

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 lockmakers, 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.

JOHN PERRY
W. E. AYRTON

London, October 18

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 those 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 these 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 immus*) 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 forms 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 *mole* 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.

HENRY FAULDS

Tsukiji Hospital, Tokio, Japan

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

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]

The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.]

Fertilisation of Yucca

IN NATURE, vol. xxii, pp. 606, 607, appears a letter to which my attention has only to-day been called—signed E. L. Layard—on the subject of the fertilisation of yuccas successfully introduced and cultivated in New Caledonia.

The writer shows himself to be under some misapprehension as to the generic characters and appearance of the insect which is generally credited with the fertilisation of these plants in their native country. The moth of the genus *Pronuba*, to which he refers, is not a "large moth having yellow under-wings." Although a common species belonging to the *Noctuidæ*, standing in our British lists under the genus *Triphana* (Ochs), but included in Dr. Standinger's European Catalogue in the genus *Agrotis* (Ochs), is distinguished by the specific, not generic, name *pronuba* (Lin.), as well as by the characteristic appearance to which your correspondent evidently alludes.

The genus *Pronuba* (Riley) was founded for the reception of *Pronuba yuccasella* (Riley) (see *Proceedings Acad. Sci. Missouri*, ii, pp. 55, 333; *Report Nox. Ins. Missouri*, v. 151, vi. 131; *Canadian Entomologist*, iv. 182; Hayden's *Bulletin of the U.S. Geological and Geographical Survey*, iii. 121-141, &c.), which has also been described by Prof. Zeller in the *Verhandlungen der zoologisch-botanischen Gesellschaft in Wien*, 1873, vol. xxiii, pp. 232, 233, under the name *Tegeticula alba*.

This small white moth, of which some varieties have a few black dots on the fore-wings, belongs to the Lepidopterous group *Tineina* (Stn.), possibly to the family *Hyponomeutidae*. Prof. Riley finds that the female, which has the basal joints of the maxillary palpi developed into a long curved tentacle furnished with spines, uses these appendages to collect and convey the pollen of the yucca to the tube of the stigma, which it could not otherwise reach; the eggs are then deposited, and the larva feeds upon the fruit, subsequently hibernating and becoming a pupa on the earth. It would be most interesting to ascertain whether *Pronuba yuccasella* (Riley) has been introduced with the yucca into New Caledonia, or whether any other insect, either indigenous or not indigenous to North America, has been found to take its place in carrying on the work of fertilisation. Prof. Riley considers the fact that yuccas introduced into the more northern portions of America have failed to produce seed may be attributed to the absence of *Pronuba*.

If Mr. Layard will direct his attention to this point he can scarcely fail to supply some valuable and instructive evidence bearing upon the subject.

WALSINGHAM

Eaton House, Eaton Square, November 13

Skin Furrows of the Hand

ALLOW me to contribute the information in my possession in furtherance of the interesting study undertaken by your Japan correspondent (vol. xxii. p. 605).

I have been taking sign-manuals by means of finger-marks for now more than twenty years, and have introduced them for practical purposes in several ways in India with marked benefit.

The object has been to make all attempts at personation, or at repudiation of signatures, quite hopeless wherever this method is available.

(1) First I used it for pensioners whose vitality has been a distracting problem to Government in all countries. When I found all room for suspicion effectually removed here, I tried it on a larger scale in the several (2) registration offices under me, and here I had the satisfaction of seeing every official and legal agent connected with these offices confess that the use of these signatures lifted off the ugly cloud of suspiciousness which always hangs over such offices in India. It put a summary and absolute stop to the very idea of either personation or repudiation from the moment half a dozen men had made their marks and compared them together. (3) I next introduced them into the jail, where they were not unneeded. On commitment to jail each

prisoner had to sign with his finger. Any official visitor to the jail after that could instantly satisfy himself of the identity of the man whom the jailor produced by requiring him to make a signature on the spot and comparing it with that which the books showed.

The ease with which the signature is taken and the hopelessness of either personation or repudiation are so great that I sincerely believe that the adoption of the practice in places and professions where such kinds of fraud are rife is a substantial benefit to morality.

I may add that by comparison of the signatures of persons now living with their signatures made twenty years ago, I have proved that that much time at least makes no such material change as to affect the utility of the plan.

For instance, if it were the practice on enlisting in the army to take (say) three signatures—one to stay with the regiment, one to go to the Horse Guards, and one to the police at Scotland Yard—I believe a very appreciable diminution of desertions could be brought about by the mere fact that identification was become simply a matter of reference to the records.

And supposing that there existed such a thing as a finger-mark of Roger Tichborne, the whole Orton imposture would have been exposed to the full satisfaction of the jury in a single sitting by requiring Orton to make his own mark for comparison.

The difference between the general character of the rugæ of Hindoos and of Europeans is as apparent as that between male and female signatures, but my inspection of several thousands has not led me to think that it will ever be practically safe to say of any single person's signature that it is a woman's, or a Hindoo's, or not a male European's. The conclusions of your correspondent seem, however, to indicate greater possibilities of certainty. In single families I find myself the widest varieties.

15, St. Giles, Oxford, November 13

W. J. HENSCHEL

P.S.—It would be particularly interesting to hear whether the Chinese have really used finger-marks in this way. Finger-dips (mere blots) are common in the East, as "marks."

The Aurora of the 3rd Instant

MR. E. DOWLEN has kindly communicated to me some particulars of the above as seen by him at Southport.

He first noticed the aurora at 6h. 50m. (it had however been visible before that time) as a greenish white glow on the north horizon. This gradually rose until 7h. 45m., when the top of the arch was estimated at two-thirds of the way up between the horizon and the Great Bear. It then gradually died out from the ends of the arch, and at 8h. 30m. had disappeared. During the time it was watched the following changes took place:—

From 7h. to 7h. 15m. it faded away from the eastern end until 7h. 30m., when nearly half the arch was gone. The western end then seemed to gather itself up somewhat, and to get brighter. After this the ends again lengthened out until 7h. 45m., when the whole began to fade away. At 7h. 25m. a narrow-arched band of black cloud concentric with the auroral arch was formed. It seemed to start from the ends, and meet over the middle point. At first this lay close upon the aurora. It then rose quickly, passed through the Great Bear, and vanished. It took about ten minutes to form, rise, and disappear.

Mr. Dowlen saw no streamers, but faint ones might have been present and escaped notice owing to adjacent gas-lamps. The aurora was at no time bright, and Mr. Dowlen doubts whether any beyond the green line would have been seen in the spectroscope.

The cloud formation detailed seems to me of considerable interest.

J. RAND CAPRON

Guildown, November 19

Temperature of the Breath

THERE is no doubt that Dr. Roberts has discovered the true explanation of the phenomena that puzzled me and a good many others to whom I showed them. I have repeated Dr. Roberts's method of heating the enveloping material so as to expel all moisture from it, cooling it down to the temperature of the room and then breathing through it. In every case where I did so the thermometer showed a rise to 112° and upwards at the end of a minute; at the end of two minutes the index was pushed into the small bulb at the top, showing a temperature of about 116°. It is evident, therefore, that the high temperature observed is not the actual temperature of the breath, but is