OBSERVATIONS
ON THE
TACTILE SENSIBILITY OF THE HAND.

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THE observations which constitute the basis of this paper are submitted to the Royal Medical and Chirurgical Society, in the hope that they will not be regarded as uninteresting or unworthy of acceptance. In prosecuting any inquiry such as this, it is of the highest importance that the first observations should be conducted on a part which is endowed with the greatest amount of tactile sensibility. The phenomena to be noted being subjective, the great difficulty to be surmounted is the acquisition of a standard by which they may be measured. This standard must be entrusted to the memory; it must be definite and decided; and as no part of the body conveys to the intelligence more precise impressions than does the hand, so there is no part with which tactile impressions made elsewhere can be so readily compared.

The succeeding observations are limited to my own person and to my right hand, hence the numbers given apply solely to myself; probably other persons whose hand is of the same size would furnish similar results, but different

numbers would be anticipated with hands of a different size, and hence in female children and large persons. I am disposed rather to agree with Valentin, that the absolute values may differ in different persons, and that a delicate skin and an active mind may modify the absolute results of any experiments, than with Brown-Séguard, who appears to hold the opposite view. In all persons, however, we may expect that the distribution of the tactile sensibility will pretty well coincide.

The method employed in my experiments was that many years ago suggested by Weber, and since commonly employed in medical practice for purposes of diagnosis. I used the ordinary compasses, tipped with cork points; I tried other materials, but fell back upon the cork, as, after all, affording the purest kind of tactile impression; steel points, unless used very lightly, give more or less the impression of a prick, and are decidedly unpleasant, when employed upon thin-skinned parts of the body; cork may be cut with a sharp knife to a very fine point; the only objection to its use is the necessity for an occasional renewal of the points. The pieces of cork should be cut into such a shape that, when the compasses are closed, the adjoining plane surfaces shall lie together without interval, and the points lie at the same level.

The scale adopted for measurement has been the English inch divided into tenths; I used this in preference to the measurement by lines, chiefly because it is that which is, for most other purposes, in use in this country, and is supplied in every case of mathematical instruments.

The plan I adopted to represent the spots of the surface experimented upon was to mark the intended spots with a cross, and having done this I had photographs taken, so as to represent precisely the locality of each observation. For these I am indebted to the kind and ready assistance of my friend, Dr. Matthews. On these photographs I could then mark the results of the observations.

It is well known that the numbers obtainable by Weber's

method differ according to the direction in which the points are placed. When they are placed in the long axis of the part to be examined (I am speaking now of the extremities), the numbers are higher, the measurements greater, than when placed transversely. To represent accurately, therefore, in numbers the sensitiveness of a part, both these measurements must be included; I therefore measured in both directions, and have assumed *their sum to be the absolute sensitiveness of each spot*. On surfaces much curved, if the points included any considerable arc, I have dipped the points in ink, and reapplying them to the surface, have measured with tape between the dots produced, and assumed this measurement as the correct one. In the Appendix the measurements are given both as furnished by the compasses and also by the tape, where this was employed.

The mode in which the experiment is performed is also of some consequence. In experimenting on any spot, the compasses should be opened at first to a distance *less* than what is presumed will be necessary, and should be gradually opened wider and wider until the proper width is attained, that is until the two points are not only unmistakeably felt as distinct impressions, but until the consciousness assures us that there is *a distinct interval between them*. It is easier to discover the lowest measurement which will give this result by proceeding as I advise than by opening the compasses first to a greater width than is necessary and gradually lessening it. The idea of an interval once had at any spot is apt to be retained in the memory, and to vitiate the sensation imparted as the width is reduced. Another precaution I must give, and this arises from a somewhat similar cause. It is to use our experience in guessing the probable width which will be requisite so as to commence at each spot only a little below it. If we commence with too small a width, the touches on the same point will necessarily be more numerous before the proper measurement can be obtained, the attention becomes wearied, and the tactility of the part by repeated touches becomes absolutely lowered. The quicker the measurement can be obtained consistently

with all due care, the more accurate it is therefore likely to be. I will, after these preliminary remarks, proceed to detail the observations I have made. I will merely add that I have since tested their accuracy by repeating them, and that I am not aware of any equally precise or extended observations being in existence. The number of separate spots upon the hand, the tactile sensibility of which has been examined, is 142. On each spot two observations have been made, one in each direction, making thus 284 observations, each of which has been repeated several times for verification. *The mean sensibility of the entire hand*, as thus ascertained, is 1.384 in. *The lowest sensibility* at any spot was found on the dorsum, at a spot corresponding with the base of the fifth metacarpal bone; it is represented by 5.0 inches. *The highest or most acute sensibility* was found at the top of the index finger, viz., .35 in. The range, therefore, is very extensive.

It is for me now to show how this varying sensibility is distributed.

HAND AS A WHOLE.

The sensibility of the surfaces, palmar and dorsal, and of the edges and distal extremity of the hand, have first to be examined.

Palmar surface.—1st. Including the thumb, the fingers lying in apposition, and the thumb laid at the side of the hand. —The number of spots examined on the palmar surface thus constituted (excluding the tips of the thumb and fingers) was 40. *The mean sensibility* may be represented by 1.222 in. *The lowest sensibility* was 2.0 in., and was seated at a spot corresponding to the base of the first and second metacarpal bones. *The most acute sensibility*, .55, was found at the middle of the last phalanx of the index finger.

2nd.—But the palmar surface may be considered *excluding the thumb*. The number of spots examined thus was 34. *The mean sensibility* was 1.215 in.

Dorsal surface.—1st. The number of spots examined, including the thumb, was 40. The *mean sensibility* may be represented by 1·975 in. The *lowest* sensibility, 5·0 in., was seated opposite the base of the fifth metacarpal bone. The *highest*, ·725 in., was found to correspond with the middle of the last phalanx of both the index and little fingers.

2nd. Excluding the thumb, the number of spots examined was 34. The *mean sensibility* was 2·016 in.

Radial border.—1st. With the thumb in apposition with the border of hand.—The number of spots examined (excluding tip of thumb) was 11. The *mean sensibility* was 1·104 in.

2nd. With the thumb placed in apposition with the palm, and its tip directed towards the middle finger: the border is then formed by the interval between the first and second metacarpal bones and the border of the index finger. The number of spots examined was 10. The *mean sensibility* was 1·447.

Ulnar border.—The number of spots examined was 9. The *mean sensibility* was 1·216 in.

Distal extremity.—This is constituted by the tips of the four fingers. The *mean sensibility* of these is ·4 in.

Comparison of sensibility of the surfaces and borders generally.—1st. Including the thumb.—The order is, distal extremity, radial border, ulnar border, palmar surface, dorsal surface.

The distal extremity exceeds the radial border by $1\frac{3}{4}$ ths, or is nearly three times as sensitive.

The radial border exceeds the ulnar border by over $\frac{1}{10}$ th.

The ulnar border exceeds the palmar surface by quite a trifle; they may practically be regarded as identical.

The palmar surface exceeds the dorsal surface by over $\frac{1}{3}$ ths.

2nd. Excluding the thumb.—The order is, distal extremity, palmar surface, ulnar border, radial border, dorsal surface.

The distal extremity is about three times as sensitive as the palmar surface and ulnar border.

The palmar surface and ulnar border exceed the radial border by under $\frac{1}{4}$ th.

The radial border exceeds the dorsal surface by over $\frac{1}{4}$ ths.

COMPARISON OF PROXIMAL AND DISTAL PORTIONS OF HAND.

—Weber not only pointed out that the palmar surface of the hand exceeded the dorsal in sensibility, but that the sensibility increased as the distal extremity of the hand was approached. He determined this by the apparent increase in the distance between the points of the compasses when these were fixed, but applied successively to parts nearer and nearer to the extremity of the hand. “In manu autem,” he says, “hoc annotandum est, tactum in volari superficie subtiliorem esse quam in dorsali, simul autem eo auctiorem deprehendi, quo propior locus in manu apicibus digitorum est.” (‘Annotaciones Anatom. et Physiol.,’ prol. viii.)

An accurate appreciation of this fact may be obtained from the observations I have tabulated, in various ways. 1st. We may compare the metacarpal with the digital portions of the hand generally, and those of the palmar and dorsal surfaces in particular, as well as the metacarpal and digital portions of the borders. 2nd. We may examine anatomically corresponding spots which lie in one line across the hand with those which lie in other lines nearer to the apex, both as they form zones on the surfaces and edges and lines on the palmar and dorsal surfaces in particular. 3rd. We may trace the same law as pertaining to zones at corresponding anatomical parts in the fingers. This last mode I shall defer until I treat of the fingers specially.

I. Comparison of metacarpal and digital portions of hand generally.—The anatomical peculiarities of the thumb, which consists of three in place of four bones, and is so situated and arranged as to form, as it were, an opposable hand, render it convenient to exclude this organ from the present comparison, as well as from most of those which succeed. It will be more convenient to consider it separately.

Metacarpal portion of hand, generally, mean of 24 spots, 2·58 in.	
Digital	“ 94 “ 1·045

The digital portion of the hand generally (excluding the thumb) exceeds the metacarpal in sensibility, being, in fact, about one and a half time more sensitive.

Comparison of the metacarpo-palmar and digito-palmar regions (exclusive of tips of fingers).—

Metacarpo-palmar region, mean of 10 spots, 1.750 in.
Digito-palmar " " 24 " .992

The digito-palmar region, then, exceeds the metacarpo-palmar in sensibility by nearly four fifths.

Comparison of the metacarpo-dorsal and digito-dorsal regions.—

Metacarpo-dorsal region, mean of 10 spots, 3.770 in.
Digito-dorsal " " 24 " 1.285

The digito-dorsal region, then, is about three times more sensitive than the metacarpo-dorsal. The greatest difference, then, between the metacarpal and digital regions exists on the dorsal surface of the hand.

Comparison of the metacarpo-palmar and metacarpo-dorsal regions, and of the digito-palmar and digito-dorsal, respectively.—The above numbers enable us to effect this. In the metacarpal portion of the hand the palmar surface is more than twice as sensitive as the dorsal. In the digital portion the palmar exceeds the dorsal in sensibility to much less extent, viz., by about one third. The principal difference, then, between the palmar and dorsal surfaces is found in the metacarpal part of the hand.

Comparison of the metacarpal and digital portions of the radial border of hand.—For the purposes of this comparison we may consider the metacarpal border as formed by the interval between the metacarpal bone of the thumb and that of the index finger.

Metacarpal portion of border, mean of 4 spots, 2.41 in.
Digital " " 6 " .804

formed by the interval between the first or second metacarpal bones, the metacarpo-palmar surface exceeds it in sensibility by above one third.

Radial metacarpal border (including border of thumb), mean of 5 spots, 1.585 in.

Metacarpo-dorsal surface (including that of thumb to 1st phalangeal joint), mean of 18 spots, 3.080 in.

In this view the radial border of the proximal portion of the hand has almost twice the mean sensibility of the metacarpo-dorsal surface.

In the other view the radial border exceeds the metacarpo-dorsal surface by about three fifths.

The metacarpo-ulnar border is less in mean sensibility than the metacarpo-palmar surface (as partly formed by thumb), the latter exceeding it by about one seventh. The same is the case where the thumb is excluded from calculation, but the difference is very much less, the palmar surface exceeding it by only a small fraction (about one twenty-first).

The metacarpo-ulnar border exceeds the metacarpo-dorsal surface (as partly formed by thumb) by nearly three fourths. The same is the case where the thumb is excluded from calculation, but the difference is greater, the metacarpo-ulnar border being more than twice as sensitive as the metacarpo-dorsal surface.

*Comparison of the digital borders with the digital surfaces (palmar and dorsal).—*The digito-radial border exceeds in sensibility the digito-palmar surface by nearly one fourth. It exceeds the digito-dorsal surface by three fifths.

The digito-ulnar border exceeds the digito-palmar surface by rather more than one eleventh. It exceeds the digito-dorsal surface by about three sevenths.

II. We may now proceed a step further, and see how the sensibility of the hand, as a whole, increases from the base to the distal extremity. In this inquiry we will exclude

the thumb, which may be made the subject of a separate examination.

Sensibility of zones formed by corresponding anatomical parts on both surfaces and borders of hand from base to distal extremity.

Zone.	Number of spots.	Mean Sensibility.	Excess over previous zone.
1. At base of metacarpus .	. 8 ...	3.175 in.	
2. At middle of metacarpus .	. 8 ...	2.712 "	over $\frac{1}{4}$ th.
3. At heads of metacarpus .	. 10 ...	2.115 "	over $\frac{1}{4}$ th.
4. At clefts of fingers .	. 10 ...	1.547 "	over $\frac{1}{3}$ rd.
5. Between last and 1st phalangeal joints .	. 10 ...	1.325 "	about $\frac{1}{8}$ th.
6. At first phalangeal joints .	. 10 ...	1.145 "	under $\frac{1}{8}$ th.
7. At middle of 2nd phalanges .	. 10 ...	1.007 "	under $\frac{1}{4}$ th.
8. At 2nd phalangeal joints .	. 10 ...	.790 "	over $\frac{1}{4}$ th.
9. At middle of last phalanges .	. 10 ...	.680 "	about $\frac{1}{8}$ th.
Tips of fingers .	. 4 ...	.4 "	about $\frac{1}{3}$ rd.

In even a superficial glance at this table, it will appear that while there is an uninterrupted increase of sensibility in the hand from the base to the tip, there are two remarkable parts at which it increases more rapidly than at others. The necessity of imparting a high sensibility to the fingers leads to a rapid increase as they are approached, and this increase is most observable immediately the heads of the metacarpal bones are passed. The rapid increase of sensibility at this spot was not unnoticed by Weber, although he applied a rough test to it, and applied it only to the palmar surface. It is at the heads of the metacarpal bones that the fingers anatomically commence. We need, therefore, not to be astonished at this rapid increase of sensibility prior to the attainment of the cleft of the fingers. The next part, and that at which the most rapid increase in sensibility of all takes place, is in the distal half of the last phalanges. From the cleft of the fingers to this latter part the rate of increase in sensibility is tolerably regular, being only slightly greater than elsewhere as the second phalangeal joint is approached. Nature here appears to have studied to avoid any great increase on approaching parts of the hand exposed, when the

fist is closed, to collisions, viz., the heads of the metacarpal bones and the first phalangeal joints. We shall see that this is so when we compare transverse lines on the dorsal surface.

Sensibility of transverse lines formed by analogous anatomical parts on the palmar surface.—These lines, as those to be presently considered on the dorsal surface, form part of the zones just considered.

Line.	Number of spots.	Mean sensibility.	Excess over previous line.
1. At base of metacarpus .	. 3 ...	1·900 in.	
2. At middle of metacarpus .	. 3 ...	1·800 "	$\frac{1}{18}$ th.
3. At heads of metacarpus .	. 4 ...	1·600 "	$\frac{1}{8}$ th.
4. In crease opposite clefts of fingers .	. 4 ...	1·275 "	about $\frac{1}{4}$ th.
5. Between last and 1st phalangeal joints .	. 4 ...	1·200 "	$\frac{1}{16}$ th.
6. In crease opposite 1st phalangeal joints .	. 4 ...	1·062 "	over $\frac{1}{8}$ th.
7. At middle of 2nd phalanges .	. 4 ...	·956 "	$\frac{1}{8}$ th.
8. In crease opposite 2nd phalangeal joints .	. 4 ...	·800 "	about $\frac{1}{8}$ th.
9. Middle of last phalanges .	. 4 ...	·662 "	about $\frac{1}{8}$ th.
Tips of fingers .	. 4 ...	·4 "	about $\frac{1}{3}$ rds.

The base of the hand on the palmar surface commences with a comparatively high sensibility, so that in order to attain the maximum at the tip the rate of increase need not be considerable. On this surface it is seen, as with the zones we have just considered, that there is a remarkable increase in the rate of augmentation immediately on passing the heads of the metacarpal bones, followed by as remarkable a decrease. The rate increases again, however, as soon as the parts of the fingers are approached, the palmar surface of which is most employed for palpation, viz., after passing the middle of the second row of phalanges, and especially on approaching the highly sentient tips of the fingers.

Sensibility of transverse lines formed by analogous anatomical parts on the dorsal surface.—The spots examined in these lines correspond to those on the palmar surface, and enter into the formation of the zones above considered.

Line.		Number of spots.	Mean sensibility.	Excess over previous line.
1.	At base of metacarpus .	. 3 ...	4·633 in.	
2.	At middle of metacarpus .	. 3 ...	3·900 „	under $\frac{1}{4}$ th.
3.	At heads of metacarpus .	. 4 ...	3·025 „	about $\frac{2}{3}$ ths.
4.	Opposite clefts of fingers .	. 4 ...	2·012 „	about $\frac{1}{2}$.
5.	Between last and 1st phalangeal joints .	. 4 ...	1·575 „	over $\frac{1}{4}$ th.
6.	At first phalangeal joints .	. 4 ...	1·343 „	about $\frac{1}{8}$ th.
7.	At middle of 2nd phalanges .	. 4 ...	1·181 „	about $\frac{1}{4}$ th.
8.	At 2nd phalangeal joints .	. 4 ...	·850 „	about $\frac{2}{3}$ ths.
9.	At middle of last phalanges .	. 4 ...	·750 „	over $\frac{1}{4}$ th.

We meet here again with the rapid increase in sensibility after passing the heads of the metacarpal bones, and again on approaching the second phalangeal joints, immediately after passing which, on approaching the nail, the rate of increase drops.

Comparison of corresponding lines on palmar and dorsal surfaces, and of rate of increase of sensibility on these surfaces.

—The difference in sensibility of the two surfaces at various distances from the base of the hand may be thus stated :

Line.			
1.	At base of metacarpus, palmar surface exceeds dorsal in sensibility by .	.	about $1\frac{1}{2}$ time.
2.	At middle of metacarpus, ditto by .	.	$1\frac{1}{4}$ th. „
3.	Opposite heads of metacarpus, ditto by .	.	about $\frac{7}{8}$ ths. „
4.	At clefts of fingers, ditto by .	.	about $\frac{3}{4}$ ths. „
5.	Between last and 1st phalangeal joints, ditto by .	.	about $\frac{1}{4}$ rd. „
6.	At 1st phalangeal joints, ditto by .	.	a little over $\frac{1}{4}$ th. „
7.	At middle of 2nd phalanges, ditto by .	.	a little under $\frac{1}{4}$ th. „
8.	At 2nd phalangeal joints, ditto by .	.	$\frac{1}{16}$ th. „
9.	At middle of last phalanges, ditto by .	.	under $\frac{1}{8}$ th. „

From this it appears that the difference in sensibility, considerable at the base, where a high sensibility on the dorsum would be inconvenient, gradually lessens as the apex of the hand is approached, where it is important that the dorsum should be little less sensitive than the palmar surface. And in order to attain this similarity, when at the base the sensibility of the palmar and dorsal surfaces is so dissimilar, it is necessary that the rate of increase, band after band, along the dorsum shall be more rapid on the dorsum than on the palmar surface, which originally starts with a more acute sensitiveness. The difference in rate is most remarkable in the proximal bands, and again in the band from the middle of

second phalanges to the second phalangeal joints. In the third band, commencing at the heads of the metacarpal bones, the difference is especially worthy to be observed. On passing the second phalangeal joints the rate of increase is highest on the palmar surface, to provide for the high sensitiveness of the tips.

COMPARISON OF LATERAL HALVES OF THE HAND.—We have already seen that the radial border of the hand (as partly formed by the radial side of the thumb) exceeds the ulnar border in sensibility, but that the ulnar border is the more sensitive when the radial border is considered to be constituted by the interval between the first and second metacarpal bones. We shall now see that a similar arrangement prevails if we compare, not the borders only, but the borders and adjoining surfaces together.

Comparison of lateral halves generally, including thumb and palmar and dorsal surfaces of fingers only.—The division is assumed to be formed by a line drawn down between the third and fourth metacarpal bones.

Radial half of the hand, mean sensibility of 59 spots, 1.424.
Ulnar " " 43 " 1.447.

The difference, indeed, is very trifling, but what there is is in favour of the radial side.

Comparison of lateral halves generally, excluding thumb, but including palmar and dorsal surfaces of fingers only.—

Radial half of the hand, mean sensibility of 44 spots, 1.410.
Ulnar " " 43 " 1.447.

Regarded in this way, the difference is again very trifling, but rather greater than when the thumb is included in the calculation.

I. We may now proceed to examine the lateral halves of the palmar and dorsal surface respectively.

Comparison of the lateral halves on the palmar surface, excluding tips of fingers.—

1st. Including thumb.—

Radio-palmar half of hand, mean of 21 spots, 1.139.
Ulnar- " " 16 " 1.204.

Thus regarded, the sensibility of the radial half of the palmar surface exceeds that of the ulnar half, but only by a trifle (about one eighteenth).

2nd. Excluding thumb.—

Radio-palmar half of hand, mean of 16 spots, 1.146.
Ulnar- " " 16 " 1.204.

Regarded thus, too, the difference is still less, but what there is is in favour of the radial side.

Comparison of the lateral halves on the dorsal surface.—

1st. Including thumb.—

Radio-dorsal half of hand, mean of 25 spots, 1.889.
Ulnar- " " 16 " 1.948.

Here, again, the predominance of sensibility is (but still to a very trifling extent) in favour of the radial side.

2nd. Excluding thumb.—

Radio-dorsal half of hand, mean of 16 spots, 1.779.
Ulnar- " " 16 " 1.948.

Regarded thus, a similar relation exists, but (otherwise to the palmar surface) the difference is greater than when the thumb is admitted into the calculation; it amounts to somewhat over one eleventh.

The palmar and dorsal surfaces may be compared on the radial and ulnar sides respectively.

Comparison of the radio-palmar and radio-dorsal regions.—

1st. Including the thumb.—The radio-palmar exceeds the radio-dorsal surface by something over three fifths.

2nd. Excluding the thumb.—It exceeds it by about four sevenths, rather less than the general average of excess of the whole palmar over the whole dorsal region (two thirds), excluding the thumb.

Comparison of the ulno-palmar and ulno-dorsal regions.—The palmar surface exceeds the dorsal here by close upon the average of the whole surfaces, viz., three fifths.

Comparison of lateral halves in the proximal (metacarpal) region.—

1st. Including the thumb.—

Metacarpo-radial region, mean of 25 spots, 2·037.

Metacarpo-ulnar „ „ 11 „ 2·518.

In the proximal region, then, including the thumb in the calculation, the sensibility being still in favour of the radial half, the excess of that half amounts to nearly one fourth.

2nd. Excluding thumb.—

Metacarpo-radial region, mean of 12 spots, 3·050.

Metacarpo-ulnar „ „ 11 „ 2·518.

Regarded in this way (taking the interval at first and second metacarpal bones as forming part of radial border), the ulnar half of metacarpal region is more sensitive than the radial, the excess amounting to somewhat over one fifth.

Comparison of lateral halves in the digital region.—This only includes the consideration of the digital borders of the hand and the palmar and dorsal surfaces of the fingers.

Digito-radial region, mean of 32 spots, 1·000.

Digito-ulnar „ „ 32 „ 1·079.

There is here, also, a difference in favour of the radial side, which is in excess of the ulnar in sensibility, but only to a trifling extent.

Whether, then, the thumb be included or excluded, the greatest difference between the sides, when the fingers are in apposition, is found in the metacarpal region.

Let us now inquire how the relations of the lateral halves of the hand stand in the proximal and distal parts of the palmar and dorsal surfaces respectively.

Comparison of the lateral halves of the metacarpal region on the palmar surface.—

1st. Including the thumb.—

Radio-metacarpo-palmar region, mean of 8 spots, 1·481.
Uln- " " 4 " 1·700.

In this comparison it appears that the radial portion of the palm of the hand, when the palmar surface of the thumb as far as the phalangeal joint is taken into the calculation, exceeds the ulnar by above one seventh.

2nd. Excluding thumb.—

Radio-metacarpo-palmar region, mean of 4 spots, 1·750.
Uln- " " 4 " 1·700.

In this view it appears that the part of the palm to the rear of the index and middle fingers is to a very trifling extent less sensitive than that in the rear of the little and ring fingers.

Comparison of the lateral halves of the metacarpal region on the dorsal surface.—

1st. Including thumb.—

Radio-metacarpo-dorsal region, mean of 12 spots, 2·679.
Uln- " " 4 " 3·850.

The radio-metacarpal region on the dorsum of the hand then exceeds the ulno-metacarpal region by about one half, the difference between the sides of the hand when the thumb is included being thus very strongly marked, much more marked on the dorsal than on the palmar region.

2nd. Excluding thumb.—

Radio-metacarpo-dorsal region, mean of 4 spots, 3·350.
Uln- " " 4 " 3·850.

In this view the difference is much less marked, the predominance of the radial side being only somewhat over one seventh.

*Comparison of the radio-metacarpo-palmar with the radio-metacarpo-dorsal surface.—*1st. Including thumb.—On this

side of the hand, in the metacarpal region, the palmar exceeds the dorsal surface in sensibility by about four fifths.

2nd. Excluding thumb.—Thus considered, the palmar is almost twice as sensitive as the dorsal.

Comparison of the ulno-metacarpo-palmar with the ulno-metacarpo-dorsal surface.—On this side of the hand the metacarpo-palmar surface is about two and a quarter times as sensitive as the dorsal. The difference, then, of the palmar and dorsal surfaces in the proximal part of the hand, is most marked upon the ulnar side.

Comparison of the lateral halves of the palmar surface in the distal (digital) part of hand.—

Radio-digito-palmar surface (index and middle fingers), mean of 12 spots, .945.
 Ulno- " (ring and little fingers) " 12 " 1.039.

The palmar surfaces of the index and middle fingers together thus exceed those of the little and ring fingers together by one tenth. So that, whereas in the metacarpo-palmar region of the hand (exclusive of the thumb), the sensibility preponderates, if at all, to the ulnar side, in the digito-palmar region it preponderates on the radial.

Comparison of the lateral halves of the dorsal surface in the distal (digital) part of the hand.—

Radio-digito-dorsal surface (index and middle fingers), mean of 12 spots, 1.256.
 Ulno- " (ring and little fingers) " 12 " 1.314.

On the dorsal surface of the fingers the difference in mean sensibility between the two radial and the two ulnar fingers is less than on the palmar surface.

Comparison of the radio-digito-palmar with the radio-digito-dorsal surface.—The palmar surface of the two radial fingers together exceeds in sensibility that of the dorsal by one third, a very much smaller difference than is found in the surfaces in the radio-metacarpal region.

Comparison of the ulno-digito-palmar with the ulno-digito-dorsal surface.—The palmar surface of the two radial fingers together exceeds in sensibility that of the dorsal by somewhat over one fourth, so that while the difference of the surface in sensitiveness is vastly less than in the metacarpal portion of the hand on the same side, it is also less than exists in the digital region of the radial side.

II. We may now examine more minutely how the lateral halves of the hand differ in sensibility as we proceed from base to apex; we can see, at the same time, the rate of increase of sensibility on the two sides. I again omit the thumb from calculation.

Comparison of lateral halves of zones formed by corresponding anatomical parts on both surfaces and borders of hand, from base to distal extremity.—

RADIAL SIDE.				ULNAR SIDE.			Difference, excess of.		
Zone.		Spots.	Mean.	Increase.	Spots.	Mean.	Increase.	Radial.	Ulnar.
1	Base of metacarpus . .	3	3.233	—	3	3.000	—	—	About $\frac{1}{3}$ th.
2	Middle of ditto . . .	3	2.600	Under $\frac{1}{3}$ th.	3	2.566	Over $\frac{1}{3}$ th.	—	Trifling.
3	Heads of ditto . . .	5	2.030	About $\frac{1}{3}$ ths.	5	2.200	About $\frac{1}{3}$ th.	About $\frac{1}{3}$ th.	—
4	Clefts of fingers . .	5	1.500	About $\frac{1}{3}$ ths.	5	1.595	About $\frac{1}{3}$ ths.	About $\frac{1}{3}$ th.	—
5	Between last and 1st phalangeal joints . .	5	1.290	Under $\frac{1}{3}$ th.	5	1.360	Over $\frac{1}{3}$ th.	About $\frac{1}{3}$ th.	—
6	1st phalangeal joints .	5	1.115	Under $\frac{1}{3}$ th.	5	1.175	Under $\frac{1}{3}$ th.	About $\frac{1}{3}$ th.	—
7	Middle of 2nd phalanges .	5	.945	Over $\frac{1}{3}$ th.	5	1.070	About $\frac{1}{3}$ th.	Under $\frac{1}{3}$ th.	—
8	2nd phalangeal joints .	5	.750	Over $\frac{1}{3}$ th.	5	.830	About $\frac{1}{3}$ ths.	Under $\frac{1}{3}$ th.	—
9	Middle of last phalanges .	5	.650	Under $\frac{1}{3}$ th.	5	.710	Over $\frac{1}{3}$ th.	Under $\frac{1}{3}$ th.	—

From this table it appears—1. As respects the difference in sensibility of the two sides of the hand in the several zones, that at the base of the metacarpus the excess is, on the whole, in favour of the ulnar side, but that this difference disappears on proceeding further along the metacarpus, until at the level of the heads of the metacarpal bones the difference is in favour of the radial side, and remains so throughout the remaining distal part of the hand. From this point, however, to the first phalangeal joints the difference becomes gradually less marked, but after this is

considerably increased, lessening again, however, from the second phalanges towards the apex of the hand.

2. As respects the rate of increase of sensibility on the two sides, on proceeding towards the apex of the hand it appears that, on the whole, as the ulnar side commences with a higher sensitiveness than the radial, so that sensibility increases towards the apex at a less rapid rate.

Comparison of lateral halves of transverse lines formed by analogous anatomical parts on the palmar surface.

RADIAL SIDE.				ULNAR SIDE.			Difference, excess of.		
Line.		Spots.	Mean.	Increase.	Spots.	Mean.	Increase.	Radial.	Ulnar.
1	Base of metacarpus . . .	1	2 000	—	1	1 800	—	—	$\frac{1}{8}$ th.
2	Middle of ditto . . .	1	1 900	$\frac{1}{8}$ th.	1	1 700	$\frac{1}{8}$ th.	—	Under $\frac{1}{8}$ th.
3	Heads of ditto . . .	2	1 550	About $\frac{1}{4}$ ths.	2	1 650	Very trifling.	Under $\frac{1}{8}$ th.	—
4	Clefts of fingers . . .	2	1 250	Under $\frac{1}{4}$ th.	2	1 300	Over $\frac{1}{4}$ th.	Very trifling.	—
5	Between last and 1st phalangeal joints . . .	2	1 150	Under $\frac{1}{4}$ th.	2	1 250	Very trifling.	Under $\frac{1}{8}$ th.	—
6	1st phalangeal joints . . .	2	1 025	Under $\frac{1}{4}$ th.	2	1 100	Under $\frac{1}{4}$ th.	Under $\frac{1}{8}$ th.	—
7	Middle of 2nd phalanges . . .	2	887	Under $\frac{1}{4}$ th.	2	1 025	About $\frac{1}{8}$ th.	Under $\frac{1}{4}$ th.	—
8	2nd phalangeal joints . . .	2	737	Over $\frac{1}{4}$ th.	2	862	Under $\frac{1}{4}$ th.	Over $\frac{1}{8}$ th.	—
9	Middle of last phalanges . . .	2	625	Over $\frac{1}{4}$ th.	2	700	Under $\frac{1}{4}$ th.	Under $\frac{1}{4}$ th.	—
	Tips of fingers . . .	2	375	$\frac{1}{4}$ rds.	2	425	About $\frac{1}{4}$ rds.	Under $\frac{1}{4}$ th.	—

1. Thus, on the whole, the relative distribution of the sensibility on the two sides corresponds with what we found when the lateral halves of the zone were compared, but at most parts the difference between the sides is more marked.

2. The greatest difference in the rate of increase of sensibility, on tracing it from base to apex, is seen in the zone which commences in the middle of the metacarpus and at first phalangeal joints. There is greater uniformity after these joints are passed.

Comparison of lateral halves of transverse lines formed by analogous anatomical parts on the dorsal surface.

RADIAL SIDE.					ULNAR SIDE.			Difference, excess of.	
Line.		Spots.	Mean.	Increase.	Spots.	Mean.	Increase.	Radial.	Ulnar.
1	Base of metacarpus . . .	1	4.100	—	1	5.000	—	About $\frac{3}{4}$ ths.	—
2	Middle of ditto . . .	1	3.600	Under $\frac{1}{4}$ th.	1	4.000	$\frac{1}{4}$ th.	About $\frac{1}{4}$ th.	—
3	Heads of ditto . . .	2	2.850	Over $\frac{1}{4}$ th.	2	3.200	$\frac{1}{4}$ th.	About $\frac{1}{4}$ th.	—
4	Clefts of fingers . . .	2	1.900	$\frac{1}{2}$.	2	2.125	About $\frac{1}{4}$.	Under $\frac{1}{4}$ th.	—
5	Between last and 1st phalangeal joints . . .	2	1.550	Over $\frac{1}{4}$ rd.	2	1.600	Under $\frac{1}{4}$ rd.	Very trifling.	—
6	1st phalangeal joints . . .	2	1.360	Over $\frac{1}{4}$ th.	2	1.335	About $\frac{1}{4}$ th.	Very trifling.	—
7	Middle of 2nd phalanges . . .	2	1.137	Under $\frac{1}{4}$ th.	2	1.225	About $\frac{1}{4}$ th.	About $\frac{1}{15}$ th.	—
8	2nd phalangeal joints . . .	2	.850	About $\frac{1}{4}$ rd.	2	.850	Under $\frac{1}{4}$.	None.	—
9	Middle of last phalanges . . .	2	.750	Under $\frac{1}{4}$ th.	2	.750	Under $\frac{1}{4}$ th.	None.	—

1. On this surface it is to be observed, then, that where a difference between the two sides does exist, it is in favour of the radial side, but that after passing the clefts of the fingers there comes to be a very trifling difference observable, and on passing the middle of the second row of phalanges none at all, and this in a part of the digital region where on the palmar surface the difference is the most marked.

2. As regards the rate of increase on the two sides, but little difference is, on the whole, observable.

Comparison of the sensibility of the palmar and dorsal surfaces, on the radial and ulnar halves respectively, in the several transverse lines.

Line	RADIAL SIDE.	
1. Base of metacarpus . . .	.	Palmar surface is twice as sensitive as dorsal.
2. Middle of ditto . . .	.	Palmar surface is nearly twice as sensitive as dorsal.
3. Heads of ditto . . .	.	Ditto.
4. Clefts of fingers . . .	.	Palmar surface exceeds dorsal by over $\frac{1}{4}$.
5. Between last and 1st phalangeal joints . . .	.	Ditto over $\frac{1}{4}$ rd.
6. 1st phalangeal joints . . .	.	Ditto under $\frac{1}{4}$ rd.
7. Middle of 2nd phalanges . . .	.	Ditto over $\frac{1}{4}$ th.
8. 2nd phalangeal joints . . .	.	Ditto over $\frac{1}{4}$ th.
9. Middle of last phalanges . . .	.	Ditto $\frac{1}{4}$ th.

ULNAR SIDE.		
Line.		
1. Base of metacarpus	.	Palmar surface is nearly thrice as sensitive as dorsal.
2. Middle of ditto	.	Palmar surface is more than twice as sensitive as dorsal.
3. Heads of ditto	.	Palmar surface is nearly twice as sensitive as dorsal.
4. Clefts of fingers	.	Palmar surface exceeds dorsal by nearly $\frac{2}{3}$ rds.
5. Between last and 1st phalangeal joints	.	Ditto over $\frac{1}{4}$ th.
6. 1st phalangeal joints	.	Ditto over $\frac{1}{4}$ th.
7. Middle of 2nd phalanges	.	Ditto under $\frac{1}{4}$ th.
8. 2nd phalangeal joints	.	Palmar and dorsal surfaces nearly agree.
9. Middle of last phalanges	.	Palmar surface exceeds dorsal by $\frac{1}{4}$ th.

Thus it appears that, until the clefts of the fingers are passed, the difference between the dorsal and palmar surfaces is much more marked on the ulnar than on the radial side, but that beyond this line the difference is less marked than on the radial side.

COMPARISON OF THE CENTRAL WITH THE LATERAL PARTS OF THE HAND ON THE PALMAR AND DORSAL SURFACES.—Generally this comparison may be thus stated (excluding thumb):

	Radial side, mean of	Centre, mean of	Ulnar side, mean of
Palmar surface	9 spots, 1·177	16 spots, 1·200	9 spots, 1·280
Dorsal ditto	9 „ 1·888	16 „ 2·037	9 „ 2·105

In this comparison, in the digital region the radial side is assumed to be formed by the surface of the index finger, the central by the middle and ring fingers, and the ulnar by the little finger. Thus compared, it appears that the sensibility on the palmar surface generally may be said to shade off from the radial to the ulnar side, the central part being intermediate in sensibility. On the dorsal surface the same is observed.

Comparison of the central and lateral parts in the metacarpal region on the palmar and dorsal surfaces.—

	Radial side, mean of	Centre, mean of	Ulnar side, mean of
Metacarpo-palmar surface	3 spots, 1·800	4 spots, 1·725	3 spots, 1·733
Metacarpo-dorsal ditto	3 „ 3·300	4 „ 4·025	3 „ 3·900

Thus it appears that—1. On the palmar surface (excluding the thumb) the highest sensibility in the metacarpal region is in the centre, and that proceeding from this towards the border the sensibility becomes lowered, but more so towards the radial than towards the ulnar side, which last differs, in fact, very little from the centre in sensibility.

2. On the dorsal aspect the converse is observed; the centre is here the least sensitive part, and the sensibility increases towards the borders, and more markedly towards the radial than towards the ulnar border.

3. As a result of all this, it further follows that the difference in sensibility of the palmar and dorsal surface in this region is greatest in the central part and least in the radial; thus—

The palmar surface exceeds the dorsal in the radial part by $\frac{5}{8}$ ths.			
"	"	central	" $1\frac{1}{2}$ rd.
"	"	ulnar	" $1\frac{1}{4}$ th.

Comparison of the central and lateral parts in the digital region on the palmar and dorsal surfaces.—

	Radial side, mean of		Centre, mean of		Ulnar side, mean of
Digito-palmar surface	6 spots,	·866 ...	12 spots,	1·025 ...	6 spots, 1·054
Digito-dorsal ditto	6 „	1·183 ...	12 „	1·375 ...	6 „ 1·208

Hence—1. On the palmar surface the sensibility is highest on the index finger, and shades off towards the ulnar side, becoming least on the little finger. It is worthy of remark that the amount of sensibility of the palmar surfaces of the middle and ring fingers is identical, not only generally, but over each anatomically analogous spot.

2. On the dorsal surface, as in the metacarpal region, the lowest sensibility is found in the centre, the highest (as on the palmar) over the index finger, and the next highest over the little finger. On this surface the two central fingers, however, do not agree so closely in sensibility, the ring finger on the dorsum being less sensitive than the middle finger, although this difference is mainly discoverable posteriorly to the first phalangeal joint.

3. Thus it happens that the palmar sensibility, highest upon the index finger and shading off towards the little finger, becomes intensified on both borders, but chiefly upon the radial; that after turning these borders it again rapidly becomes lowered, until it attains its minimum upon the dorsum of the ring finger.

4. The difference in sensibility between the palmar and dorsal surfaces is greatest on the index finger. The nearest approach to uniformity, however, is found upon the little finger, thus—

The palmar surface exceeds the dorsal on the index finger by over $\frac{1}{3}$ rd.
 " " " central fingers by about $\frac{1}{3}$ rd.
 " " " little finger by about $\frac{1}{4}$ th.

Of the two central fingers the palmar surface exceeds the dorsal in the middle finger by less than one third, and on the ring finger by over one third.

Comparison of sensibility of central and lateral parts in transverse lines on the palmar surface.

RADIAL SIDE.

Line.	Spots.	Mean.	Increase.
1. Base of metacarpus	1 ...	2.0	
2. Middle of ditto	1 ...	1.9	$\frac{1}{10}$ th.
3. Heads of ditto	1 ...	1.5	$\frac{1}{15}$ ths.
4. Clefts of fingers (index)	1 ...	1.2	$\frac{1}{4}$ th.
5. Between last and 1st phalangeal joints	1 ...	1.05	$\frac{1}{4}$ th.
6. 1st phalangeal joints	1 ...	.95	under $\frac{1}{5}$ th.
7. Middle of 2nd phalanges	1 ...	.775	" $\frac{1}{4}$ th.
8. 2nd phalangeal joints	1 ..	.675	over $\frac{1}{4}$ th.
9. Middle of last phalanges	1 ...	.55	under $\frac{1}{4}$ th.
Tips of fingers	1 ...	.35	" $\frac{2}{3}$ rd.

CENTRE.

Line.	Spots.	Mean.	Increase.
1. Base of metacarpus	1 ...	1.9	
2. Middle of ditto	1 ...	1.8	$\frac{1}{10}$ th.
3. Heads of ditto	2 ...	1.6	$\frac{1}{10}$ th.
4. Clefts of fingers (middle and ring)	2 ...	1.3	under $\frac{1}{4}$ th.
5. Between last and 1st phalangeal joints	2 ...	1.25	$\frac{1}{15}$ th.
6. 1st phalangeal joints	2 ...	1.1	under $\frac{1}{10}$ th.
7. Middle of 2nd phalanges	2 ...	1.0	$\frac{1}{10}$ th.
8. 2nd phalangeal joints	2 ...	.8	$\frac{1}{4}$ th.
9. Middle of last phalanges	2 ...	.7	$\frac{1}{4}$ th.
Tips of fingers	2 ...	.425	about $\frac{1}{3}$ rd.

ULNAR SIDE.

Line.		Spots.	Mean.	Increase.
1. Base of metacarpus	.	1 ...	1·8	
2. Middle of ditto	.	1 ...	1·7	$\frac{1}{11}$ th.
3. Heads of ditto	.	1 ...	1·7	none.
4. Clefts of fingers (little)	.	1 ...	1·3	under $\frac{1}{12}$ rd.
5. Between 1st and last phalangeal joints	.	1 ...	1·25	$\frac{1}{13}$ th.
6. 1st phalangeal joints	.	1 ...	1·1	under $\frac{1}{14}$ th.
7. Middle of 2nd phalanges	.	1 ...	1·05	very trifling.
8. 2nd phalangeal joints	.	1 ...	·925	under $\frac{1}{15}$ th.
9. Middle of last phalanges	.	1 ...	·7	under $\frac{1}{16}$ rd.
Tips of fingers	.	1 ...	·4	$\frac{1}{17}$ ths.

The middle and ring fingers absolutely agree at each line.

1. At the two proximal lines, then, the sensibility is lowest in the parts corresponding to the index finger, increasing regularly to the ulnar side (the parts corresponding to the little finger), but from the heads of the metacarpal bones onwards towards the apex the predominance is on the radial, and it either gradually lessens towards the little finger or the lowered sensibility of the central finger is maintained unaltered on the little finger.

2. The increase takes place at the greatest rate in the index finger, and the parts where this greater rate is most perceptible are in the band succeeding the clefts of the fingers and that succeeding the first phalangeal joints.

Comparison of sensibility of central and lateral parts in transverse lines on the dorsal surface.

RADIAL SIDE.

Line.		Spots.	Mean.	Increase.
1. Base of metacarpus	.	1 ...	4·1	
2. Middle of ditto	.	1 ...	3·6	under $\frac{1}{11}$ th.
3. Heads of ditto	.	1 ...	2·2	about $\frac{1}{12}$ rd.
4. Clefts of fingers	.	1 ...	1·7	under $\frac{1}{13}$ rd.
5. Between last and 1st phalangeal joints	.	1 ...	1·45	over $\frac{1}{14}$ th.
6. 1st phalangeal joints	.	1 ...	1·3	„ $\frac{1}{15}$ th.
7. Middle of 2nd phalanges	.	1 ...	1·125	under $\frac{1}{16}$ th.
8. 2nd phalangeal joints	.	1 ...	·8	„ $\frac{1}{17}$ ths.
9. Middle of last phalanges	.	1 ...	·725	over $\frac{1}{18}$ th.

CENTRE.				
Line.		Spots.	Mean.	Increase.
1. Base of metacarpus	.	1 ...	4.8	
2. Middle of ditto	.	1 ...	4.1	about $\frac{1}{4}$ th.
3. Heads of ditto	.	2 ...	3.6	" $\frac{1}{4}$ th.
4. Clefts of fingers	.	2 ...	2.275	" $\frac{3}{8}$ ths.
5. Between last and 1st phalangeal joints	.	2 ...	1.7	" $\frac{1}{4}$ rd.
6. 1st phalangeal joints	.	2 ...	1.4	over $\frac{1}{4}$ th.
7. Middle of 2nd phalanges	.	2 ...	1.2	$\frac{1}{4}$ th.
8. 2nd phalangeal joints	.	2 ...	.9	$\frac{1}{4}$ rd.
9. Middle of last phalanges	.	2 ...	.775	about $\frac{1}{8}$ th.

ULNAR SIDE.				
Line.		Spots.	Mean.	Increase.
1. Base of metacarpus	.	1 ...	5.0	
2. Middle of ditto	.	1 ...	4.0	$\frac{1}{4}$ th.
3. Heads of ditto	.	1 ...	2.7	about $\frac{1}{8}$.
4. Clefts of fingers	.	1 ...	1.8	$\frac{1}{8}$.
5. Between last and 1st phalangeal joints	.	1 ...	1.45	under $\frac{1}{4}$ th.
6. 1st phalangeal joints	.	1 ...	1.275	about $\frac{1}{4}$ th.
7. Middle of 2nd phalanges	.	1 ...	1.2	" $\frac{1}{10}$ th.
8. 2nd phalangeal joints	.	1 ...	.8	$\frac{1}{8}$.
9. Middle of last phalanges	.	1 ...	.725	over $\frac{1}{10}$ th.

On the dorsum the middle and ring fingers do not accurately correspond; the principal difference in favour of the middle finger is met with on the proximal side of the first phalangeal joints; beyond this the sensibility of the fingers nearly corresponds.

1. In all of these lines, then, the centre is the least sensitive part of the dorsum, with the solitary exception of the first, the spot of lowest sensibility of the whole hand being found to lie over the base of the fifth metacarpal bone. With a trifling exception, scarcely worth noticing, the sensibility of corresponding spots on the index and little fingers is either in favour of the index or no difference is perceptible at all.

2. The most rapid rate of increase is noticed on the little finger and the corresponding part of the metacarpal region; the least rapid on the index.

FINGERS.

I. Observations were made upon the four surfaces of each finger (their free portion) and upon their tips.

The mean sensibility of the four fingers, including their tips, is as follows:

The palmar surface and radial sides of the little finger are almost identical in sensibility.

Comparison of the radial sides of fingers with their dorsal surfaces.—On every finger the radial side is more sensitive than the dorsal surface, thus—

The radial side of the index finger exceeds the dorsal surface by under $\frac{1}{2}$.					
"	middle	"	"	"	$\frac{2}{3}$ ths.
"	ring	"	"	"	$\frac{1}{3}$ rd.
"	little	"	"	"	over $\frac{1}{10}$ th.

The radial side of each, then, approaches in character the dorsal surface more and more as the fingers lie nearer and nearer to the ulnar side of the hand ; it comes very much nearer to it on the little finger than on any of the others.

Ulnar sides of the fingers.—Their mean sensibility is as follows :

Index finger, mean of 5 spots, '965. in.					
Middle	"	"	5	"	1.140 "
Ring	"	"	5	"	1.120 "
Little	"	"	6	"	.908 "

The ulnar side of the little finger entering into the formation of the border of the hand, which it is important should possess considerable tactile sensibility, is seen here, then, to be the most sensitive of all the fingers on their ulnar side. Next to it in order stands the index, which is superlatively the organ of touch, being so commonly used for this purpose separately from the other fingers. The ulnar sides of the middle and ring fingers nearly agree, as they do on their palmar and dorsal aspects. The little finger on this side exceeds the index in sensibility by about one sixteenth, and the ring finger by under one third. The index finger exceeds the middle and ring fingers by over one sixth.

Comparison of the ulnar sides of the fingers with their palmar surfaces.—The little finger (forming part of border of hand) here stands alone, for as the radial side of the index finger exceeds its palmar surface in sensibility, so the ulnar

side of the little finger is more sensitive than its palmar surface. In all the other fingers the palmar surface exceeds in sensibility their ulnar side. Thus—

The palmar surface of index finger exceeds the ulnar side by	over $\frac{1}{3}$ th.
„ middle finger „ „	about $\frac{1}{3}$ th.
„ ring finger „ „	over $\frac{1}{3}$ th.

The ulnar side of the little finger exceeds the palmar surface by under $\frac{1}{3}$ th.

Comparison of the ulnar sides of the fingers with their dorsal surfaces.—On each of the fingers the ulnar side is more sensitive than their dorsal surface. Thus—

The ulnar side of the index finger exceeds the dorsal surface by	under $\frac{1}{4}$ th.
„ middle finger „ „	about $\frac{1}{3}$ th.
„ ring finger „ „	over $\frac{1}{4}$ th.
„ little finger „ „	$\frac{1}{3}$ rd.

The nearest approach to the character of the dorsal surface is met with, then, on the middle finger, and the greatest difference on the little finger.

Comparison of the radial and ulnar sides of each finger.—The little finger here stands alone. The importance of giving high sensibility to the border of the hand has caused a concentration of its sensibility upon its ulnar side, so that it is the only finger in which the sensibility of this side exceeds that of the radial. In all the others the radial exceeds the ulnar side. Thus—

The radial side of the index finger exceeds the ulnar side by	$\frac{1}{3}$ th.
„ middle finger „ „	under $\frac{1}{3}$ th.
„ ring finger „ „	about $\frac{1}{15}$ th.

The ulnar side of the little finger exceeds the radial side by over $\frac{1}{3}$ th.

The little use which is made of the sides of the ring finger make their sensibility of but little importance. The radial and ulnar sides, then, differ very slightly, both being comparatively low in the scale of sensibility. The radial side of the little finger is of no importance at all compared with the side which enters into the formation of the border of the hand.

Sensibility of the interspaces of the fingers ; comparison of opposing sides.—As a body sufficiently small may be

placed between the fingers in any of the three interspaces, this relation must not be overlooked.

	Ulnar side of		Radial side of		Sum of means.
1st interspace.	Index finger	.965 ...	middle finger	.960	1.925.
2nd	" Middle	" 1.140 ...	ring	" 1.065	2.205.
3rd	" Ring	" 1.120 ...	little	" 1.095	2.215.

The second and third interspaces pretty nearly agree in sensibility. The first exceeds them by over one seventh. A body placed in the interval between the index and middle fingers, then, would be felt better than when placed between the other fingers. In each interval the opposing radial side of the fingers forming it is the more sensitive. In the first interspace, however, the two opposing sides nearly agree in sensibility.

TIPS OF FINGERS.—In my hand the sensibility of the tips of the fingers is as follows :

Index finger	.35 in.
Middle "	.4 "
Ring "	.45 "
Little "	.4 "

Weber represents "the tip of the third finger" (? middle) as the most sensitive. Valentin gives the predominance to that of the index. In my own hand the index is unquestionably the most sensitive at the tip. In this it merely corresponds with the general character of the finger. It is the finger the extremity of which we most commonly and instinctively employ alone to determine the physical qualities of any substance to which the sense of touch is applicable. The lowest sensibility is seated at the tip of the ring finger, which, except in conjunction with the other fingers is rarely used for this purpose. The tip of the middle finger is commonly used in conjunction with that of the index, and a somewhat higher sensibility of the tip of the little finger appears to be imparted to it, as forming, as it were, the extremity of the border of the hand.

II. As with the hand at large, so with each finger, the sensibility gradually increases from the attachment of the

fingers towards their extremities. This also may in each finger be studied in zones, formed by anatomically analogous parts, and also upon each surface.

Sensibility of zones formed by corresponding parts of fingers, from their attachment to distal extremities. The numbers within parentheses indicate the corresponding zones in the tables given with respect to the hand at large :

INDEX.

Zones.	Mean of	Increase.
(4) 1. Clefts of fingers . . .	3 spots, 1·336	
(5) 2. Between last and 1st phalangeal joint . . .	4 " 1·225	about $\frac{1}{11}$ th.
(6) 3. 1st phalangeal joint . . .	4 " 1·062	over $\frac{1}{11}$ th.
(7) 4. Middle of 2nd phalanx . . .	4 " ·875	" $\frac{1}{8}$ th.
(8) 5. 2nd phalangeal joint . . .	4 " ·693	" $\frac{1}{8}$ th.
(9) 6. Middle of last phalanx . . .	4 " ·606	about $\frac{1}{11}$ th.
Tip . . .	·350	" $\frac{3}{4}$ ths.

MIDDLE.

Zones.	Mean of	Increase.
(4) 1. Clefts of fingers . . .	2 spots, 1·700	
(5) 2. Between last and 1st phalangeal joint . . .	4 " 1·475	over $\frac{1}{11}$ th.
(6) 3. 1st phalangeal joint . . .	4 " 1·268	about $\frac{1}{8}$ th.
(7) 4. Middle of 2nd phalanx . . .	4 " 1·056	" $\frac{1}{8}$ th.
(8) 5. 2nd phalangeal joint . . .	4 " ·843	" $\frac{1}{8}$ th.
(9) 6. Middle of last phalanx . . .	4 " ·662	over $\frac{1}{11}$ th.
Tip . . .	·400	about $\frac{1}{8}$ ths.

RING.

Zones.	Mean of	Increase.
(4) 1. Clefts of fingers . . .	2 spots, 1·875	
(5) 2. Between last and 1st phalangeal joint . . .	4 " 1·537	over $\frac{1}{11}$ th.
(6) 3. 1st phalangeal joint . . .	4 " 1·300	under $\frac{1}{8}$ th.
(7) 4. Middle of 2nd phalanx . . .	4 " 1·106	over $\frac{1}{8}$ th.
(8) 5. 2nd phalangeal joint . . .	4 " ·843	under $\frac{1}{8}$ th.
(9) 6. Middle of last phalanx . . .	4 " ·675	about $\frac{1}{11}$ th.
Tip . . .	·450	$\frac{1}{2}$.

LITTLE.

Zones.	Mean of	Increase.
(4) 1. Clefts of fingers . . .	3 spots, 1·408	
(5) 2. Between last and 1st phalangeal joint . . .	4 " 1·350	very trifling.
(6) 3. 1st phalangeal joint . . .	4 " 1·156	about $\frac{1}{8}$ th.
(7) 4. Middle of 2nd phalanx . . .	4 " 1·056	over $\frac{1}{8}$ th.
(8) 5. 2nd phalangeal joint . . .	4 " ·825	" $\frac{1}{8}$ th.
(9) 6. Middle of last phalanx . . .	4 " ·681	" $\frac{1}{8}$ th.
Tip . . .	·400	under $\frac{1}{8}$ ths.

The rapid increase from the middle of the last phalanges to the tips of the fingers is here most marked ; it is greatest

in those fingers which have the highest sensibility at the extremity.

The order of most acute sensibility of the fingers at large, viz., index, little, middle, and ring, is observed to be pretty accurately preserved in each zone. Now and then, however, the little and middle fingers agree in sensibility, and in one zone the middle and ring fingers agree. At the middle of the last phalanges, however, a different order is assumed, apparently preparatory to the final distribution of sensibility to their extremities, the order being index, middle, ring, little.

Comparison of anatomically analogous spots on radial sides of fingers.

Lines.	INDEX.		MIDDLE.	
	Increase.		Increase.	
(5) 2. Between clefts of fingers and 1st phalangeal joint	1.050		1.400	
(6) 3. 1st phalangeal joint	.825	about $\frac{2}{3}$ ths.	1.175	under $\frac{1}{2}$ th.
(7) 4. Middle of 2nd phalanx	.675	under $\frac{1}{2}$ th.	.925	over $\frac{1}{2}$ th.
(8) 5. 2nd phalangeal joint	.575	over $\frac{1}{2}$ th.	.775	under $\frac{1}{2}$ th.
(9) 6. Middle of last phalanx	.500	over $\frac{1}{2}$ th.	.525	„ $\frac{1}{2}$.

Lines.	RING.		LITTLE.	
	Increase.		Increase.	
(5) 2. Between clefts of fingers and 1st phalangeal joint	1.550		1.600	
(6) 3. 1st phalangeal joint	1.300	under $\frac{1}{2}$ th.	1.250	about $\frac{2}{3}$ ths.
(7) 4. Middle of phalanx	1.125	„ $\frac{1}{2}$ th.	1.125	„ $\frac{1}{2}$ th.
(8) 5. 2nd phalangeal joint	.775	„ $\frac{1}{2}$.	.850	about $\frac{1}{3}$ rd.
(9) 6. Middle of last phalanx	.575	over $\frac{1}{3}$ rd.	.650	under $\frac{1}{3}$ rd.

Each corresponding spot, then, follows the general rule of gradation of sensitiveness from radial to ulnar side pretty accurately.

Comparison of anatomically analogous spots on the ulnar sides of the fingers.

Lines.	INDEX.		MIDDLE.	
	Increase.		Increase.	
(5) 2. Between clefts of fingers and 1st phalangeal joint	1.350		1.600	
(6) 3. 1st phalangeal joint	1.175	over $\frac{1}{2}$ th.	1.400	$\frac{1}{2}$ th.
(7) 4. Middle of 2nd phalanx	.925	about $\frac{2}{3}$ ths.	1.150	over $\frac{1}{2}$ th.
(8) 5. 2nd phalangeal joint	.725	„ $\frac{2}{3}$ ths.	.900	„ $\frac{1}{2}$ th.
(9) 6. Middle of last phalanx	.650	over $\frac{1}{2}$ th.	.650	„ $\frac{1}{3}$ rd.

Lines.		RING.		LITTLE.	
		Increase.		Increase.	
5)	2. Between clefts of fingers and 1st phalangeal joint	1·600		1·100	
(6)	3. 1st phalangeal joint	1·400	$\frac{1}{2}$ th.	1·000	$\frac{1}{10}$ th.
(7)	4. Middle of 2nd phalanx	1·050	$\frac{1}{3}$ rd.	·850	over $\frac{1}{8}$ th.
(8)	5. 2nd phalangeal joint	·900	$\frac{1}{8}$ th.	·725	„ $\frac{1}{8}$ th.
(9)	6. Middle of last phalanx	·650	over $\frac{1}{3}$ rd.	·650	„ $\frac{1}{3}$ th.

In these tables, while the general rule as to the order of sensitiveness of these surfaces generally holds good, the following points are worthy of observation:—1st. That in the two most distal spots the index and little fingers actually coincide, while in the more proximal the little exceeds the index in sensibility. 2nd. That in all the spots, with one trifling exception, the ring and middle fingers agree. 3rd. That in the last spot the fingers all agree in sensitiveness. This last point appears to be related to the shape of the extremity of the hand from the different lengths of the fingers, bringing the ulnar side of the last phalanx of the ring finger into the formation of the border or extremity of the hand.

Comparison of sides and surfaces of each finger at each zone, arranging the sides and surfaces at each zone in the order of sensitiveness.

		INDEX.		MIDDLE.	
		Surfaces.	Excess over succeeding surface.	Surfaces.	Excess over succeeding surface.
(5)	2. Between clefts of fingers and 1st phalangeal joints.	Palmar	1·050	Palmar	1·250
		Radial	1·050	Radial	1·400
		Ulnar	1·350	Ulnar	1·600
		Dorsal	1·450	Dorsal	1·650
		RING.		LITTLE.	
		Surfaces.	Excess over succeeding surface.	Surfaces.	Excess over succeeding surface.
		Palmar	1·250	Ulnar	1·100
		Radial	1·550	Palmar	1·250
		Ulnar	1·600	Dorsal	1·450
		Dorsal	1·750	Radial	1·600

Zone.	INDEX.		MIDDLE.	
	Surfaces.	Excess over succeeding surface.	Surfaces.	Excess over succeeding surface.
(6) 3. 1st phalangeal joints.	Radial	·825 over $\frac{1}{4}$ th.	Palmar	1·100 trifling.
	Palmar	·950 under $\frac{1}{4}$ th.	Radial	1·175 under $\frac{1}{4}$ th.
	Ulnar	1·175 under $\frac{1}{4}$ th.	Ulnar	1·400
	Dorsal	1·300	Dorsal	1·400
	RING.		LITTLE.	
	Palmar	1·100 under $\frac{1}{4}$ th.	Ulnar	1·000 $\frac{1}{10}$ th.
	Radial	1·300 $\frac{1}{15}$ th.	Palmar	1·100 under $\frac{1}{4}$ th.
	Ulnar	1·400	Radial	1·250 trifling.
	Dorsal	1·400	Dorsal	1·275

Zone.	INDEX.		MIDDLE.	
	Surfaces.	Excess over succeeding surface.	Surfaces.	Excess over succeeding surface.
(7) 4. Middle of 2nd phalanges.	Radial	·675 over $\frac{1}{4}$ th.	Radial	·925 trifling.
	Palmar	·775 under $\frac{1}{4}$ th.	Palmar	1·000 over $\frac{1}{4}$ th.
	Ulnar	·925 over $\frac{1}{4}$ th.	Ulnar	1·150
	Dorsal	1·125	Dorsal	1·150
	RING.		LITTLE.	
	Palmar	1·000 trifling.	Ulnar	·850 under $\frac{1}{4}$ th.
	Ulnar	1·050 $\frac{1}{14}$ th.	Palmar	1·050 $\frac{1}{14}$ th.
	Radial	1·125 $\frac{1}{5}$ th.	Radial	1·125 over $\frac{1}{14}$ th.
	Dorsal	1·250	Dorsal	1·200

Zone.	INDEX.		MIDDLE.	
	Surfaces.	Excess over succeeding surface.	Surfaces.	Excess over succeeding surface.
(8) 5. 2nd phalangeal joints.	Radial	·575 over $\frac{1}{4}$ th.	Radial	·775 trifling.
	Palmar	·675 about $\frac{1}{13}$ th.	Palmar	·800 $\frac{1}{8}$ th.
	Ulnar	·725 over $\frac{1}{10}$ th.	Ulnar	·900
	Dorsal	·800	Dorsal	·900
	RING.		LITTLE.	
	Radial	·775 trifling.	Ulnar	·725 over $\frac{1}{10}$ th.
	Palmar	·800 $\frac{1}{8}$ th.	Dorsal	·800 $\frac{1}{16}$ th.
	Ulnar	·900	Radial	·850 about $\frac{1}{11}$ th.
	Dorsal	·900	Palmar	·925

		INDEX.		MIDDLE.	
		Surfaces.	Excess over succeeding surface.	Surfaces.	Excess over succeeding surface.
(9) 6. Middle of last phalanges.	Radial	.500	over $\frac{1}{10}$ th.	Radial	.525 $\frac{1}{10}$ th.
	Palmar	.550	over $\frac{1}{8}$ th.	Ulnar	.650 $\frac{1}{13}$ th.
	Ulnar	.650	„ $\frac{1}{9}$ th.	Palmar	.700 under $\frac{1}{9}$ th.
	Dorsal	.725		Dorsal	.775
		RING.		LITTLE.	
(9) 6. Middle of last phalanges.	Radial	.575	over $\frac{1}{8}$ th.	Ulnar	.650
	Ulnar	.650	$\frac{1}{13}$ th.	Radial	.650 $\frac{1}{13}$ th.
	Palmar	.700	under $\frac{1}{9}$ th.	Palmar	.700 trifling.
	Dorsal	.775		Dorsal	.725

But few remarks are needed with respect to the above table.—1. On the index finger in each zone, the order of sensibility on the surfaces is, radial, palmar, ulnar, and dorsal, the only exception being that in the proximal zone the radial and palmar surfaces coincide. 2. On the middle finger the superiority in sensibility of the radial side over the others is only observable from the first phalangeal joints onwards. When the radial side becomes the most sensitive, the palmar surface comes second in order, until arriving at the last zone, when the ulnar side takes precedence of it. In all but the proximal and distal zones the ulnar and dorsal surfaces coincide. This renders the high position of the ulnar in the last zone more remarkable. 3. On the ring finger it is still later that the radial side acquires pre-eminence, viz., at the penultimate zone. Until this happens the palmar stands highest, and subsequently second. Both on this finger and on the middle there appears a tendency for the ulnar side to rise in the scale; here too in the last zone, and also in the antepenultimate zone, it stands second, in the former being above the palmar, and in the latter above the radial. 4. On the little finger this predominance of the ulnar side is confirmed. It throughout takes the first rank. In the three proximal zones the palmar stands next to it, but in the last two it is either lowest in sensibility or is not far removed from the lowest. In the last zone the radial side, which

had previously stood lowest or next to the lowest in sensibility, rises to the second place, next to the ulnar. It is worthy of remark, first, than in every zone in each finger, with the exception of two on the little finger, the dorsal surface stands last and lowest in sensibility; and next, that at the last zones (middle of last phalanges) of every finger, except the index, the radial and ulnar sides are more sensitive than the palmar surface.

A study of the columns headed "Excess of sensibility over succeeding surface," will show how gradually any variation in the order of pre-eminence on proceeding from the base towards the tip is effected.

THUMB.

In the previous portions of this inquiry I have found it convenient, for the most part, to discard the thumb from my calculations, and this mainly on the ground of simplicity in my statements. It is incumbent upon me now to enter upon a separate consideration of this organ, peculiar in its anatomy, in its attachment to the carpus, and in its opposability to other portions of the hand. In doing this, however, it will be necessary to take again into consideration the sensibility of certain spots upon its surface which have already been considered in other relations.

THUMB AS A WHOLE.—Its general sensibility, including its metacarpal and free portions, may thus be stated;—Mean sensibility of 25 spots, 1·529 in.

If we regard the thumb as destitute of a metacarpal bone, and as framed upon three bones analogous to phalanges, we may compare this mean with that of the fingers (including metacarpo-phalangeal joints and tips), on which view it is represented as less sensitive than any of them.

The sensibility of—					Excess over that of thumb.
Index finger thus represented is, mean of 27 spots, 1·012 in.					over $\frac{1}{4}$.
Middle finger	"	"	25 "	1·205	under $\frac{2}{3}$ ths.
Ring finger	"	"	25 "	1·254	over $\frac{1}{4}$ th.
Little finger	"	"	27 "	1·133	" $\frac{1}{3}$ rd.

It will be observed that by thus including the metacarpo-phalangeal joints, the order of sensibility is the same as when they are excluded.

*SURFACES, from carpal attachment to extremity.—Palmar surface (excluding tip).—*Mean sensibility of 6 spots, 1.262 in.

This surface is comparable with the palmar surface of the other fingers, including their metacarpo-phalangeal joints. Thus—

					Excess over sensibility of thumb.
Index finger thus represented, mean of 7 spots,				.957 in.	under $\frac{1}{8}$ rd.
Middle finger	"	"	7	" 1.107 .	" $\frac{1}{8}$ th.
Ring finger	"	"	7	" 1.107 .	" $\frac{1}{8}$ th.
Little finger	"	"	7	" 1.146 .	" $\frac{1}{8}$ th.

It is, therefore, lower in sensibility than the corresponding parts of any of the other fingers.

It will be observed that, thus including the metacarpo-phalangeal joints, the order of sensibility of the above four fingers is the same as when they are excluded.

Dorsal surface.—Mean sensibility of 6 spots, 1.741 in.

This surface is comparable with the dorsal surface of the other fingers, including their metacarpo-phalangeal joints. Thus—

					Excess of sensibility over that of thumb.
Index finger thus represented, mean of 7 spots,				1.328 in.	under $\frac{1}{8}$ rd.
Middle finger	"	"	7	" 1.639 .	about $\frac{1}{16}$ th.
Ring finger	"	"	7	" 1.746 .	none.
Little finger	"	"	7	" 1.421	under $\frac{1}{8}$ th.

The dorsal surface of the thumb thus agrees very closely with the corresponding part of the ring finger, of the finger whose dorsal surface is least sensitive of the four.

Here, too, the inclusion of the metacarpo-phalangeal joints does not affect the order of sensibility of the four fingers.

Radial side.—Mean sensibility of 6 spots, 1.420 in.

This surface may be compared with the radial side of the index finger, including the metacarpo-phalangeal joint. Thus—

Index finger thus represented, mean of 7 spots, .882; excess over sensibility of thumb, under $\frac{1}{8}$ ths.

But to compare with the other fingers, the carpo-metacarpal joint of thumb must be excluded. Thus—

Thumb, mean sensibility of 5 spots, 1·185 in.

				Excess over sensibility of thumb.
Middle finger, mean of 5 spots,	·960 in.			under $\frac{1}{4}$ th.
Ring finger	„ 5 „ 1·065	.		over $\frac{1}{8}$ th.
Little finger	„ 5 „ 1·095	.		under $\frac{1}{12}$ th.

In all these instances the radial side of the thumb is below the sensibility of the radial sides of the other fingers.

Ulnar side.—Mean sensibility of 6 spots, 1·858 in.

The surface may be compared with the ulnar side of the little finger, including its metacarpo-phalangeal joint. Thus :

Little finger thus represented, mean of 7 spots, ·964, nearly twice the sensibility of the thumb.

But to compare with the other fingers, the carpo-metacarpal joint of thumb must be excluded. Thus—

Thumb, mean sensibility of 5 spots, 1·500.

				Excess of sensibility over that of thumb.
Index finger, mean of 5 spots,	·965 in.	.		under $\frac{1}{3}$ rd.
Middle finger	„ 5 „ 1·140	.		„ $\frac{1}{3}$ rd.
Little finger	„ 5 „ 1·120	.		„ $\frac{1}{3}$ rd.

It thus is exceeded in sensibility by all the other fingers.

Comparison of the above surfaces among themselves.—The order of sensibility of the surfaces of the thumb, then, is, palmar surface, radial side, dorsal surface, and ulnar side. Thus—

The palmar surface exceeds the radial side in sensibility by over $\frac{1}{8}$ th.	
The radial side	„ dorsal surface „ under $\frac{1}{4}$ th.
The dorsal surface	„ ulnar side „ about $\frac{1}{12}$ th.

METACARPAL PORTION.—Sensibility of the metacarpal portion, including metacarpo-phalangeal joint, mean of 12 spots, 2·200 in.

If we compare this with the first phalanges of the fingers, including in the latter their metacarpo-phalangeal joints and the first phalangeal joints, we find the following results :

					Excess of sensibility over thumb.
The above portion of the index finger, mean of 14 spots, 1·307 in.					over $\frac{3}{4}$ rds.
"	middle finger	"	12	"	1·622 . " $\frac{3}{4}$ rd.
"	ring finger	"	12	"	1·700 . under $\frac{3}{4}$ rd.
"	little finger	"	14	"	1·425 . over $\frac{1}{2}$.

So that the excess of the analogous parts of the fingers over this portion of the thumb is considerable.

Comparison of the palmar surface of the metacarpal portion of the thumb with the palmar surface of the analogous parts of the fingers.—

Palmar surface of metacarpal portion of thumb, mean of 3 spots, 1·666 in.

Palmar surface of analogous part (1st phalangeal) of—					Excess over thumb.
Index finger, mean of 4 spots, 1·175 in.					under $\frac{1}{2}$.
Middle finger	"	4	"	1·312	over $\frac{1}{4}$ th.
Ring finger	"	4	"	1·312	" $\frac{1}{4}$ th.
Little finger	"	4	"	1·337	under $\frac{1}{4}$ th.

So that in every finger this part exceeds the sensibility of the metacarpo-palmar surface of thumb. That it should do so is in accordance with the former being mostly free and the latter not free, and with the comparatively low sensibility of the adjoining part of the palm of the hand. It is less used for palpation than the fingers, only coming in contact with bodies which are grasped.

Comparison of dorsal surface of the metacarpal portion of the thumb with the dorsal surface of the analogous parts of the fingers.—

Dorsal surface of the metacarpal portion of thumb, mean of 3 spots, 2·300 in.

Dorsal surface of analogous part (1st phalangeal) of—					Excess over thumb.
Index finger, mean of 4 spots, 1·662					over $\frac{3}{4}$ ths.
Middle finger	"	4	"	2·162	about $\frac{1}{8}$ th.
Ring finger	"	4	"	2·325	nearly the same sensibility.
Little finger	"	4	"	1·806	over $\frac{1}{4}$ th.

While, then, the sensibility of the dorsal surface of this part agrees nearly with that of the analogous part of the ring finger, it is considerably lower than that of the other fingers.

Comparison of the radial side of the metacarpal portion of the thumb with that of the analogous parts of the fingers.—

Radial side of metacarpal portion of thumb, mean of 3 spots, 2·066 in.

This may be compared with the index finger :—

Radial side of analogous (1st phalangeal) part of index finger, mean of 4 spots, 1·106; excess over thumb, over $\frac{1}{3}$ ths.

But for comparison with the other fingers, the carpo-metacarpal joint must be excluded. Thus—

Radial side of metacarpal portion of thumb, mean of 2 spots, 1·800 in.

Radial side of analogous part of—				Excess of sensibility over thumb.
Middle finger, mean of 2 spots,	1·287	.		about $\frac{2}{3}$ ths.
Ring finger " 2 "	1·425	.		over $\frac{1}{3}$ th.
Little finger " 2 "	1·425	.		over $\frac{1}{4}$ th.

So that the excess is here again considerably in favour of all the other fingers.

Comparison of the ulnar side of the metacarpal portion of the thumb with that of the analogous parts of the fingers.—

Ulnar side of metacarpal portion of thumb, mean of 3 spots, 2·766.

This may be compared with the little finger :

Ulnar side of analogous (1st phalangeal) part of little finger, mean of 4 spots, 1·131, or $2\frac{1}{2}$ times that of thumb.

But for comparison with the other fingers, the carpo-metacarpal joint must be excluded. Thus—

Ulnar side of metacarpal portion of thumb, mean of 2 spots, 2·350 in.

Ulnar side of analogous (1st phalangeal) part of—				
Index finger, mean of 2 spots,	1·262	;	excess over thumb,	about $\frac{2}{3}$ ths.
Middle finger " 2 "	1·500			under $\frac{2}{3}$ ths.
Ring finger " 2 "	1·500			" $\frac{2}{3}$ ths.

The difference in favour of the fingers is greater here than on any other surface.

*Comparison of surfaces of metacarpal portion of thumb with one another.—*The order of sensitiveness is the same as in the thumb at large.

The palmar surface exceeds the radial side in sensibility by under $\frac{1}{4}$ th.
 The radial side " dorsal surface " about $\frac{1}{4}$ th.
 The dorsal surface " ulnar side " " $\frac{1}{4}$ th.

FREE PORTION OF THUMB.—Mean sensibility, including tip, mean of thirteen spots, '909 in.

This may be compared with that of analogous parts of fingers, all beyond first phalangeal joints :

					Excess over sensibility of thumb.
The above part of index finger, mean of 13 spots,	'696	.			under $\frac{1}{4}$ rd.
" middle finger " 13 "	'819	.			about $\frac{1}{4}$ th.
" ring finger " 13 "	'842	.			" $\frac{1}{4}$ th.
" little finger " 13 "	'819	.			" $\frac{1}{4}$ th.

So that here, too, as in the metacarpal portion, the sensibility of the thumb is less than that of any of the fingers.

Comparison of the palmar surface of the free portion of the thumb with the palmar surface of the analogous portions of the fingers.—

Palmar surface of free portion of thumb, mean of 3 spots, '858 in.

Palmar surface of analogous part (3 last zones) of—

Index finger, mean of 3 spots,	'666,	exceeds sensibility of thumb by about $\frac{1}{4}$ ths.
Middle finger " 3 "	'833	" a trifle.
Ring finger " 3 "	'833	" "
Little finger " 3 "	'891,	exceeded slightly by thumb.

So that the palmar surface of this part of the thumb agrees pretty nearly with that of the last three fingers in their analogous parts, but is exceeded slightly by analogous part of index. On the whole, then, its sensibility is high.

Comparison of the dorsal surface of the free portion of the thumb with the dorsal surface of analogous portions of the fingers.—

Dorsal surface of free portion of thumb, mean of 3 spots, 1'183 in.

Dorsal surface of analogous part (3 last zones) of—

Index finger, mean of 3 spots,	'883,	exceeds thumb by about $\frac{1}{4}$ ths.
Middle finger " 3 "	'941	" over $\frac{1}{4}$ th.
Ring finger " 3 "	'975	" about $\frac{1}{4}$ ths.
Little finger " 3 "	'908	" under $\frac{1}{4}$ rd.

The difference is here also, to some extent, in favour of the fingers.

Comparison of the radial side of the free portion of the thumb with the radial side of the analogous portions of the fingers.—

Radial side of free portion of thumb, mean of 3 spots, $\cdot775$ in.

Radial side of analogous part (3 last zones) of—

Index finger, mean of 3 spots,	$\cdot583$,	exceeds thumb by about $\frac{1}{3}$ rd.
Middle finger	" 3 "	$\cdot741$ " trifling amount.
Ring finger	" 3 "	$\cdot825$, is exceeded by thumb by about $\frac{1}{15}$ th.
Little finger	" 3 "	$\cdot875$ " over $\frac{1}{8}$ th.

The radial side of the free portion of the thumb thus possessing a high sensibility, stands next in rank to that of the middle finger in its analogous part, and above that of the ring and little fingers.

Comparison of the ulnar side of the free portion of the thumb with the ulnar side of the analogous portions of the fingers.—

Ulnar side of free portion of thumb, mean of 3 spots, $\cdot950$ in.

Ulnar side of analogous part (3 last zones) of—

Index finger, mean of 3 spots,	$\cdot766$,	exceeds thumb by about $\frac{1}{4}$ th.
Middle finger	" 3 "	$\cdot900$ " $\frac{1}{18}$ th.
Ring finger	" 3 "	$\cdot866$ " under $\frac{1}{10}$ th.
Little finger	" 3 "	$\cdot741$ " about $\frac{1}{2}$ ths.

The difference here, too, is in favour of the other fingers, but the ulnar side of the thumb is not far behind that of the middle finger in sensibility.

*Comparison of the above surfaces of free portion of thumb among themselves.—*In this portion of the thumb the order of sensibility of the surfaces is different from that on the metacarpal portion, and resembles that of the index and middle fingers. The radial side has the highest sensibility, and the other sides follow in the order, palmar surface, ulnar side, dorsal surface. Thus—

The radial side exceeds the palmar surface in sensibility by under $\frac{1}{5}$ th.			
The palmar surface	"	ulnar side	" " $\frac{1}{8}$ th.
The ulnar side	"	dorsal surface	" " $\frac{1}{4}$ th.

So that the dorsal side is by far the least sensitive.

TIP OF THUMB.—This is less sensitive than the tip of any of the other fingers. It is $\cdot 525$ in.

COMPARATIVE SENSIBILITY OF PROXIMAL AND DISTAL PARTS OF THUMB.—*Comparison of metacarpal and free portions.*—The free portion exceeds the metacarpal in sensibility. It is $2\frac{1}{3}$ times as sensitive. This is a much greater difference than exists between the corresponding parts of the other fingers. Thus—

The more distal part of index and middle fingers is not quite twice as sensitive as that which is analogous to the metacarpal portion of thumb.

The more distal part of ring finger is about twice as sensitive as that which is analogous to the metacarpal portion of thumb.

The more distal part of little finger exceeds the proximal part by $\frac{3}{4}$ ths.

Comparison of palmar surfaces of metacarpal and free portions.—On the palmar surface the free portion is nearly twice as sensitive as the metacarpal. This is a greater difference than exists between corresponding parts of the other fingers. Thus—

The more distal part of index finger exceeds the part analogous to the metacarpal of thumb by under $\frac{2}{3}$ ths; middle and ring finger, by about $\frac{1}{2}$ ths; little finger, by $\frac{1}{4}$.

Comparison of dorsal surfaces of metacarpal and free portions.—On this surface, also, the free portion is nearly twice as sensitive as the metacarpal. Here the difference is mostly less than between corresponding parts of the other fingers. Thus—

The more distal part of index finger exceeds the part analogous to the metacarpal of thumb by about $\frac{2}{3}$ ths.

The more distal part of middle finger is $2\frac{1}{2}$ times as sensitive as part analogous to the metacarpal of thumb; ring finger is about $2\frac{1}{3}$ rd; little finger, about twice.

Comparison of radial sides of metacarpal and free portions.—Here the free portion is $2\frac{2}{3}$ th times as sensitive as the metacarpal portion. This is a greater difference than exists between the corresponding parts of other fingers. Thus—

The more distal part of index finger is not quite twice as sensitive as that analogous to the metacarpal of thumb.

The more distal part of middle finger exceeds that analogous to the metacarpal of thumb by about $\frac{4}{5}$ ths; ring finger, by $\frac{3}{4}$ ths; little finger, by $\frac{2}{3}$ ths.

Comparison of ulnar side of metacarpal and free portions.—

On this side the free portion is nearly three times as sensitive as the metacarpal. No approach to this difference is noticeable between the corresponding parts of the other fingers. Thus—

The more distal part of index finger exceeds that analogous to the metacarpal of thumb by about $\frac{4}{5}$ ths; middle finger, by $\frac{3}{4}$ ths; ring finger, by $\frac{3}{4}$ ths; little finger, by about $\frac{2}{3}$.

So, then, the greatest difference between the metacarpal and free portions of the thumb is found on the ulnar side, and the next greatest difference on the radial side. It is only on the dorsal surface that the difference is to a less extent than is found existing on the other fingers; for the most part it is much greater.

Comparison of zones, &c., from base to distal extremity of thumb.—The following table will enable me to represent this comparison. The surfaces in each zone are arranged in order of highest sensibility.

Zone.	Surface.	Excess over succeeding surface.		Excess over same surface in preced- ing zone.
1. Base of metacarpus	Palmar . . .	2·000	.	—
	Radial . . .	2·600	.	—
	Dorsal . . .	2·700	.	—
	Ulnar . . .	3·600	—	—
	Mean . . .	2·725		
2. Middle of metacarpus	Palmar . . .	1·700	.	over $\frac{1}{10}$ th
	Radial . . .	2·200	.	$\frac{2}{11}$ ths
	Dorsal . . .	2·200	.	under $\frac{1}{4}$ th
	Ulnar . . .	2·600	.	$\frac{4}{15}$ ths
	Mean . . .	2·175		

Exceeds previous zone by over $\frac{1}{4}$ th.

Zone.	Surface.	Excess over succeeding surface.		Excess over same surface in preced- ing zone.	
3. Head of metacarpus	Palmar	1·300	.	.	$\frac{1}{13}$ ths
	Radial	1·400	.	.	$\frac{1}{7}$ ths
	Dorsal	2·000	.	.	$\frac{1}{20}$ th
	Ulnar	2·100	.	.	under $\frac{1}{4}$ th
	Mean	1·700			

Exceeds previous zone by under $\frac{1}{4}$ ths.

4. Middle of 1st phalanx	Palmar	1·000	.	.	$\frac{3}{10}$ ths
	Radial	1·000	.	.	$\frac{2}{3}$ ths
	Ulnar	1·250	.	under $\frac{1}{12}$ th	over $\frac{2}{3}$ ths
	Dorsal	1·350	.	.	under $\frac{1}{2}$
	Mean	1·250			

Exceeds previous zone by over $\frac{1}{3}$ rd.

5. Phalangeal joint	Radial	·725	.	over $\frac{1}{8}$ th	over $\frac{1}{3}$ rd
	Palmar	·850	.	under $\frac{1}{8}$ th	over $\frac{1}{8}$ th
	Ulnar	·950	.	over $\frac{1}{4}$ th	under $\frac{1}{2}$ rd
	Dorsal	1·200	.	.	$\frac{1}{3}$ th
	Mean	·931			

Exceeds previous zone by over $\frac{1}{3}$ rd.

6. Middle of last phalanx	Radial	·600	.	$\frac{1}{13}$ th	over $\frac{1}{3}$ th
	Ulnar	·650	.	under $\frac{1}{8}$ th	under $\frac{1}{2}$
	Palmar	·725	.	over $\frac{1}{3}$ rd	over $\frac{1}{3}$ th
	Dorsal	1·000	.	.	$\frac{1}{3}$ th
	Mean	·743			

Exceeds previous zone by over $\frac{1}{4}$ th.

In the above table the rate of increase in sensibility is seen to be greatest after leaving the connected part of the thumb. The gradual increase in sensibility of each surface from the base to the last phalanx is readily traceable; and, as in a former table relating to the fingers, the steady increase by which, zone after zone, the ulnar side acquires its ultimate high position of sensibility, from being the least sensitive at the base, is easily seen. In other respects the table speaks for itself.

I must postpone to some future communication the con-

sideration of the results obtained by the application of the compasses in the long axis of the hand and transversely to it. The numbers upon which any subsequent remarks will be founded, I have, however, thought it best to include in the table which constitutes the appendix to the present paper.

General Summary.

1. Expressed in inches and parts of an inch, the sensibility of the hand, as ascertained by Weber's method, is 1.384. The extremes are 5 in. and .35 in. These numbers represent the sum of two measurements, one transverse and the other vertical.

2. The order of highest sensibility of the several surfaces and borders of the hand, as a whole, differs somewhat according as the thumb is included in the calculation or excluded. 1st. Including the thumb, the order is, distal extremity, radial border, ulnar border, palmar surface, dorsal surface. 2nd. Excluding the thumb, it is, distal extremity, palmar surface and ulnar border, radial border, dorsal surface.

3rd. The sensibility of the hand, and of all parts of the hand, increase, gradually, but at a varying rate, from the wrist to the extremity. This is seen when we compare the numbers expressing the mean sensibility of the metacarpal and digital portions of the hand and of their several surfaces and borders, or when we compare zone after zone of anatomically corresponding parts, proceeding from the base towards the extremity, or, lastly, when each finger is examined separately.

4. The surfaces and borders of the metacarpal and digital portions being examined separately, it appears—1st. In the metacarpal region—(a) including the thumb, the order of sensibility is, radial border, palmar surface, ulnar border, dorsal surface; (b) excluding the thumb, the order is, palmar surface, ulnar border, radial border, dorsal surface. 2nd. In the digital region the order is, radial border, ulnar border, palmar surface, dorsal surface.

5. Comparing successive zones formed by anatomically

corresponding parts, the sensibility is seen to vary from the lowest at the base of the metacarpus, represented by 3·175 in., to ·680 in. at the middle of the last phalanges. The rate of increase from zone to zone is not uniform, but is most rapid immediately beyond the heads of the metacarpal bones, at which part, in fact, the fingers commence, although for a short distance they are connected by soft tissues. But the most rapid increase of all takes place from the middle of the last phalanges to the tips of the fingers. The same general facts are observed when the surfaces and borders of the hand and the fingers are separately examined.

6. Comparing the sensibility of the palmar and dorsal surfaces at each zone, it appears that the greatest difference between them is met with at the base of the metacarpus, but that this difference lessens steadily zone after zone as the distal extremity is approached.

7. The radial half of the hand, generally, exceeds the ulnar somewhat in sensibility. This same relation is found to exist when the radial and ulnar halves of the palmar and dorsal surfaces are separately examined.

8. In the proximal (metacarpal) portion, whether the thumb be included in the calculation or not, the radial half exceeds the ulnar half in sensibility much more than is observed in the distal (digital) portion.

9. On the palmar aspect of the proximal portion—(a) if the thumb be included in the calculation, the difference in favour of the radial half is still observed, but it is less than the average difference when all the surfaces are considered; but if (b) the thumb be excluded, and only the part of the palm of the hand in the rear of the four fingers be examined, the difference of sensibility is rather in favour of the ulnar half.

10. The most marked difference in favour of the radial side is found upon the dorsum. It comes out most strongly when the thumb is included in the calculation.

11. In the metacarpal region the greatest difference by far between the palmar and dorsal surfaces is met with on the ulnar half of the hand.

12. In the distal (digital) portion of the hand the pre-eminence of the radial side in sensibility is not very great on the palmar surface, and it is very much less upon the dorsal.

13. The difference in sensibility between the palmar and dorsal surface on the radial half of the digital portion (index and middle fingers) is more marked than on the ulnar half (little and ring fingers). But on both halves the amount of difference is less than is found in the proximal (metacarpal) region.

14. Omitting the thumb from calculation, and comparing the sensibility of the lateral halves at each zone, it appears that at the very base of the hand the difference is in favour of a higher sensibility on the ulnar side, but that this lessens on proceeding towards the heads of the metacarpal bones, where, as in all succeeding zones, the radial side becomes the more sensitive. This difference at the base in favour of the ulnar half is found to be limited to the palmar surface, for on the dorsal surface, wherever a difference of the two halves exists, it is always in favour of the radial half. But there is no difference on the dorsal surface at and beyond the second phalangeal joints.

15. On the palmar surface of the hand generally it may be said that the sensibility predominating on the radial side shades off towards the ulnar, and the same may be said generally of the dorsal surface. But this rule, thus expressed in general terms, calls for modification as different parts of the hand are examined. Thus—

16. Again omitting the thumb in the metacarpo-palmar region, whatever difference there may be is in favour of the centre of the palm, and the sensibility lessens towards the sides, and especially towards the radial side. But in the metacarpo-dorsal region the converse of this is observed, for the centre is, on the whole, the least sensitive part, and the sensibility increases towards the sides, and especially towards the radial side.

17. But in the digito-palmar region the general rule hold good absolutely ; the two central fingers (middle and

ring), however, agreeing completely in their sensibility. On the digito-dorsal surface the lowest sensibility is found upon the ring finger, and the highest upon the index, the middle finger being intermediate. It increases also upon the little finger, which stands in sensibility next in rank to the index.

18. On comparing the lateral and central parts of the hand in the several successive zones on the palmar aspect, it is found that in the two proximal zones the sensibility is lowest on the radial side (parts in rear of index finger), and increases towards the ulnar side, but that from the heads of the metacarpal bones onwards the sensibility in each zone is greatest on the index finger, and shades off towards the little finger. On the dorsal aspect, in the line of every zone the centre is the least sensitive part, with one exception, and that is the zone corresponding to the base of the metacarpus, where the spot of lowest sensibility (5 in.) found over the base of the fifth metacarpal bone.

19. The order of highest sensibility of the fingers, taken in the mean of each, is index, little, middle, ring. The mean sensibility of the index finger is .929 in., and of the ring finger 1.132 in.

20. The superior sensitiveness of the index finger is apparent, whatever part or surface is compared with the corresponding part or surface of any other finger, with the exception of the ulnar side. The tip of the index finger is the most sensitive part of the hand—it is .35 in.

21. The radial sides of the fingers, like the palmar surface, are less sensitive the further we go from the radial side of the hand. The ulnar side of the little finger is the most sensitive, and the sensibility is lower as we go further from the ulnar side of the hand; the exception to this is the index finger, whose ulnar side stands next in rank to that of the little finger.

22. The radial sides of all the fingers exceed their dorsal surfaces in sensibility, and on the index and middle fingers they are also more sensitive than the palmar.

23. The ulnar sides of all the fingers are more sensitive

than the dorsal surface, but only the ulnar side of the little finger is more so than the palmar surface.

24. On the little finger alone the ulnar side is more sensitive than the radial. In all the others it is the reverse.

25. The sensibility of adjoining sides of the fingers is such that any object would be felt better when placed in the interval between the index and middle fingers, than between any of the others.

26. The order of sensibility of the tips of the fingers, in my hand, is—index, middle and little, ring.

27. In each finger the most rapid increase in sensibility is met with after passing the middle of the second phalanx, but the most rapid increase of all is from the middle of the last phalanx to the tip of the finger.

28. The orders of sensibility of the fingers at large is observed to hold good for each zone examined; but at the middle of the last phalanges a somewhat different order is assumed, viz., index, middle, ring, little.

29. On comparing corresponding spots on the radial sides of the four fingers, the order of sensibility established for the whole of these sides holds good. The same observation, *mutatis mutandis*, holds good generally as to the ulnar side, but it is worthy of observation that on the two most distal spots the sensibility of the index and little fingers coincides; that in all the spots, with a trifling exception, the ring and middle fingers agree, and that in the last spot all the fingers possess the same amount of sensitiveness.

30. The order of sensitiveness of the several sides and surfaces of each finger is not the same at all parts of the finger, with the exception of the index. The order, however, is in no case suddenly changed; a gradual alteration can, in each instance, be established.

31. In estimating the sensibility of the thumb, and in comparing it with other parts of the hand, I have regarded it as a finger destitute of a metacarpal element. The whole organ, from the carpo-metacarpal articulation to the tip, has been regarded as the analogue of a finger from the meta-

carpo-phalangeal articulation onwards. The free portion of the thumb has been compared with the portion of the fingers from the second phalanges onwards.

32. The thumb is, on the whole, less sensitive than the least sensitive of the fingers. This observation is true also when the tip or any surface of the thumb is compared with the tip or any corresponding surface of the four fingers; the only modification requisite in this statement being that the dorsal surface of the thumb coincides in sensibility with the least sensitive dorsal surface of the fingers; *i. e.*, with that of the ring finger. It also holds good when the metacarpal and free portions are severally compared with the analogous parts of the fingers.

33. Taking the thumb as a whole, the order of sensibility of its surfaces is palmar, radial, dorsal, ulnar. The order is the same if we confine our observations to its proximal (metacarpal) element.

34. Taking the free portion of the thumb alone, the order of sensibility of its surface is radial, palmar, ulnar, dorsal; the last being far inferior to the other three.

35. Comparing the several surfaces of the free portion of the thumb with those of analogous parts of the four fingers, it appears that its dorsal and ulnar sides are, on the whole, of lower sensibility than the corresponding parts of the fingers; that the palmar surface is of comparatively high sensibility, being only slightly exceeded by that of the index finger, and that the radial surface stands next in rank to that of the middle finger.

36. The free portion of the thumb is more than twice as sensitive as its connected (metacarpal) portion. On the ulnar side the difference is most marked, the next greatest difference is found on the radial side.

APPENDIX.

Table showing the actual Tactile Sensibility of One Hundred and Forty-two Spots on the Right Hand of the Author as measured in two directions, with the sum of the measurements at each spot examined.

HAND.	Measurement in long axis.	Transverse measurement.	Transverse with tape.	Sum.
1.—Palm of hand (exclusive of elevation corresponding with muscles of thumb).				
Point corresponding with—				
— base of 3rd and 4th metacarpal bones	·9	1·0	...	1·9
— base of 2nd ditto	1·2	·8	...	2·0
— base of 5th ditto	·9	·9	...	1·8
— middle of 5th ditto	·9	·8	...	1·7
— middle of interval between 3d and 4th metacarpal bones	·9	·9	...	1·8
— middle of 2nd metacarpal bone	·9	1·0	...	1·9
— 2nd metacarpo-phalangeal articulation in anterior transverse crease	·7	·8	...	1·5
— 3rd ditto	·8	·8	...	1·6
— 4th ditto	·8	·8	...	1·6
— 5th ditto	·9	·8	...	1·7
Sum	8·9	8·6	...	17·5
Mean	·89	·86	...	1·75
2.—Back of hand (exclusive of metacarpal bone and muscles of thumb).				
Point corresponding with—				
— base of 3rd and 4th metacarpal bones	2·8	1·8	2·0	4·8
— base of 2nd ditto	2·5	1·5	1·6	4·1
— base of 5th ditto	3·3	1·4	1·7	5·0
— middle of 5th ditto	2·8	1·1	1·2	4·0
— middle of interval between 3rd and 4th ditto	2·5	1·6	...	4·1
— middle of 2nd ditto	2·2	1·4	...	3·6
— 2nd metacarpo-phalangeal articulation	1·1	1·1	...	2·2
— 3rd ditto	1·8	1·7	...	3·5
— 4th ditto	2·0	1·7	...	3·7
— 5th ditto	1·5	1·2	...	2·7
Sum	22·5	*	15·2	37·7
Mean	2·25	...	1·52	3·77

* Wherever a measurement has been made with the tape it is, in the adding up, assumed as the correct measurement.

THUMB.	Measurement in long axis.	Transverse measurement.	Transverse with tape.	Sum.
THUMB (including metacarpal portion and elevation on palm corresponding to adductor muscles).				
3.—Palmar surface.				
Point corresponding to middle of metacarpal bone (i. e. midway between point on outer side of metacarpal bone and middle of 2nd metacarpal bone)	1.0	.7	...	1.7
In crease corresponding to metacarpo-phalangeal joint	.8	.5	...	1.3
Point corresponding to middle of 1st phalanx	.65	.35	...	1.0
" " phalangeal joint	.45	.4	...	.85
Midway between last and tip of thumb, middle of last phalanx	.4	.325	...	.725
Tip of thumb	.25	.275	...	.525
Sum	3.55	2.55	...	6.100
Mean	.591	.425	...	1.017
4.—Dorsal surface.				
Point corresponding to base of metacarpal bone	1.5	.9	1.2	2.7
" " middle of ditto	1.1	1.0	1.1	2.2
" " metacarpo-phalangeal joint	1.0	.8	1.0	2.0
" " middle of 1st phalanx	.9	.45	...	1.35
" " phalangeal joint	.7	.5	...	1.2
A little below nail	.55	.45	...	1.0
Sum	5.75	4.10	4.70	10.45
Mean	.958	...	.783	1.741
5.—Radial surface.				
Point corresponding to base of metacarpal bone	1.5	1.0	1.1	2.6
" " middle of ditto	1.2	.8	1.0	2.2
" " metacarpo-phalangeal joint	.85	.55	...	1.4
" " middle of 1st phalanx	.65	.35	...	1.0
" " phalangeal joint	.45	.275	...	.725
Side of nail corresponding to middle of last phalanx	.35	.25	...	.6
Sum	5.0	...	3.525	8.525
Mean	.833	...	.587	1.420

INDEX FINGER.		Measurement in long axis.	Transverse measurement.	Transverse with tape.	Sum.
THUMB (<i>continued</i>).					
6.— <i>Ulnar surface.</i>					
Point corresponding to base of metacarpal bone .	.	2·3	1·3	...	3·6
" " middle of ditto .	.	1·4	1·2	...	2·6
" " metacarpo-phalangeal joint .	.	1·1	1·0	...	2·1
" " middle of 1st phalanx .	.	·8	·45	...	1·25
" " phalangeal joint .	.	·6	·35	...	·95
" " middle of last phalanx .	.	·4	·25	...	·65
Sum		6·6	4·55	...	11·15
Mean		1·1	·758	...	1·858
INDEX FINGER.					
7.— <i>Palmar surface.</i>					
Crease opposite cleft of fingers .	.	·7	·5	...	1·2
Between last point and 1st phalangeal joint .	.	·6	·45	...	1·05
1st phalangeal joint .	.	·55	·4	...	·95
Middle of 2nd phalanx .	.	·45	·325	...	·775
2nd phalangeal joint .	.	·375	·3	...	·675
Middle of last phalanx .	.	·3	·25	...	·55
Tip of finger .	.	·15	·2	...	·35
Sum		3·125	2·425	...	5·550
Mean		·446	·346	...	·792
8.— <i>Dorsal surface.</i>					
Point opposite cleft of fingers .	.	1·0	·7	...	1·7
Between last point and 1st phalangeal joint .	.	·9	·55	...	1·45
1st phalangeal joint .	.	·8	·5	...	1·3
Middle of 2nd phalanx .	.	·7	·425	...	1·125
2nd phalangeal joint .	.	·4	·4	...	·8
A little below nail .	.	·4	·325	...	·725
Sum		4·2	2·900	...	7·100
Mean		·700	·483	...	1·183

MIDDLE FINGER.	Measurement in long axis.	Transverse measurement.	Transverse with tape.	Sum.
INDEX FINGER (<i>continued</i>).				
9.— <i>Radial surface</i> (forming part of outer margin of hand).				
Point corresponding to metacarpo-phalangeal articulation .	·75	·6	..	1·35
" " cleft of fingers and crease on palmar surface .	·75	·45	...	1·20
Between last point and 1st phalangeal joint .	·65	·4	...	1·05
1st phalangeal joint .	·55	·275	...	·825
Middle of 2nd phalanx .	·45	·225	...	·675
2nd phalangeal joint .	·375	·2	...	·575
Middle of last phalanx .	·3	·2	...	·5
Sum	3·825	2·350	...	6·175
Mean	·546	·335	...	·882
10.— <i>Ulnar surface</i> .				
Midway between cleft of finger and phalangeal joint .	·8	·55	—	1·35
1st phalangeal joint .	·8	·375	—	1·175
Middle of 2nd phalanx .	·6	·325	—	·925
2nd phalangeal joint .	·45	·275	—	·725
Middle of last phalanx .	·4	·25	—	·65
Sum	3·05	1·775	—	4·825
Mean	·610	·355	—	·965
MIDDLE FINGER.				
11.— <i>Palmar surface</i> .				
Crease corresponding to cleft of fingers .	·8	·5	...	1·3
Midway between last point and 1st phalangeal joint .	·75	·5	...	1·25
1st phalangeal joint .	·65	·45	...	1·1
Middle of 2nd phalanx .	·6	·4	...	1·0
2nd phalangeal joint .	·45	·35	...	·8
Middle of last phalanx .	·4	·3	...	·7
Tip of finger .	·175	·225	...	·4
Sum	3·825	2·725	...	6·55
Mean	·546	·389	...	·935

RING FINGER.				Measurement in long axis.	Transverse measurement.	Transverse with tape.	Sum.
MIDDLE FINGER (continued).							
12.— <i>Dorsal surface.</i>							
Point corresponding to cleft of fingers	.	.	.	1.4	.7	...	2.1
Between last point and 1st phalangeal joint	.	.	.	1.1	.55	...	1.65
1st phalangeal joint	.	.	.	.9	.5	...	1.4
Middle of 2nd phalanx	.	.	.	.7	.45	...	1.15
2nd phalangeal joint	.	.	.	.45	.45	...	.9
A little below nail	.	.	.	.45	.325	...	.775
Sum				5.0	2.975	...	7.975
Mean				.833	.495	..	1.329
13.— <i>Radial side.</i>							
Midway between cleft of fingers and 1st phalangeal joint	.	.	.	.9	.5	...	1.4
1st phalangeal joint	.	.	.	.8	.375	...	1.175
Middle of 2nd phalanx	.	.	.	.6	.325	...	.925
2nd phalangeal joint	.	.	.	.5	.275	...	.775
Middle of last phalanx	.	.	.	.3	.225	...	.525
Sum				3.1	1.70	...	4.8
Mean				.624	.340	...	.960
14.— <i>Ulnar side.</i>							
Midway between cleft of fingers and 1st phalangeal joint	.	.	.	1.1	.5	...	1.6
1st phalangeal joint	.	.	.	1.0	.4	...	1.4
Middle of 2nd phalanx	.	.	.	.8	.35	...	1.15
2nd phalangeal joint	.	.	.	.6	.3	...	.9
Middle of last phalanx	.	.	.	.4	.25	...	.65
Sum				3.9	1.8	...	5.7
Mean				.780	.360	..	1.140
RING FINGER.							
15.— <i>Palmar surface.</i>							
Crease corresponding to cleft of fingers	.	.	.	.8	.5	...	1.3
Between last point and 1st phalangeal joint	.	.	.	.75	.5	...	1.25
1st phalangeal joint	.	.	.	.65	.45	...	1.1
Middle of 2nd phalanx	.	.	.	.6	.4	...	1.0
2nd phalangeal joint	.	.	.	.45	.35	...	.8
Middle of last phalanx	.	.	.	.4	.3	...	.7
Tip of finger	.	.	.	.2	.25	..	.45
Sum				3.85	2.75	...	6.60
Mean				.550	.392	...	.942

LITTLE FINGER.				Measurement in long axis.	Transverse measurement.	Transverse with tape.	Sum.
RING FINGER (<i>continued</i>).							
16.— <i>Dorsal surface.</i>							
Point corresponding to cleft of fingers	.	.	.	1·8	·65	...	2·45
Between last point and 1st phalangeal joint	.	.	.	1·2	·55	...	1·75
1st phalangeal joint	.	.	.	·9	·5	...	1·4
Middle of 2nd phalanx	.	.	.	·8	·45	...	1·25
2nd phalangeal joint	.	.	.	·5	·4	...	·9
A little below nail	.	.	.	·45	·325	...	·775
Sum				5·65	2·875	...	8·525
Mean				·941	·479	...	1·420
17.— <i>Radial side.</i>							
Midway between cleft of fingers and 1st phalangeal joint	.	.	.	1·0	·55	...	1·55
1st phalangeal joint	.	.	.	·9	·4	...	1·3
Middle of 2nd phalanx	.	.	.	·8	·325	...	1·125
2nd phalangeal joint	.	.	.	·5	·275	...	·775
Middle of last phalanx	.	.	.	·35	·225	...	·575
Sum				3·55	1·775	...	5·325
Mean				·710	·355	...	1·065
18.— <i>Ulnar side.</i>							
Midway between cleft of fingers and 1st phalangeal joint	.	.	.	1·1	·5	...	1·6
1st phalangeal joint	.	.	.	1·0	·4	...	1·4
Middle of 2nd phalanx	.	.	.	·7	·35	...	1·05
2nd phalangeal joint	.	.	.	·6	·3	...	·9
Middle of last phalanx	.	.	.	·4	·25	...	·65
Sum				3·8	1·8	...	5·6
Mean				·760	·360	...	1·120
LITTLE FINGER.							
19.— <i>Palmar surface.</i>							
Crease corresponding to cleft of fingers	.	.	.	·8	·5	...	1·3
Between last point and 1st phalangeal joint	.	.	.	·75	·5	...	1·25
1st phalangeal joint	.	.	.	·65	·45	...	1·1
Middle of 2nd phalanx	.	.	.	·65	·4	...	1·05
2nd phalangeal joint	.	.	.	·55	·375	...	·925
Middle of last phalanx	.	.	.	·4	·3	...	·7
Tip of finger	.	.	.	·175	·225	...	·4
Sum				3·975	2·75	...	6·725
Mean				·567	·392	...	·960

LITTLE FINGER.				Measurement in long axis.	Transverse measurement.	Transverse with tape.	Sum.
LITTLE FINGER (<i>continued</i>).							
20.— <i>Dorsal surface.</i>							
Point corresponding to cleft of fingers	.	.	.	1·3	·5	...	1·8
Between last point and 1st phalangeal joint	.	.	.	1·0	·45	...	1·45
1st phalangeal joint	.	.	.	·85	·425	...	1·275
Middle of 2nd phalanx	.	.	.	·8	·4	...	1·2
2nd phalangeal joint	.	.	.	·4	·4	...	·8
A little below nail	.	.	.	·4	·325	...	·725
Sum				4·75	2·5	...	7·25
Mean				·791	·416	...	1·208
21.— <i>Radial side.</i>							
Midway between cleft of fingers and 1st phalangeal joint	.	.	.	1·1	·5	...	1·6
1st phalangeal joint	.	.	.	·85	·4	...	1·25
Middle of 2nd phalanx	.	.	.	·8	·325	...	1·125
2nd phalangeal joint	.	.	.	·6	·25	...	·85
Middle of last phalanx	.	.	.	·425	·225	...	·65
Sum				3·775	1·7	...	5·475
Mean				·755	·340	...	1·095
22.— <i>Ulnar side</i> (forming inner margin of hand).							
Point corresponding to base of 5th metacarpal bone at							
side of hand	.	.	.	1·1	·8	1·1	2·2
" " middle of ditto	.	.	.	1·0	·7	1·0	2·0
" " 5th metacarpo-phalangeal joint	.	.	.	·8	·5	...	1·3
" " crease opposite cleft of fingers	.	.	.	·75	·375	...	1·125
Between last and 1st phalangeal joint	.	.	.	·75	·35	...	1·1
1st phalangeal joint	.	.	.	·7	·3	...	1·0
Middle of 2nd phalanx	.	.	.	·6	·25	...	·85
2nd phalangeal joint	.	.	.	·5	·225	...	·725
Middle of last phalanx	.	.	.	·45	·2	...	·65
Sum				6·65	...	4·30	10·95
Mean				·738	...	·477	1·216

DESCRIPTION OF PLATES IV AND V.

These plates (reduced from photographs) show the precise spots at which measurements of the sensibility of the hand were taken. The two lines forming each cross indicate the two directions of measurement. The number written against each cross is the sum of the two measurements.

Fig. 1.—Palmar surface of hand and fingers.

- „ 2.—Dorsal „ „
- „ 3.—Radial side of hand and fingers.
- „ 4.—Ulnar „ „