

Mr. A has a brother who has 9 loops and 1 pattern which may be called a loop with a very small whorl within it.

A half brother of Mrs. A had 10 loops. He was married to a sister of the wife of N and of the husband of M, she having 1 arch, 1 whorl and 8 loops. Prints from five of their children reveal 1 arch, 1 whorl and 48 loops, or 96 per cent of loops.

The number of radial loops is noticeably small in the children and grandchildren of the A's; except the children of B, whose husband has radial loops on his index fingers. Among their eight children are 4 radial loops on index fingers.

There is information at hand which points to an excess of loops in the families of both Mr. and Mrs. A. But relying simply on the records contained in the prints from the persons here mentioned, there seems to be good reason to conclude that there is a decided tendency to hereditary transmission of the type or general class of patterns. This is further supported by resemblances in the lesser characteristics of the patterns studied, such as their general regularity, the fineness of lines, slope and size of the loops, the sub-class of whorls where they occur, and the general symmetry of the prints. When these are considered it appears fairly certain that a decided family likeness in finger patterns is transmitted to the children and the grandchildren.

FACTORS OF EXTINCTION.

BY HERBERT OSBORN.

While we have come to recognize clearly the fact of extinction of animal types and their replacement by other forms of life there appears to have been less attention to the special factors concerned in such extinction, or, to put it differently we have been devoting our attention especially to the factors concerned in the production of new types, the variation and evolution of animals, rather than the factors of extinction. It is true that these may bear a close relationship and present mutual dependencies and possibly we might take them as necessary corollaries or consider factors of extinction as merely negative factors of evolution, but it seems to me worth while to attempt a distinct formulation of those factors especially concerned in the elimination of life forms even if for no other purpose than to emphasize those factors of progressive evolution against which they contrast.

In the first place there is a certain kind of elimination which can hardly be called extinction in the proper sense. I refer to the progressive evolution by which a particular