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FINGER PRINTS AND FINGER PRINTING

An Historical Study

Cyril John Polson

Cyril John Polson, M.D., F.R.C.P., Barrister-at-Law, is Professor of Forensic Medicine at the University of Leeds, England. For this article Dr. Polson made an extensive survey of historical documents and books dealing with the history of finger prints and finger printing and has compiled a comprehensive report of the work of those who were responsible for the introduction and use of finger printing as a means of personal identification. In this paper he has attempted to reevaluate the work of each early worker in this field so that despite long standing controversies and personal claims each might be given his proper share of credit. Because of the length of this paper it has been found necessary to publish it in two parts, the second of which is to appear in the following issue of this JOURNAL—EDITOR.

The practical use of finger prints as a means of identification, notably of criminals, is now a commonplace. Indeed, the process has become "a simple story of a long and tedious job well done." Even so, the untiring patience, persistence, and skill of a team of experts cannot fail to excite admiration, especially when their work is crowned with success.

The story of the identification of Griffiths, who murdered June Anne Devaney in 1948, told by Mr. Looms, Chief Constable of Blackburn and Detective Chief Inspector Campbell, of the Lancashire Constabulary, again demonstrates the value which may now be set upon finger printing.

It is well to recall that investigations of this calibre only had their beginnings as recently as October, 1880. It was not until 1901 that active steps were taken to create a finger print bureau in this country. In the relatively short time which has elapsed, a considerable national organization is now linked with bureaux of world-wide distribution. Several generations of experts have been trained and to-day, whether it be, for example, London, Edinburgh, Glasgow, Preston, or Wakefield, a skilled team is immediately available to investigate finger print evidence.

Some idea of the speed with which these facilities are available is given by the Devaney case. The child was missed at about 1:30 a.m.; the local police were notified at 1:55 a.m.; and the body was found at 3:17 a.m. Mr. Campbell had arrived to commence investigations by 5:10 a.m., and, within another twelve hours, a team of twelve of his colleagues had begun the first of the large scale finger print examinations. (Looms & Campbell, 1949; 1950.)¹

1. EDITOR'S NOTE. All references noted in this article are listed in a bibliography which follows the second installment of this article and will appear in next issue.

It is now familiar knowledge that the pattern of finger prints is peculiar to the individual and that the possibility of any two persons having identical finger prints is infinitely remote. Having demonstrated coincidence of two sets of impressions, it is beyond all reasonable doubt that they were made by one and the same person. Moreover, it is now equally well-known that the pattern is unchanged by time, and it cannot be impaired beyond expert recognition, by age or injury. Scars, modifying the pattern, serve only to strengthen the significance of the impressions.

In short, finger print evidence is not rarely the sole basis of identification. This is well known to criminals, and, when their identity has been established solely by finger prints, they are often ready to plead guilty to their crime.

Finger printing is still largely confined to the detection of criminals, but it should not be forgotten that it has value in other fields, wholly unconnected with crime. There are a number of advantages which would be derived from the institution of a national finger print register. At the same time, doubtless because of its criminal associations, public opposition remains strong.

Although the police are denied the benefits of such a register, the precedent created in Blackburn is not an inconsiderable compromise. The detection of the murderer of June Anne Devaney involved the finger printing of the whole of the adult male population of a town of over 100,000 inhabitants. This task was practicable through the willing cooperation of the public, led by the Mayor of Blackburn. It was promised that, at the conclusion of the investigation, the records would be, and were, publicly destroyed. No valid objection could be made to a procedure of this kind in circumstances where it offers the only likely means of detecting the criminal.

The story of finger prints and finger printing has been told by many but by none so well as Wilton (1938), whose vindication of Faulds has special value in its accurate documentation and research. Subsequent authors continue to err by omission or inaccuracy and, therefore, no apology is offered for a re-examination of the evidence.

THE ANCIENT USE OF FINGER MARKS IN THE EAST.

It has been claimed that finger printing was known and applied in the East long before the time of Herschel and Faulds (Laufer, 1913; 1917). This claim was denied by Herschel even until 1916. When he wrote of his voyage in the S.S. "Mongolia" in 1877, he said he had then made enquiry of his fellow passengers, including "business men on

their way back to the Far East. . . . If any one of them had heard of the use of these marks, say in China, I could not but have been told of it. But there was not a breath of the sort" (Herschel, 1894).

In the light of the evidence now available, it is clear that Herschel was misinformed. Finger marks had had a practical value in the East for centuries, but there is room for opinion concerning the precise use made of them. They may, for example, have been the basis of systems of palmistry or superstitious practices. It is the present purpose to consider only their use in identification and to determine how far, if at all, the making of finger marks was more than the making of a mark by illiterates or a formal act in the execution of a document. It is also relevant to consider the precise nature of the mark, i.e., whether it was made by the finger tip or by the pad of the finger.

Yule's account of the customs in Ancient China in the XIV Century, derived from the writings of Raschid (A.D. 1303), the Persian historian, is cited (e.g., Laufer, 1917) as evidence of finger printing in the past. It was said that members of the Council of State then verified their decisions by applying their "finger-signatures" to the record. It appears, however, when Sainsbury examined the original on behalf of Wilton, that the meaning of "finger-signature" did not appear there. It seems to have been an interpolation by Yule, in lieu of a footnote (Wilton, 1938).

In "The Road to Cathay," Yule also described the practice by which documents were "signed" by a tracing of the signatory's hand. The hand was placed on the document, and an outline drawn round the fingers up to the divisions (the rendering "knuckles" was questioned by Sainsbury). It is clear, from this account, that the Chinese had appreciated that no two individuals had fingers alike. Tempting though it might be to infer that this meant finger impressions, it is more probable that it referred only to the gross outline of the hand. Those who are familiar with Gayer's (1909) "Footprints," based on Baden-Powell's scouting and the practice of native Indian trackers, will recall that, although he completely ignored the skin pattern of the foot, he recognized the individuality of footprints in terms of their gross appearance. It is not possible to agree, with Cordier (1914), who edited the Hakluyt Edition of Yule's "The Road to Cathay," that the evidence was "peremptory proof of the antiquity of the use of finger prints by the Chinese."

Marks made by the finger-tips, dipped in ink, had long been practised. The Japanese, for example, borrowed the idea from the Chinese, who had used finger marks at least as far back as the 7th Century. These "nail stamps" were made by the thumb tip and the edge of its nail. When



Figure 1.

Chinese Contract of Loan, A. D. 782, bearing finger marks (lower left center). (By Courtesy of the Trustees of the British Museum. Stein MSS. No. A.5871).

the contract or agreement was made under oath, the mark was made by the ring finger "inked" with blood drawn from it (Minakata, 1894).

The ancient use of impressions of this kind is proved by the discoveries of Sir Aurel Stein (1907), during his excavations of 1900-1901, in southern Chinese Turkestan. His collection of 7,000 manuscripts included 380 which were dated; amongst the latter there were certain contracts which bear the finger marks of the parties.

The most notable of these contracts, one which was found entire, was dated A.D. 782 (Fig. 1). It relates that a soldier, being in pressing need of money, borrowed 1,000 pieces from Ch'ien Ying, a monk, at the interest rate of 10%. He agreed to repay the money when the lender had need of it or, by default, the lender could seize his furniture and cattle in compensation. The parties, having agreed to the contract as clear and equitable, then affixed the impression of their fingers "pour servir de marque." (No. S.5871, Giles & D.VII 2, Plate CXV, Stein.) A similar clause, which differs only by the inclusion of the phrase, "being in the presence of each other" was included in a contract for the loan of grain, also dated A.D. 782; the lender being the same Ch'ien Ying (D.VII 4a, Plate CXV, Stein). Chavannes's French rendering of the Chinese does not qualify "marque" as "distinctive"; Laufer's version (1917) is not, therefore, in accordance with the text. It is not to be implied that these marks were distinctive in the sense that they were

impressions of the finger pattern by which the parties could be identified.

Wilton (1938) examined the original contract and said, "To the eye of the layman, the finger marks upon the one that is entire do resemble blobs. With the magnifying glass, it is difficult to discern finger-ridge lineations. The marks seem to have been made more by the tips than by the bulbs or pads of the fingers."

Lionel Giles (1937), who published a detailed description of the Stein manuscripts, regarded these marks as a sort of guarantee of good faith. "It must not be imagined that this served any purpose of identification like our modern finger-prints, for the impression is merely a small blob of ink in which no fine lines are traceable; it is comparable rather with the custom of making one's mark once practised by illiterates in this country. In many cases, indeed, brush-marks in the shape of a rude cross or the like take the place of finger-marks in these mss." (Giles, 1944; 1950).

The Stein manuscript (S.5871) bears finger marks which are as blobs. Their area ranges from 7 to 13 sq.mm., and they are, therefore, smaller even than *tep-sai*, which, as illustrated by Herschel (1916) and personal test, have an area of approximately 64 sq.mm. Touch impressions of an index finger are yet appreciably larger because in adults their area is likely to be from about 130-150 sq.mm., for women, and from about 190-210 sq.mm., for men. Even when due allowance is made for individual difference in the size of finger, and difference in the amount of pressure used, the marks on the Stein manuscript could not have been "touch" impressions by adults, and they were appreciably less in size than a *tep-sai*.

In proceedings for divorce, the documents were written by an official, but the parties signed them by hand stamps, or impressions of the thumb and four fingers (Aston, 1906; Wilder & Wentworth, 1918). Katurakawa, cited by Minakata (1894), said that the husband, when unable to write, signed with an impression of his index finger, a practice which the Japanese borrowed from the Chinese. Contracts for the sale of a wife were marked or smeared with impressions from the inked surface of the inner aspect of the hand and sole of the foot (Wilder & Wentworth, 1918). It was thought, but is not now confirmed, that documents exist on which the Mikados authenticated their signatures by an impression of the hand in red ink (Aston, 1906).

Herschel (1916) said that in Bengal "the common way for illiterates to sign is to wet the tip of one finger with ink from a pen, and then touch the document (leaving a small black blot) where we touch a wafer." This *tep-sai*, or pressure token, resembles the nail mark of the Chinese.

It is useless for the purpose of identification since it does not reproduce the pattern of the finger tip. Moreover, its size is likely to be much the same when made by any number of adults. Personal tests showed that the tep-sai had an almost identical appearance and dimensions as that depicted by Herschel. When the finger was lightly inked, a fragment of skin pattern occasionally appeared, but the majority of tests yielded only blobs.

Evidence of Chinese practice between A.D. 782 and A.D. 1850 is scanty. The facsimile of a land contract dated 1839 is the sole, reliable evidence (Meadows, 1847). This demonstrates that the Chinese then made touch impressions, of thumb or index finger, of a quality which permits classification.

This impression has an area of 110 sq.mm., and therefore, if made by an adult, it was made by a woman. Tests showed that women's impressions are likely to have an area of less than 150 sq.mm., whereas those of men are about 200 sq.mm., in area. The difference in size between the impression in the Chinese document and test female impressions is likely to be due to individual difference in the size of finger and degree of the pressure applied by it. These differences are likely to be of the order of about 20 sq.mm., and, therefore, insufficient to bring a female impression, unless exceptional, into the male range. In the present case, since the document was presumably signed by an adult, it must have been by a woman or, as a remote possibility, a man with a finger of exceptionally small size. The pattern of the imprint and the absence of evidence that the small finger has ever been used in these circumstances, counter the possibility that this impression was of a man's little finger.

Mr. Colin Campbell (1950) sent me this opinion on the impression shown on the facsimile of the contract, taken from the volume in the School of Oriental and African Studies, University of London. "The impression of the Land Contract was made by a finger; I think, a left forefinger. It is a whorl with an inner ridge tracing. According to the Battley system the core would be described as an 'A.4.' There is evidence of what has been a severe injury; this is denoted by a scar which runs from the region of the right delta towards the centre of the finger. No deltas are visible. There is more than sufficient ridge data disclosed to enable positive identification to be made."

Galton (1892) concluded that the ancient Chinese made finger marks which were only "daubs." He referred to the article by Meadows on "Land Tenure in China," and to the sale of land "in facsimile and its translation." He described, however, only the wood-cut, included in

the English translation. "The impression, as it appears in the wood-cut, is roundish in outline, and was therefore made by the tip and not the bulb of the finger. Its surface is somewhat mottled, but there is no trace of any ridges."

It is not surprising that Wilton (1938), having a facsimile of the Chinese text, bearing an unequivocal touch impression of a finger, was at a loss to understand Galton's observations.

The present research shows that there are at least four facsimiles of this Chinese contract, namely, two in Chicago, and one each in London and Cambridge. The finger print does not appear on all these facsimiles. The first, in a volume which belonged to Laufer, now in the Field Museum of Natural History, Chicago, was the source of the plates published by Laufer (1917) and Wilton (1938). The second, in the University of Chicago, bears no finger print (photostat, 1950). The third is discussed above. The fourth, at Cambridge, for some reason not determined, also bears no trace of any finger print. It cannot be proved, but it may be, that Galton examined the Cambridge facsimile. In that event he was bound to rely on the wood-cut, and his opinion, if erroneous, at once becomes intelligible.

Evidence to show that the Chinese did in fact use finger impressions to establish identity is slender. There is, for example, no record of frustration of attempts to repudiate contracts by finger print comparison. It was said that Chinese sailors, when shipped aboard junks, signed on by making an impression of five fingers, instead of only one, and Hough (1886) thought this was done to make identification more certain. A newspaper article, "The World of Wonders," of March, 1883, recalled by James (1886), described the practice of thumb printing important criminals in some parts of the Chinese Empire. The impressions were stored, and, if the offenders "should ever again fall into the hands of the police, another impression at once affords the means of comparison." This brief letter by James, retailing information at second-hand, is sometimes cited as evidence of ancient Chinese practice. It is of moment therefore, to note also this phrase: "We photograph their faces, they take impressions from their thumbs." Is it not within the bounds of possibility, if not probability, that the original article was based upon Faulds's letter to "Nature" (1880)? In a footnote to that letter he said: "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." If the source, cited by James, was, in fact, retailing this remark by Faulds, it

should have continued to say that Faulds had "not yet, however, succeeded in getting any precise or authenticated facts on that point."

According to Hough (1886), some rudimentary classification of impressions had been devised. "Dr. D. B. McCartee informs us that the Chinese class the striae at the ends of the fingers into 'pots' when arranged in a coil, and 'hooks' when they form a curving loop."

It cannot be maintained, with A. S. Giles (1908), that modern finger printing "was borrowed straight from China." Nor is there any ground for the inference by Söderman and O'Connell (1938) that Galton used McCartee's reported information as the basis of his system of classification. These authors not only misquoted the reference to Dr. McCartee, but they also misinterpreted Heindl's views on Galton's classification. Even if Galton derived a primary grouping of whorls and non-whorls from the Chinese, "by far the larger part of Galton's formula of his registration method cannot be traced back, in Dr. Heindl's view, to Chinese models" (Wilton, 1938). There is nothing comparable between Galton's arches, loops, and whorls, and the crude pots and hooks, alleged to have been recognized by the Chinese.

EARLY ANATOMICAL STUDIES OF THE FINGER SKIN.

Anatomical writings are silent about the pattern of the finger skin until late in the 17th Century. The earliest accounts traced by Cummins and Midlo (1943) were those of Grew (1684), Bidloo (1685), and Malpighi (1686).

Grew (1684), in an account notable for its clarity and brevity, described the pores of the skin of the hands and feet. His original illustration is an excellent engraving of a left hand, in which the pattern of the digits, except that of the ring finger, is well shown; the thumb bears a whorl, and there are ulnar loops on the other digits. The pattern on the ring finger is represented only by a number of dots. The plate was re-drawn for the 1809 abridgement of the Transactions. Although this engraving is coarser, it shows an ulnar loop on the ring finger and the openings of the sweat glands (Fig. 2).

The drawing of the palmar aspect of a thumb by Bidloo (1685) shows a whorl of which the ridges are exaggerated, but it is believed otherwise an accurate study.

In his account of "De Externo Tactus Organo," Malpighi (1686) made a brief reference to the ridges of the skin and the openings of the sweat glands.² "Finally, we have to examine the hand. On its palm

2. I am indebted to my colleagues, Dr. R. J. Scothorne, for tracing the relevant passage, and Professor E. J. Wood, for its translation.

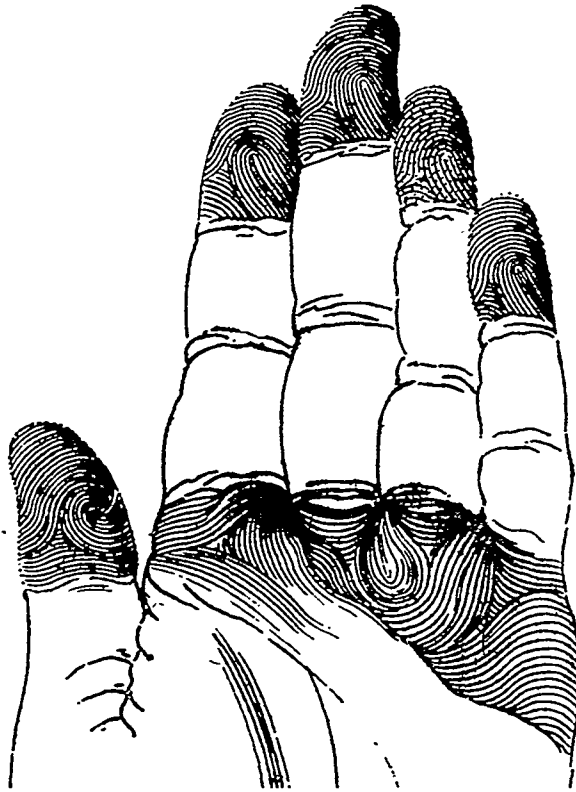


Figure 2.

A re-drawing in 1809 of the illustration by Grew, 1684, showing added detail on the ring finger. (By Courtesy of the Librarian and Keeper of the Brotherton Collection, University of Leeds).

certain well-marked wrinkles describe various patterns; at the fingertips, however, these wrinkles curve spirally and, if examined through a microscope, show open pores for sweat along the middle of a protracted ridge."

The plate by Mayer (1788), brought to notice by Cummins and Midlo (1943), shows the details of the pattern of the digits together with an enlargement of that of a thumb. Mayer had appreciated that "the arrangement of skin ridges is never duplicated in two persons, nevertheless the similarities are closer among some individuals. In others the differences are marked, yet in spite of their peculiarities of arrangement all have a certain likeness" (Translated by Cummins and Midlo).

It will be seen that Purkinje (1823) was not the first to describe the pattern of the finger skin. He was, however, the first to attempt a classification, and he recognized nine groups, which included ellipses,



Figure 3.

Finger print in a Vignette by Thomas Bewick, 1827. (By Courtesy of the Librarian and Keeper of the Brotherton Collection, University of Leeds).

almonds, circles, spirals, etc. It was in no way a workable classification, and he was not interested in, nor aware of, the practical application of his observations. (Our knowledge of this rare Breslau thesis is due to Galton (1892), who published an English translation of the relevant section.)

Thomas Bewick



Figure 4.

Thomas Bewick's mark as used on his receipt, enclosed with copies of "The Fables of Aesop," 1818. (By Courtesy of R. B. Fishenden, Esq., Technical Editor, King Penguin Books, and Penguin Books, Ltd.).

THE USE OF FINGER MARKS BY THOMAS BEWICK AND OTHERS, PRIOR TO 1880.

The earliest known use of finger prints in England was by Thomas Bewick (1753-1823). His famous "British Birds" (1797-1804) included a vignette, which shows a village scene almost wholly "obliterated" by an impression of a finger (Fig. 3). This engraving was



Figure 5.

Thomas Bewick's mark as shown in his "Memoir" in 1862. (By Courtesy of the Librarian and Keeper of the Brotherton Collection, University of Leeds).

reprinted in his 1827 collection of "Vignettes." The illustrated edition of Aesop's Fables, (Bewick, 1818), sometimes included a receipt on which he printed his "mark" (Austin Dobson, 1889). This was a finger impression with the legend, "Thomas Bewick, his Mark" (Fig. 4). The engraving reproduces his signature, as written on one of his letters, now in the Brotherton Library of the University of Leeds. This "mark" is seen on the spine of Austin Dobson's "Thomas Bewick and his Pupils" (1889), and on the back of the cover of John Rayner's "Wood Engravings by Thomas Bewick" (1947).

Bewick's "Memoir," which was published by his daughter in 1862, ends with a second version of his "mark." Its detail, even of the skin pores, is excellent and classification of the impression is practicable (Fig. 5).

Herschel (1916) was able to trace only these three engravings of Bewick's finger prints. The present search has yielded a fourth, namely, a partial impression of a finger (Fig. 6). It forms part, at the left upper corner, of the engraving entitled "The Alarm," reproduced by Austin Dobson (1889) on page 142 of his "Thomas Bewick and His Pupils." Mr. Cox, of the Brotherton Library, traced the history of this wood-cut. It was published in the "Memoir" of 1862 where, on page 325, it was stated by Miss Bewick to be then published for the first time. In the 1887 edition of the "Memoir," however, Austin Dobson drew attention to a copy of it in the "Treatise on Wood Engraving" by John Jackson (1839), one of Bewick's pupils. It was originally intended for inclusion

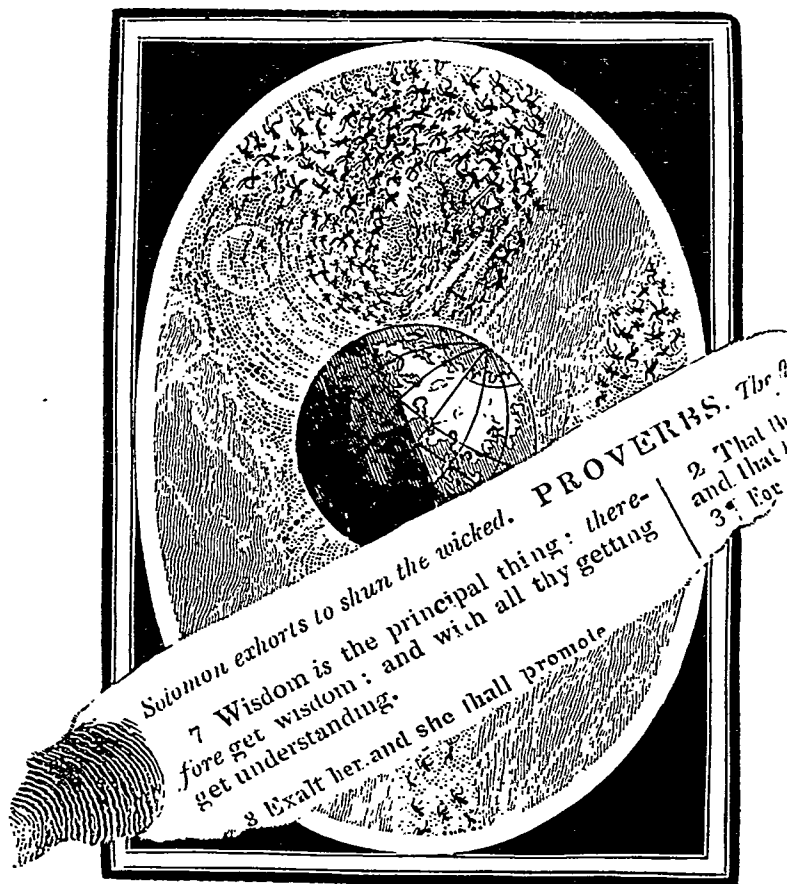


Figure 6.

Partial finger print, included in Bewick's engraving "The Alarm" circa 1818. (Reproduced by Courtesy of the Librarian and Keeper of the Brotherton Collection, University of Leeds).

in Bewick's "Fables of Aesop" of 1818. The illustration is interpreted by Dobson as representing the imps of hell setting off "like a whirlwind, amidst the glare of lighting and the roar of thunder, to take up their abode in the minds of men."

The Bewick prints were submitted to Detective Chief Inspector Campbell (1950) for classification. He properly expressed due caution "because, after all, they are engravings, and although they are superb examples of craftsmanship, they do not have quite the same delineations as real finger prints." Subject to that qualification, it was his opinion that the "Vignette" and "Receipt" prints were made by a finger whereas the mark from the "Memoir" was by a right thumb. He also thought that the "Receipt" print was made by an older person than the one who made the other two. All three prints are of loop type, and, if made

by a right hand, they are "ulnar" loops. There is a delta only in the "Memoir" print. Ridge counting showed a loop with at least nine ridges in the "Vignette," at least thirteen in the "Receipt" and eighteen in the "Memoir" impressions. Of the "Alarm" impression, Campbell said: "It is an illustration of a finger, not a thumb. It is impossible to state the type of finger print to which it belongs, it could be an arch, loop, whorl, twined loop, etc. (there is no core or delta). I am greatly impressed by the clear and accurate positioning of the pores on the ridges, and by the top left quarter of the impression which appears to illustrate the remains of an injury to the dermis."

These wood engravings are almost certainly facsimilies and at no stage enlargements. The "Vignette" impression, for example, has an area approximately that of a personal "touch" impression. The difference, one of not more than 2 mm. in any dimension, could be ascribed merely to difference in the size of finger or in the pressure used to make the print. The excellence of the cuts suggests that they were made under low magnification after the manner of miniature paintings. Mr. Taylor, R.E., A.R.C.A., of the Leeds College of Art, agreed, and drew my attention to Bliss's (1928) "History of Wood Engraving." "He (Bewick) would sit for an evening in his domestic circle, with the glass in his eye, elaborating a tiny block with the graver in his great blacksmith's hand."

Evidence of the use of finger prints by others prior to 1880 is scanty. In or about 1880, Tabor, a photographer in San Francisco, made an accidental impression of his inked finger on some blotting paper. This led to experiments on which he based his suggestion that finger prints might be of use in the identification of Chinese labourers. The method, however, was not adopted (Galton, 1892).

Gilbert Thompson, an American geologist in charge of a survey in New Mexico, used finger prints to prevent fraud by his workmen. An order issued by Thompson in August, 1882, authorized the payment of \$75.00 to one "Lying Bob." The figures showing the amount are written above Thompson's finger print, which occupies the position of the scroll on a cheque. The impression was made by a finger inked on an office pad (Galton, 1892).

Although the Chinese may have used finger marks and finger impressions, even as a rudimentary means of identification, and of criminals at that, the modern use began in 1880, when Henry Faulds drew attention to the practical value of finger prints in the detection of crime.

HENRY FAULDS: 1843-1930.

Henry Faulds first became interested in finger prints when he was

a medical missionary in Japan. His study of pre-historic pottery led him to note the impressions left by the potter's fingers on the ware, and in turn, to undertake an investigation of "the skin-furrows of the hand."

Although initially concerned with their ethnological aspect, he soon became aware of their practical value. His "ordinary botanical lens" revealed loops, whorls, and other patterns, which he likened to "junctions on a railway map"; he did not then specifically mention arches, the third primary division in Galton's (1892) system.

At the outset he recorded the impressions by means of sketches, which depicted the principal curves in the finger patterns. Later, he devised a method of taking impressions, using a technique which continues to be the basis of present day methods (New Scotland Yard, 1923). He printed each of the ten finger tips, using "touch" but not "rolled" impressions.

His fundamental contribution, from which the modern detection of criminals by finger prints derives, was his recognition of the importance of chance, or accidental, impressions at the scene of the crime. "When bloody finger-marks or impressions on clay, glass, etc., exist, they may lead to the scientific identification of criminals." Faulds illustrated this by two cases. In one, he detected a thief of hospital spirit. Greasy finger marks had been left by a medical student on the measuring glass in which he had mixed himself a drink of rectified spirit and syrupus simplex. "The pattern was unique, and fortunately I had previously obtained a copy of it. They agreed with microscopic fidelity" (Faulds, 1880; 1923). The value of finger prints in the identification of a mutilated body, or the unmasking of impostors, like Orton, the Tichborne claimant, was also appreciated by Faulds.

Faulds submitted his observations to the British authorities in 1888, but they were advised that "the method was too fine to work." Some years later, in 1907, their representative, by then promoted to high office in New Zealand, wrote to inform Faulds that he had introduced the method there (Faulds, 1911).

During the years 1880-1926 Faulds made several contributions to the subject. It is to be regretted that not a little of his writings was devoted to a "pen duel" with Herschel. Although somewhat discursive, his "Manual of Practical Dactylography," which he published in 1923, when aged 80, is still of interest and value, as are also "Dactylography" (1912) and his "Guide to Finger Print Identification" (1905).

When he wrote in 1911 on the superiority of finger printing over tattooing as a means of identification, he illustrated his article with an

outstanding example of tattooing. The subject was tattooed from neck to ankle with intricate designs of considerable artistic merit. Faulds pointed out that, notwithstanding, any other person having sufficient time, money and patience, could undergo an almost identical mutilation.

Amongst his other contributions, his "syllabic" classification of finger prints and use of the Kew Micrometer, invented by Sir Joseph Hooker, may be mentioned. He invented a glass disc, bearing a conical pit to obtain precise centering of finger patterns (Faulds, 1912).

Faulds became "a man with an old grievance," but an examination of the facts shows that this was not without cause. Herschel, for example, delayed acknowledgment of the part played by Faulds until 1917. The several editions of Henry's monograph make no reference to Faulds, but for whom Henry might not have made his own notable contribution to the subject. Other authors, e.g., Battley, 1930, have also ignored Faulds.

SIR WILLIAM HERSCHEL (1833-1917).

In November, 1880, Herschel described the practical use he had made of finger prints. He first began to take an interest in them in 1858, and, during the ensuing twenty years, he had found them of considerable value in several ways, notably in the prevention of personation and repudiation of signature. He had found that "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." In 1877, he had also suggested the use of finger prints in the identification of prisoners so that officials could detect personation. He believed their use in the Army would reduce the incidence of desertion.

He had collected impressions, which proved that the passage of time made no material change in their pattern. In 1916 he published his own prints which, save for incidental creases due to advancing years, had remained identical, even after an interval of 57 years. This is still an outstanding illustration of the unchanging character of the essential pattern of the finger skin.

Herschel was unable to recognize any features by which to distinguish sex or race by finger prints. Nor had he found evidence that the patterns were inherited. A post-script to his letter of 1880 shows that he had knowledge of finger dips or "tep-sai," but he was unaware that the Chinese has used finger prints as he had done.

Neither Faulds nor Herschel made any further contribution to the subject for fourteen years. In March, 1894, the Asquith Committee

reported on the identification of habitual criminals. This report (Brit. Govt. Blue Book, 1894, C. 7263), in the main, followed Galton's evidence, which ascribed priority to Herschel. This provoked a strong protest from Faulds in a letter to "Nature" (October, 1894, Vol. L. 548). Labouring under a just grievance, Faulds was led to write in ill-advised terms. He expressed his doubts about the part played by Herschel and invited publication of his semi-official report to the Inspector-General of Gaols in 1877. A reply by Herschel in "Nature," November, 1894, was accompanied by a copy of this report, now generally referred to as his "Hooghly Letter."

Herschel's claim to priority in the use of finger prints to identify prisoners and in other ways, but not in the detection of crime, was thus established beyond question. His recognition of the permanence of the pattern of the finger skin was confirmed. Herschel denied that Faulds could have proved this, because of the latter's limited period of observation.

Herschel reaffirmed his belief that there was no evidence that the Chinese had practiced finger printing. Indeed he went further and suggested that his experiments on the S.S. Mongolia in 1877, having "caught on rapidly among the passengers, may have found a settlement in some Chinese port by this route, and have there taken a practical form."

It was not until 1916, when aged 83, that Herschel made any further contribution to the subject. He then published his "Origin of Finger Printing" in order to establish his claim to have invented the method. He acknowledged that as a boy he had "loved Bewick on Birds" and he had been reminded by a remark by Galton that he used to see the thumbmark there. "I dare say it had something to do with my fascination over Konai's handmarkings. If so, the influence was unknown to me." As he grew older, he had forgotten that "thumb" mark. The idea of finger printing, as he asserted in 1894, was chanced upon by him in 1858, when about to conclude a contract with one Konai for some binding material used in road metalling. It then occurred to him to try an experiment by taking the stamp of Konai's hand, by way of signature instead of writing. "I was only wishing to frighten Konai out of all thought of repudiating his signature hereafter." This impression shows that the pattern of the fingers is poor and useless for identification, but that of the palm, except for a central area, is excellent.

Elsewhere in this pamphlet, Herschel reproduced a number of paired prints, which clearly demonstrate the unchanging pattern of the finger skin. That of Captain Haggard, R.N., for example, was first taken

in 1877, at the age of 2¾, and repeated in 1913, when aged 36. Herschel's own prints, taken when aged 26, 44, and 83, show that, despite the lapse of 57 years, the pattern of his digits R1 and R2 remain unchanged.

Herschel reviewed the older use of finger prints. He had now learnt from Bullock that at least as early as 1868 "Chinese bankers had been in the habit of impressing their thumbs on the notes they issued, and he had no doubt that the custom was much older than that." Herschel reproduced a Chinese bank note of 1898, which bears an imperfect thumb print. To the end, however, Herschel refused to believe that "a system so practically useful as this (i.e. finger printing) could have been known in the great lands of the East for generations past, without arresting the notice of Western statesmen, merchants, travellers, and students. Yet the knowledge never reached us." There is no mention of Meadows or Laufer.

Herschel's last word was in his "Remarks" (*Nature*, January, 1917, XCVIII, 388), on a letter by Faulds, who had complained that Herschel had made no mention of him in "The Origin of Finger Printing." Their exchange on this occasion was again acrimonious, but Herschel at last directly acknowledged the priority of Faulds for the introduction of "a long-wanted method of scientific identification, which should enable us to fix his crime upon any offender who left finger-marks behind him, and equally well to disprove the suspected identity of an innocent person. (For all which I gave him, and I still do so, the credit due for a conception so different from mine)." The present search of the literature confirms that Herschel in no other publication "gave any credit to Faulds and in any event so explicitly in regard to this particular and exclusive claim of Faulds to originality" (Wilton, 1938). We owe it to Sheriff Wilton for bringing these "Remarks" by Herschel to notice. Reference to them is not to be found in any prior bibliography, and this important admission might otherwise have escaped notice indefinitely.

Faulds (1917), alas, failed to appreciate Herschel's admission and, in consequence, published "The Hidden Hand," a pamphlet designed to explode Herschel's claim to the exclusive invention of finger prints. It is a great pity that, at the last, these two gentlemen could not have reached an amicable agreement. Each in his respective ways, are now rightly accorded equal credit for the part they played in the introduction of finger printing as a practical measure. There are still some who deny Faulds his due, but this can be explained only on the grounds that they have not troubled to examine the evidence.

Herschel's claim to priority was attacked, in particular, by Laufer

(1913; 1917). He said, "It is difficult to believe that Herschel, stationed in India, should have conjured up, entirely from his own resources, a system which had been known and applied in the East ages before his time. Had he designed it in his home study in England, the matter might be looked upon in a different light. But he resided in Calcutta where a large colony of Chinese had been settled for a long time, and if a European, living in the Orient in close official and private relations with its people, conceives an idea which seems to belong to his very surroundings, it would be proper to credit his environment with its due share in shaping that idea. The man laboring on his 'invention' for years may easily forget this first impetus. Herschel must have conceived his idea from observations of similar affairs made on the spot."

This criticism is, in effect, a charge of dishonesty. This writer is unable to believe that a man, having Herschel's background, and holding a responsible position, would have written as he did, if he were aware that the Chinese, or any one else in the East, had used finger prints as he had done. Would he have added this post-script to his letter to "Nature" in November, 1880: "It would be particularly interesting to hear whether the Chinese have really used finger-marks *in this way*," or, again, in 1894, would he have said "How I chanced upon the thing myself in 1858, and followed it up afterwards, has been very kindly stated on my authority by Mr. Galton, at whose disposal I gladly placed all my materials on his request"? Even if his phrasing might have been different, was he dishonest in 1916 when he spoke of "the gift granted to me of lighting upon a discovery"?

He may well have forgotten the first impetus, in 1916, when aged 83. He then acknowledged his acquaintance with Bewick's "British Birds" when a boy. But was his memory likely to have been equally faulty in 1880? Only three years previously he had endeavoured, unsuccessfully, to learn of the use of finger prints in identification by the Chinese. The steps then taken by Herschel to acquire information were not those of a scientist, and he had failed to learn of Meadows (1847). It is unlikely, however, that he could have done so until 1888-1892, at a time when Galton read that paper and could have brought it to his notice. Even so, Herschel is likely to have accepted Galton's opinion of it. Herschel was satisfied in 1877 to accept the reports of fellow passengers, including "business men on their way back to the Far East," and, not being a scientist by training, it is likely that a man in his position was not unreasonable when he considered this sufficient evidence.

That he was stationed in the East is not conclusive proof, or even strongly presumptive, that he must have known of the use of finger

prints in identification. Faulds (1880), had heard of it but failed to obtain confirmation in Japan.

When Herschel discussed the history of finger printing in 1916, he still omitted to mention Meadows, and he overlooked Laufer's paper of 1913. This is regrettable, the more so because it would have been valuable to have Herschel's reply to the latter's criticism. Laufer (1917) complained of this omission, but he was himself guilty of a far more serious lapse. Although he referred to Sir Aurel Stein's "Ancient Khotan" and mentioned the seals which had been found, he was here silent about the finger marks on the ancient contracts of loan, in spite of their direct and tangible bearing on his argument to discredit Herschel.

Herschel's appreciation of the value of finger prints as a means of identification was as much the result of independent and original observation as that of Faulds. But for their interest and investigations, it is doubtful whether, even now, we should have advanced beyond the rudimentary use of finger marks, as practised in the East before their time.

SIR FRANCIS GALTON: 1822-1916.

The pioneer work of Faulds and Herschel was consolidated by the more comprehensive studies of Sir Francis Galton during 1888-91, embodied in his "Finger Prints" of 1892. It is to be regretted that this valuable contribution is marred by the slighting recognition he gave to "Mr. Fauld (*Nature*, XXLI, p. 605, October, 28, 1880)." This reference demonstrates that Galton was aware of its contents, yet Faulds is dismissed as one "who seems to have taken much pains." On the other hand, there is full recognition of assistance received from Herschel, to whom Galton at all times conceded priority.

Galton was the first to take rolled impressions, which he said gave "a more extended but not quite so sharp an impression." He also took impressions of all ten digits, as did Faulds, and the title page of "Finger Prints" bears a reproduction of Galton's impressions. He drew attention to the creases, which appear in the impressions of the elderly, and the fainter ridges of the fingers of women in contrast to those of males, thickened by manual labour. He was the first to illustrate the effects of cuts, ulceration, and pin-pricks on finger prints. He appreciated that although the pattern might be completely destroyed locally, the injuries did not wholly obliterate it elsewhere on the finger. On the other hand, repair of minor injuries, e.g., the healing of a superficial burn on the hand of his assistant, was followed by a perfect restoration of the skin pattern.

His more important contributions concerned persistence of skin pat-

terns; their relative incidence in general, and on the several digits; the classification and filing of finger prints, and the impossibility of any two persons having precisely similar impressions.

His demonstration that the finger pattern was unchanged for upwards of thirty years, as shown, in particular, by impressions of Herschel's thumb taken in 1860 and repeated in 1890, was based on material supplied by Herschel.

The remote possibility of coincidence of like impressions from the hands of any two people was calculated as a chance of one to about 64,000,000,000. "A smaller chance than one to four that the print of a *single* finger of any given person would be exactly like that of the same finger of any other member of the human race." Subsequent calculations leave Galton's estimate as the lowest yet published. The accuracy of this fundamental observation of Faulds, Herschel, and Galton, has been confirmed by subsequent experience. During the past fifty years, during which millions of impressions have been taken throughout the world, no instance of identical impressions from any two people has yet been discovered. In 1937, during the trial of *Rex v. O'Farrell*, it was stated that no coincidence had occurred amongst some 5,000,000 impressions and that over 400,000 identifications by finger printing had been made without error. Further confirmation was obtained during the case of *Rex v. Griffiths* (1948). When the author of the impressions on a bottle was sought, the several finger print bureaux throughout the world, covering some millions of records, had no such impressions in their files.

Although the F.B.I. at Washington has now had experience of over 100,000,000 records, there have never yet been two finger print ridge patterns exactly alike in all details unless they were made by the same finger (Hoover, 1949).

Galton devised a filing system, which, although it differs in detail, is the basis of the present method. Cards $11\frac{1}{2} \times 5$ " were prepared to take in the upper half (nowadays the lower) a touch impression of each hand. In the lower half he recorded a rolled impression of each digit, those of the two thumbs lying on each side of the middle line.

His classification had three primary divisions, namely, arches, whorls, and loops. It is clear however, that he recognised, although he did not describe it, a fourth group which Henry (1899, 1900) termed "composites." In subdividing loops, he rightly rejected right and left but preferred inner and outer to Henry's "ulnar and radial" classes. It may be that Galton borrowed the idea of loops and whorls from Faulds, because the latter had used these terms, but it cannot be maintained that his classification was derived from the alleged Chinese "pots"

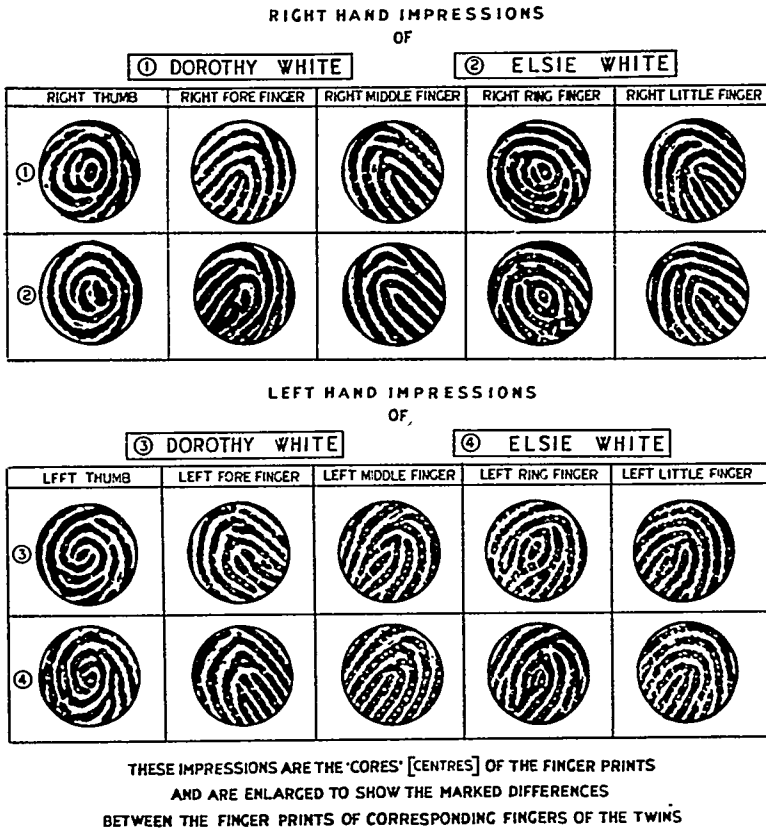


Figure 7.

Finger prints of the White Twins. (By Courtesy of the Commissioner of Police of the Metropolis, Sir Harold Scott, K.C.B., K.B.E.)

and "hooks." Nor for that matter from the more picturesque terms of "snail" (arches and whorls) and "sieve" or "winnowing basket" (loops), cited by Laufer (1913) from Giles's Chinese-English dictionary.

Anyone studying finger impressions with a view to their classification might well choose arches, loops, and whorls as names for the principal groups. It is clear that he did not borrow from Purkinje, whose nine groups included ellipses, circles, spirals, transverse flexures, and almonds, but not loops, whorls, and arches, tented or otherwise.

Galton developed the idea of drawing the outlines of the patterns, which had been done by Faulds, prior to his method of taking inked impressions. Galton also counted ridges, using a linen tester for the purpose. He was the first to number points of similarity in pairs of prints. His numbers lie over the ridges in the impression, whereas, to-day, the better practice is to mark them outside the impressions and

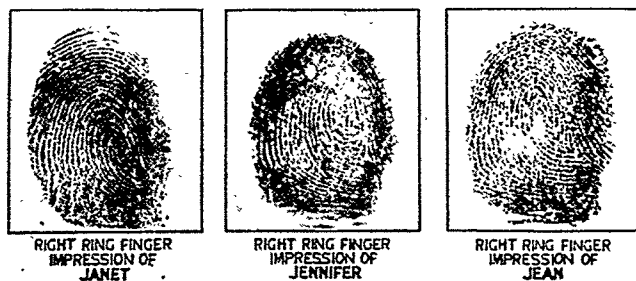


Figure 8.

Dissimilar finger prints from the Wilson identical triplets. (By Courtesy of the Commissioner of Police of the Metropolis, Sir Harold Scott, K.C.B., K.B.E.)

draw lines from the numbers to the relevant ridges. Henry followed Galton, except that letters, instead of numbers were first used to mark his sketches of impressions, when ridge counting (e.g., Fig. 37, repeated as Fig. 42, Henry, 1901, 2nd edition of "Classification and Uses of Finger Prints").

The present-day system is referred to by some as the Galton-Henry system, whereas there are others, for example Cherrill, (1950), who consider the credit for it is due to Henry alone. Since neither Faulds nor Herschel had prepared any classification, it was Galton to whom Henry must have turned for the basis of his own system. Major features common to the two systems are such that the probability of independent invention by Henry is remote. It seems beyond doubt that Galton's classification, as acknowledged by Vucetich and Henry in respect of theirs, is the basis of modern systems, but it does not appear that he had perfected a system which was workable. "He cut rather a sorry figure when asked to demonstrate his system before the Belper Committee which enquired into the method of identification of criminals by measurements and finger prints in 1900. Galton took an unconscionable time to trace a duplicate in a collection of less than 2,500" (Cherrill, 1950). In fairness it should be recalled that at that time Galton was 78, and his fingers may no longer have been nimble.

Galton's examination of some 5,000 digits showed loops represented 67.5%, whorls 26.0% and arches 6.5% of the total. Turning to the individual digits, he found that loops were especially common in the little fingers, e.g. 88% of right and 90% of the left hands. Arches on the other hand were most often seen on the forefinger and rarely seen on the little finger. Whorls were common on the thumbs and ring fingers. His observations have since been confirmed and amplified.

Bonnevie's (1925) examination of 24,518 Norwegian criminals

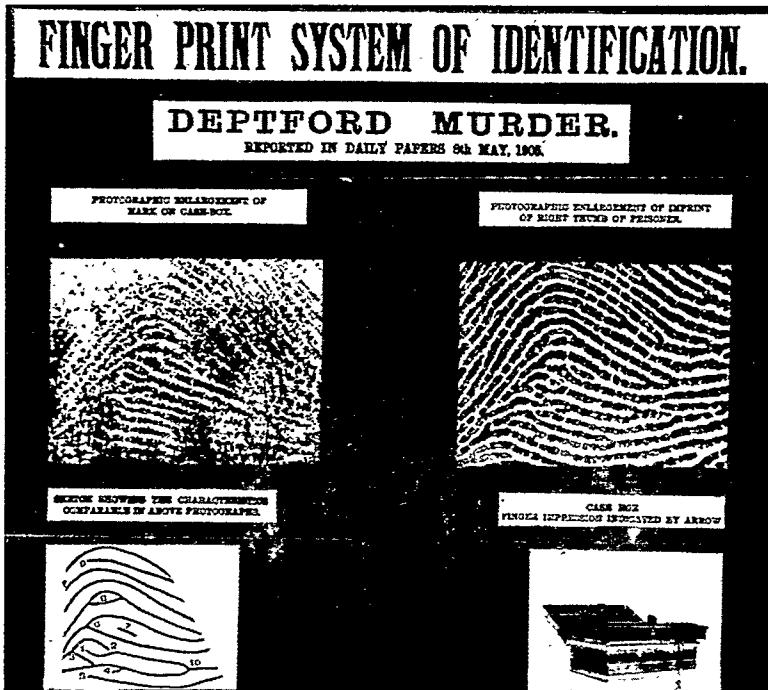


Figure 9.

The Deptford Murder; first use in Britain of finger prints in a murder trial, May 1905, by Sgt. (later Superintendent) C. S. Collins, of the Metropolitan Police. (By Courtesy of the Commissioner of Police of the Metropolis, Sir Harold Scott, K.C.B., K.B.E.) (Case discussion appears in the concluding part of this article.)

showed that the different patterns of all the fingers included 61.14% of ulnar and 5.81% of radial loops. Whorls accounted for 25.65% and arches were found on only 7.4% of the fingers. The individual digits showed a distinct tendency to bear specific patterns. Ulnar loops, for example, were usually present on the middle finger (III) and especially on the little finger (V), whereas whorls were commonest on the right thumb (I) and ring fingers (IV). Arches and radial loops were most often seen on the forefinger (II).

Galton thought, as did Faulds, that there was a tendency to hereditary transmission of patterns, but rightly stressed that, at that time, the results were insufficient to justify conclusions. More recent work, reviewed by Cummins and Midlo (1943), suggests that the general pattern, but not detailed features, is inherited. Impressions alone can serve, for example, to detect identical twins. Even they, however, are to be distinguished by a detailed examination of the pattern (Figs. 7 and 8).

(To be concluded in January-February Issue)