

a permanent difference would remain in the lengths of the two spirals, that is, there would now be a permanent twist.

Information regarding the fluidity of tempered steel, copper, brass, lead, tin, &c., will be found in the papers of M. Tresca, and in the second of the Cantor lectures delivered by Mr. Anderson before the Society of Arts April 19, 1869, as well as in Mr. Anderson's book on the "Strength of Materials," and in Mr. Bottomley's reports communicated at the Meetings of the British Association in 1879-80. We do not think, however, that much of the valuable information on the fluidity of metals which is scattered through the *Proceedings* of the different societies has yet been collated. Wire-drawers, watch and clockmakers, as well as the makers of philosophical instruments and of other small machinery, have a considerable amount of knowledge of this subject which they cannot systematise and make known to others, but which, nevertheless, they make ready use of in their work.

Finally, we would suggest that if Major Herschel wants his wire to obey Hooke's law for small twists only, he will not find it necessary to destroy the properties which are due to its being annealed. If, however, he desires to use greater twists, it will be necessary to leave the wire under a fairly large pull for a considerable time without twisting it until it ceases to continuously yield to tensile stresses of greater intensity than that of the shear stress to which it has afterwards to be subjected. And if in Mr. Allan Broun's gravimeter it be necessary to employ such large twisting couples as Major Herschel was using in his experiments, we would suggest the employment of a longer and thicker wire.

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On the Skin-furrows of the Hand

IN looking over some specimens of "prehistoric" pottery found in Japan I was led, about a year ago, to give some attention to the character of certain finger-marks which had been made on them while the clay was still soft. Unfortunately all of these which happened to come into my possession were too vague and ill-defined to be of much use, but a comparison of such finger-tip impressions made in recent pottery led me to observe the characters of the skin-furrows in human fingers generally. From these I passed to the study of the finger-tips of monkeys, and found at once that they presented very close analogies to those of human beings. I have here few opportunities of prosecuting the latter study to much advantage, but hope to present such results as I may attain in another letter. Meanwhile I would venture to suggest to others more favourably situated the careful study of the lemurs, &c., in this connection, as an additional means of throwing light on their interesting genetic relations.

A large number of nature-prints have been taken by me from the fingers of people in Japan, and I am at present collecting others from different nationalities, which I hope may aid students of ethnology in classification. Some few interesting points may here be mentioned by way of introduction.

Some individuals show quite a *symmetrical* development of these furrows. In these cases all the fingers of one hand have a similar arrangement of lines, while the pattern is simply reversed on the other hand. A Gibraltar monkey (*Macacus innus*) examined by me had this arrangement. A slight majority of the few Europeans I have been able to examine here have it also.

An ordinary botanical lens is of great service in bringing out these minor peculiarities. Where the loops occur the innermost lines may simply break off and end abruptly; they may end in self-returning loops, or, again, they may go on without breaks after turning round upon themselves. Some lines also join or branch like junctions in a railway map. All these varieties, however, may be compatible with the general impression of symmetry that the two hands give us when printed from.

In a Japanese man the lines on both thumbs form similar spiral whorls; those of the left fore-finger form a peculiar oval whorl, while those of the right corresponding finger form an open loop having a direction quite opposite to that of the right fore-finger in the previous example. A similar whorl is found on both middle fingers instead of a symmetrically reversed whorl. The right ring-finger again has an oval whorl, but the corresponding left finger shows an open loop.

The lines at the ulno-palmar margin of this particular Japanese are of the parallel sort in both hands, and are quite symmetrical, thus differing from the Englishman's considerably. These in-

stances are not intended to stand for typical patterns of the two peoples, but simply as illustrations of the kind of facts to be observed. My method of observation was at first simply to examine fingers closely, to sketch the general trend of the curves as accurately as possible, recording nationality, sex, colour of eyes and hair, and securing a specimen of the latter. I passed from this to "nature-printing," as ferns are often copied.

A common slate or smooth board of any kind, or a sheet of tin, spread over very thinly and evenly with printer's ink, is all that is required. The parts of which impressions are desired are pressed down steadily and softly, and then are transferred to slightly damp paper. I have succeeded in making very delicate impressions on glass. They are somewhat faint indeed, but would be useful for demonstrations, as details are very well shown, even down to the minute pores. By using different colours of ink useful comparisons could be made of two patterns by superposition. These might be shown by magic lantern. I have had prepared a number of outline hands with blank terms for entering such particulars of each case as may be wanted, and attach a specimen of hair for microscopic examination. Each finger-tip may best be done singly, and people are uncommonly willing to submit to the process. A little *hot* water and soap remove the ink. Benzine is still more effective. The dominance of heredity through these infinite varieties is sometimes very striking. I have found unique patterns in a parent repeated with marvellous accuracy in his child. Negative results, however, might prove nothing in regard to parentage, a caution which it is important to make.

I am sanguine that the careful study of these patterns may be useful in several ways.

1. We may perhaps be able to extend to other animals the analogies found by me to exist in the monkeys.

2. These analogies may admit of further analysis, and may assist, when better understood, in ethnological classifications.

3. If so, those which are found in ancient pottery may become of immense historical importance.

4. The fingers of mummies, by special preparation, may yield results for comparison. I am very doubtful, however, of this.

5. When bloody finger-marks or impressions on clay, glass, &c., exist, they may lead to the scientific identification of criminals. Already I have had experience in two such cases, and found useful evidence from these marks. In one case greasy finger-marks revealed who had been drinking some rectified spirit. The pattern was unique, and fortunately I had previously obtained a copy of it. They agreed with microscopic fidelity. In another case sooty finger-marks of a person climbing a white wall were of great use as negative evidence. Other cases might occur in medico-legal investigations, as when the hands only of some mutilated victim were found. If previously known they would be much more precise in value than the standard *marks* of the penny novelists. If unknown previously, heredity might enable an expert to determine the relatives with considerable probability in many cases, and with absolute precision in some. Such a case as that of the Claimant even might not be beyond the range of this principle. There might be a recognisable Tichborne type, and there might be an Orton type, to one or other of which experts might relate the case. Absolute identity would prove descent in some circumstances.

I have heard, since coming to these general conclusions by original and patient experiment, that the Chinese criminals from early times have been made to give the impressions of their fingers, just as we make ours yield their photographs. I have not yet, however, succeeded in getting any precise or authenticated facts on that point. That the Egyptians caused their criminals to seal their confessions with their thumb-nails, just as the Japanese do now, a recent discovery proves. This is however quite a different matter, and it is curious to observe that in our country servant-girls used to stamp their sealed letters in the same way. There can be no doubt as to the advantage of having, besides their photographs, a nature-copy of the for-ever-unchangeable finger-furrows of important criminals. It need not surprise us to find that the Chinese have been before us in this as in other matters. I shall be glad to find that it is really so, as it would only serve to confirm the utility of the method, and the facts which may thus have been accumulated would be a rich anthropological mine for patient observers.

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[Some very interesting examples of nature-printed finger-tips accompanied this letter.—ED.]