

## EVOLUTIONARY HISTORY OF FINGER PRINTS.

By W. W. C. BURGESS.

Mr. B. Wentworth and Professor H. Wilder have considered this aspect of finger print science very carefully. They say: Going back again to the most primitive case, where the surfaces (palmar and plantar) are covered with separate unit islands without definite arrangement there is much to suggest that the units themselves are modifications of the scales with which the bodies of typical reptiles are clothed, and which the earliest mammals still retained. At a later time the scales were lost over the rest of the body, but were retained in this modified form over the palmar and plantar surfaces, where they were eventually transformed into friction ridges.

The general arrangement of these ridges, the varying direction of their course over different areas, and especially the patterns, with their endless varieties, although they may seem at first to be entirely the result of chance, correspond, nevertheless, to a fundamental plan, which, like so many other problems of human structure, finds its explanation in Comparative Anatomy.

To begin with, the more primitive walking mammals, designed for life on the ground, and in burrows and clefts in the rocks, developed on the contact surface of each foot eleven raised pads or cushions, to bear the weight of the body and furnish the necessary elasticity; and in their modern representatives, like the squirrels, the mice, and the shrew moles, this condition is retained and may be easily studied. These eleven pads run across the paw in three transverse rows— (1) a proximal row near the wrist, (2) a middle row at the base of the digits, and (3) a terminal, or distal, row on the end joints of the digits. The proximal row consists of two pads, the thenar, on the inner or thumb side, and the hypo-thenar on the outer, or little finger side. The four pads of the middle row are placed just beneath the four intervals between the digits, and are conveniently called the interdigitals. The pads on the ends of the digits are naturally five in number, and are termed digital or apical.

These eleven pads are found to be surrounded by folds of skin, two, three, or four about each pad, and so arranged as to form a slight depression or pocket for the reception of the paw. At the points of contact of each two of the folds, they are prolonged to form a third edge, running away from the triangular pocket so that the whole structure, composed of the two edges which help to enclose the pad,

and the third edge, the prolongation away from the pad, makes a three pointed star, called a triradius. The region where these three folds meet is a DELTA.

The apical pads are peculiar in having but two deltas, while the folds coming up from them, and running towards the end of the digit, unite to form a large loop enclosing the pad.

All these surfaces, the pads, the folds, and the spaces between them, are covered with epidermic units, each with a sweat pore, and where they come into constant contact with external objects, as on the surfaces of the pads, they show the usual tendency to arrange themselves in rows and fuse into ridges. In mammals that walk on the ground the ridges on the pads run transversely across them, that is, in the direction best suited to cause friction and prevent slipping; but in certain animals that live in the trees, and are, in structure, part way between these terrestrial forms and the arboreal monkeys, the ridges upon the pads form themselves into concentric circles or ovals, the centre coinciding with the middle of the pad, where it is most elevated. This is the first appearance of true patterns, and it is interesting to note that they are in the form of whorls, and that they occur on all of the eleven pads.

The next step is shown in those monkeys which are wholly arboreal. Here the pads are reduced in height so that the palms and soles are nearly flat, and all parts of them come into contact with the tree boughs and other external objects. Thus the entire surface becomes covered with ridges, but, instead of running straight across, the newly added ridges retain the direction of the folds that originally surrounded the pads. Thus we now have, upon the flattened palmar and plantar surfaces, not a chance arrangement of ridges running in all directions, but a picture or drawing of the paw surface found in their terrestrial ancestors, with every detail of the pads and their surrounding folds. The pads are indicated by the patterns; the folds by lines and systems of ridges running at each point in the old direction, with the tri-radii and deltas as before. The flattening has simply removed the third dimension, and the relief has become a drawing.

As has already been shown, these ridged friction skin surfaces are of great functional importance to the smaller monkeys, where the ridges are large in proportion to the size of the animal and where their life continually depends upon the certainty of their grasp. When however, as has happened in the great apes, and in man, the body weight has become so considerable that skin ridges are of little value in grasping, their particular arrangement becomes of no account, and is allowed to degenerate. The patterns placed upon the raised cushions, and still of much value, in their whorled arrangement, in a little tree animal weighing ten or twenty pounds, are no longer any

better than ridges running straight across the palm, and are found in all stages of degeneracy or, more frequently, are entirely gone. Occasionally, however, a human palm may be found in which all the eleven patterns are present each in its proper position, and the five apical patterns, which still have some little use in handling small objects, are almost always present.

This sketch of the evolutionary history of the palmar and plantar surfaces is necessarily a brief one, but the reader is referred to the technical papers which, during the past dozen years, have elucidated this hitherto neglected subject, and put the history of the friction skin and its ridges on a plane with other departments of comparative anatomy. To those who prefer a rational explanation for such phenomena, and do not like to refer it all to chance, this explanation of the origin of the features found in the friction ridges may prove of interest.

#### PERSISTENCE OF PATTERN AND RIDGE CHARACTERISTICS.

The utility of finger prints as a reliable means of identification must be contingent upon the persistence through long periods of time of general form of pattern and of the details of the ridges constituting it.

The late Sir Francis Galton proved that the details of the ridges persist throughout the whole period representing the life of man, those found on the fingers of a new born infant being traceable on the fingers of the same person in old age and apparently effaceable only when after death, the skin perishes through decomposition: for example, the marks on the fingers of many Egyptian mummies, and on the paws of stuffed monkeys still remain legible.

The testimony of embryology (according to Professor Wilder) is strongly corroborative of the idea of persistence, for at the earliest stage of the human embryo at which ridge characteristics can be recognised they appear simultaneously over the entire palmar and plantar surfaces, covering it with a pattern quite of the adult type. This begins at about the fourth month of the embryo. The hands with each finger joint defined could be drawn in outlines within the limits of a copper cent, yet the palmar surfaces, of both palm and finger, bear already the very pattern which it is intended to carry through life. This method of the sudden and direct shaping of the final ridges, without a preliminary period with separate units is rather unusual, since generally, the embryo traces the important points in its evolutionary history, assuming in turn the successive stages. In some instances, as in the case of friction ridges, an organ, or set of organs drop out the earlier stages in the development and assumes at once the final form.

The persistence of ridge characteristics is continually being proved in our work here where natives are frequently found with very badly scarred or injured finger tips. It would seem impossible in many cases for a pattern to repeat itself, yet when the injury has healed (provided the sweat glands are not destroyed) the exact repetition of the original pattern reappears.

The finger print bureau is frequently called upon to identify a deceased person; sometimes when the body is mutilated, or in an advanced state of decomposition, or both. These conditions do not however, prevent a positive identification being made so long as it is possible to take reasonably clear impressions. The Central Finger Print Bureau at Nairobi has been established 4½ years, and in that time over 107,000 persons have been identified by the finger print system, 800 of whom were identified after death.

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#### A FEW NOTES ON BEES IN LUMBWA DISTRICT.

By C. M. DOBBS.

Various kinds of bees are recognised by the Lumbwa, who have different names for the different species. The following is a list of the names with a short account of the peculiar features of each. In each case the name is given in the plural:

(1) SEGEMIK.

This is the name applied to bees in general and in particular, signifies the ordinary bee which produces the honey of commerce. They are larger than the others and are provided with stings. Their natural nests are holes in trees but they go of their own accord into the native's honey barrels. These barrels (Moingonik) are made from the trunks of trees split in two and hollowed out. A honey barrel is filled in about a year. When full, the bees are driven to one side by smoke, and the honey is extracted. The principal month for swarming is January (Mulkul). These bees will, as a rule, go into any box that is placed in a suitable position and take quite well to an English bee-hive.

(2) KOSOMEK.

These bees are very small and rather like flies. They live in holes in the ground. These holes are very small and extremely hard to find. Only one bee can get in and out at a time. They are found in the bush country after the jungle has been burnt. They do not sting. The actual nest is not more than eighteen inches below the surface. The honey is no use commercially.