Fig. 1. L.

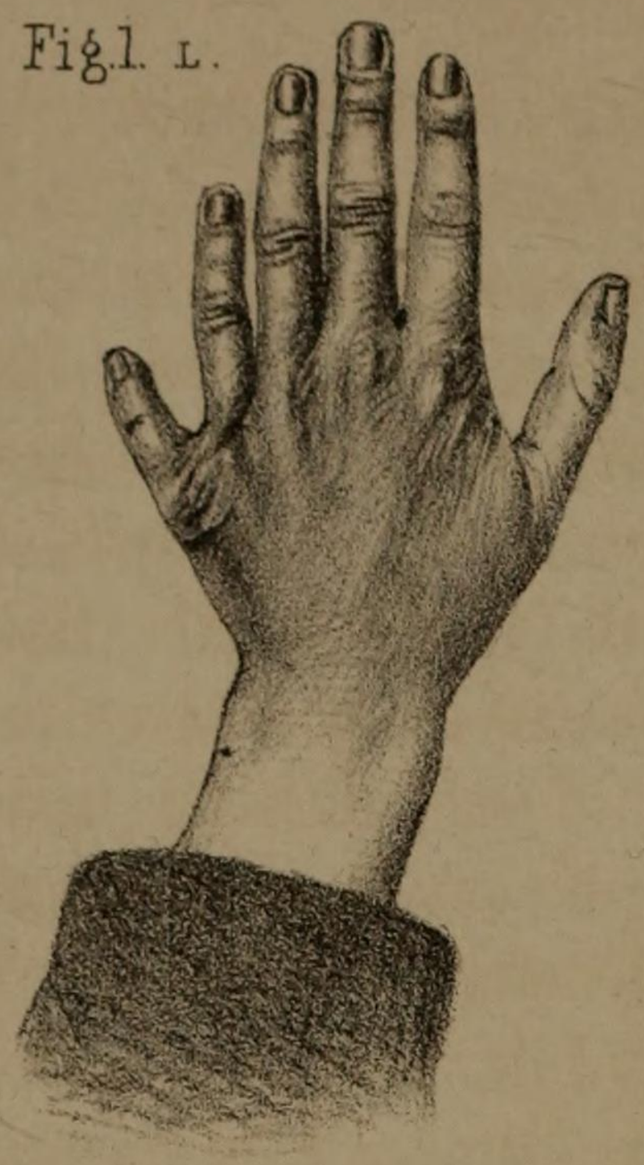


Fig. 1. R.

Fig. 2.

Fig. 3

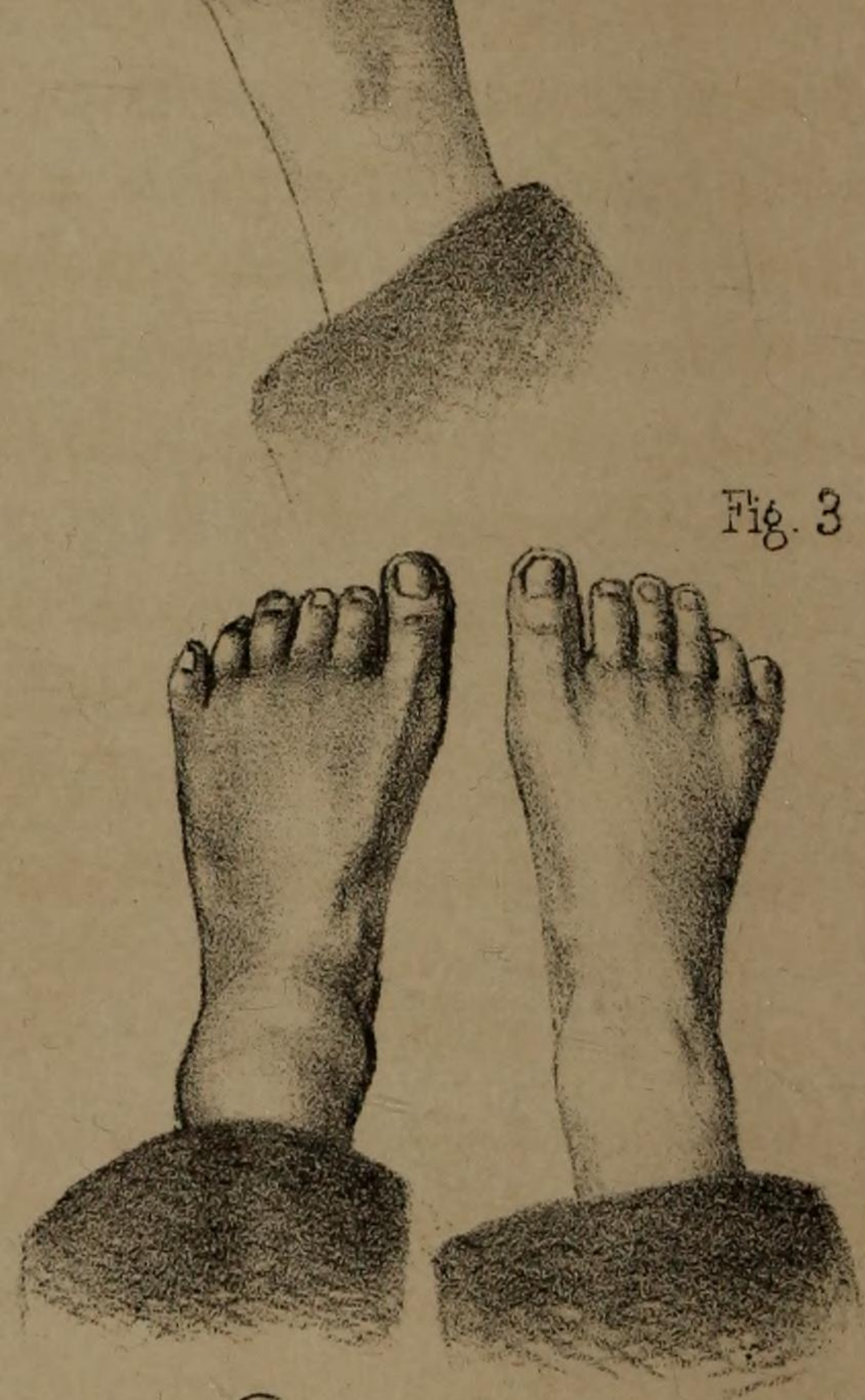
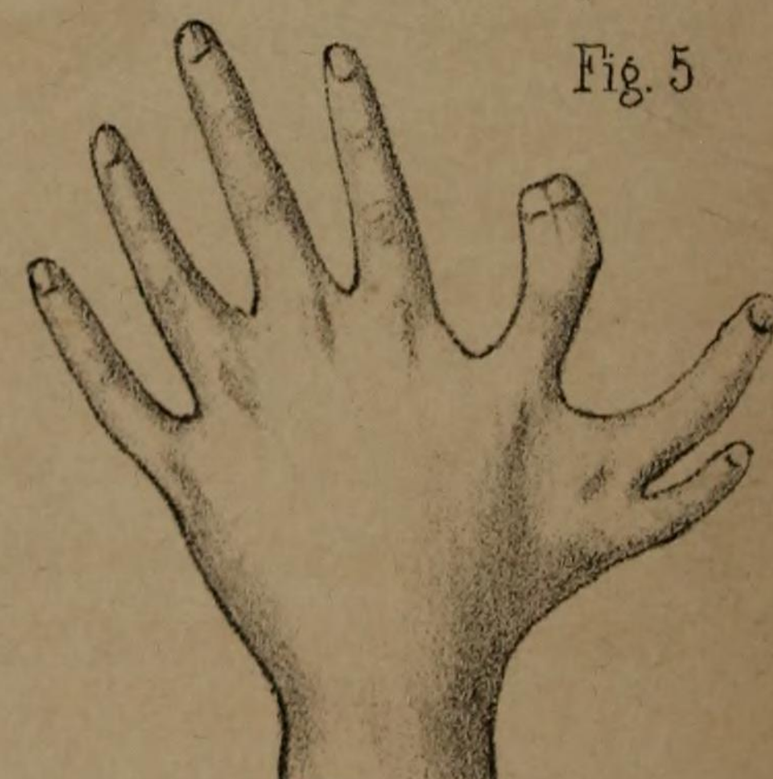


Fig. 4.

Fig. 6.

Fig. 5



W. H. Mc Farlane, Lith.r Edin.r

occipital flattening is clearly defined in at least three of the Kanaka skulls in the Mortonian Collection; No. 1300, a male native of the Sandwich Islands, aged about forty; No. 1308, apparently that of a woman, from the same locality; and in No. 695, a girl of Oahu, of probably twelve years of age, which is markedly unsymmetrical, and with the flattening on the left side of the parietal and occipital bones. The Washington Collection includes fourteen Kanaka skulls; besides others from various islands of the Pacific, among which several examples of the same artificial formation occur: *e.g.*, No. 4587, a large male skull, distorted and unsymmetrical; and No. 4367, female? from an ancient cemetery at Wailuka, Mani, in which the flattened occiput is very obvious.

The traces of purposed deformation of the head among the islanders of the Pacific have an additional interest in its relation to one possible source of South American population by oceanic migration, suggested by philological and other independent evidence. But for our present purpose, the peculiar value of those modified skulls lies in the disclosures of influences operating alike undesignedly, and with a well-defined purpose, in producing the very same cranial conformation among races occupying the British Islands in ages long anterior to earliest history; and among the savage tribes of America and the simple islanders of the Pacific in the present day. They illustrate with even greater force than the rude implements of flint and stone found in early British graves, the exceedingly primitive condition of the British Islanders of prehistoric times.

On Variation in the Number of Fingers and Toes, and in the Number of Phalanges, in Man. By JOHN STRUTHERS, M.D., F.R.C.S., Lecturer on Anatomy in the Edinburgh School of Medicine. (Plate II.)

At the present time when the subject of variation is attracting so much attention, the following illustrations will, perhaps, be read with additional interest. I have arranged the cases of increase in the number of digits into

two groups, those which illustrate original variation, and those which illustrate the phenomena of hereditary transmission. The cases of variation in the number of the phalanges are given separately, as belonging to a different order of variation. In regard to those cases for which I am indebted to the kindness of various medical friends, whose names will appear, I may mention that they have been most carefully described to me in reply to a series of inquiries relating both to the anatomical condition and the hereditary history, and that what is stated may be relied on both for accuracy and for all possible completeness. A few remarks are added at the end on some of the points in variation and inheritance which the cases illustrate, and on the special point of the absence of a bone in the thumb and great toe, as compared with the other digits.

PART I.—VARIATION IN THE NUMBER OF DIGITS.

Section 1.—INCREASE IN THE NUMBER.

Group 1.—Cases which could not be traced to have Hereditary Origin.

1. *Case of Six Digits in three members of a family, occurring Symmetrically.*

In this family of seven children, one of the daughters was born with six digits on each foot, and two of the sons with six digits on each foot and on each hand. I am indebted to the kindness of Dr John Alexander Smith for a full account of the case, and for affording me the opportunity of seeing the persons who are the subjects of the variety.

(*a*.) M—— O——, female, æt. 22, Edinburgh, was born with a

Explanation of Plate II.

Fig. 1. R. and L. Hands of J—— O——. Case 1. From a photograph.
Fig. 2. Feet of J—— O——. Case 1. From a photograph.
Fig. 3. Feet of C—— O——, younger brother to the last—Case 1. From a photograph.
Fig. 4. Hand of G—— S——. Case 14. From a sketch.
Fig. 5. Hand of J—— M——. Case 24. From a cast.
Fig. 6. Hand of J—— J——. Case 26. From a photograph.

sixth toe on the outer side of each foot. That on the right foot, being loosely attached, was removed by the surgeon a fortnight after birth, and the cicatrix is visible. The sixth toe on the left foot is fully equal in size to the fifth, and is supported on the fifth metatarsal bone. The hands are normal.

(*b.*) The elder brother, J—— O——, æt. 19, has six fingers on each hand and six toes on each foot. The additional digits are placed on the outer side of the limb. Figs. 1 and 2 are taken from photographs of the hands and feet. Each sixth finger diverges considerably, reaches to a little beyond the joint between the proximal and middle phalanges of the fifth finger, and contains two phalanges, the proximal $1\frac{1}{4}$, the distal $\frac{3}{4}$ inch in length, the distal phalanx being somewhat longer on the left hand. The fifth and sixth fingers rest on one metacarpal bone, which broadens considerably in its distal third, where it is first grooved and then deeply notched, so that the bifurcated ends are as wide apart as the other knuckles. The left sixth finger looks shorter than the right, owing to the metacarpal head which supports it being farther back. The other fingers have the usual proportionate length. Each sixth finger moves with strength and quite as independently as the other fingers, without the others being held, and there is no tendency to move the fifth when he moves the sixth. The flexor and extensor tendons are, therefore, separate up to the muscles.

The sixth toe is well formed on each foot, lying parallel in the series. The fifth is of normal size, and the sixth rather larger than it, although, from commencing farther back, it does not project so much as the fifth. The fifth metatarsal broadens and then bifurcates to support the fifth and sixth toes, the bifurcation being greatest on the right side. Although it is not very easy to make this out, the sixth toe appears to have only two phalanges on each foot. The fifth and sixth toes are slightly webbed, but less so than the second and third, which are, as is common, webbed for $\frac{1}{4}$ to $\frac{1}{2}$ of an inch.

(*c.*) The younger brother, C—— O——, æt. 10, was born with twenty-four digits, like his brother. The toes, as seen in fig. 3, also from a photograph, exactly resemble those of the elder brother (fig. 2), making allowance for the latter having corns. I can make out three phalanges in all the lesser toes except the sixth, which appears to have but two. The fifth metatarsal bones bifurcate as in the brother. The sixth fingers projected outwards so inconveniently, that they were removed, together with their supporting head of the bifurcated fifth metacarpal bone, three years ago by Dr Smith, and a cicatrix and slight bony eminence remain. On examination of one of the removed fingers I find it to contain two phalanges, which appear to be entirely destitute of flexor tendons, the proximal phalanx alone having an extensor tendon.

History of the O—— Family.—The father and mother have the fingers and toes normal, and the variety was previously unknown in the family on either side. Both grandmothers were present at the birth of the daughter, the first child which presented the

variety, and both stated that they had never known or heard of it in their ancestors, neither having ever heard of such a thing before except in the case of the son of the giant in Gath, which they called to recollection in discussing the wonder. The first child of this family was a boy, without any digital peculiarity. The mother next had four miscarriages, between the 4th and 7th months, two boys and two girls, also it is stated with the hands and feet quite natural. The sixth child, the daughter M——, was the first to present the variety; she had six toes as above described. The family had lived in Forfarshire, and now went to Glasgow.

When again pregnant, the mother's thoughts must have been strongly turned in this direction, as she relates that she heard as it were a distinct voice from the wall of the room say that the child would have more than the last. This was about the second or third month, and made a deep impression on her mind. The child was the boy James O—— above described as presenting six fingers and six toes. Three daughters, successively, were the next children born, whose hands and feet were quite natural. Lastly came the boy Charles O——, above described as having been born with an additional digit both on the feet and hands.

Dr Smith has attended two of the daughters in their confinement; one has had three children all of whom have the fingers and toes normal; the other, the daughter who was born with six toes, has had one child, a male, who lived only a few days, in whom the toes and fingers were normal. M——, J——, and C—— O—— have two paternal uncles and two paternal aunts, and one maternal uncle and five maternal aunts, all of whom have families, and in none of them—uncles, aunts, or children—do the fingers or toes present any variety. The mother, Mrs O——, was a twin, and the twin sister has had three children.

The mother, Mrs O——, mentions that she used to work beside a girl who had a double thumb, but this was years before she was married. The father mentions that after the variety had occurred in his own family, he saw a man who was exhibited as a giant with six fingers and six toes. The O—— family mention the case of a railway guard (George B——), known to them after the variety had appeared among them, who had an additional finger on the ulnar side of his right hand, and an additional toe, also said to be on the right foot. He died a few months ago and leaves five or six children, none of whom have additional fingers or toes.

The following Seven Cases present an Additional Thumb on one Hand.

2. J —— S——, æt. 25, Berwickshire, has an additional thumb on the right hand. The metacarpal bone bifurcates to support the two thumbs, which are of nearly equal length and thickness, that next the forefinger being slightly thicker and more powerful than the other. Each contains two phalanges, the proximal $1\frac{1}{2}$ inch, the distal 1 inch in length, being as long as those of the thumb of the left hand, except the distal phalanges, which are $\frac{1}{8}$ inch shorter.

In girth, each is only a little less than the left-hand thumb. The twin thumbs diverge from each other by their proximal phalanges, and converge by their distal phalanges, and are webbed half-way. In extension, the distal phalanges become parallel; in flexion, their points come together by their edges, and give a firm nip. Each can be flexed and extended separately when the other is held, but not otherwise. Flexion at the metacarpo-phalangeal joint is less extensive than usual. Motion at the carpo-metacarpal joint is free, and, in the movements of opposition, both of the thumbs move together across the hand. In writing, the pen lies between the approximated points of the two thumbs. He is right-handed as usual.

He states that variation in the number of the fingers or toes was previously unknown in the family.

3. E—— N——, æt. 13, Edinburgh (brought to me by my pupil Mr George Dickson), has an additional thumb on the left hand. The metacarpal bone is bifurcated for $\frac{1}{4}$ to $\frac{1}{3}$ inch, and forms two diverging heads for the two thumbs. The thumb next the forefinger is the larger of the two, and has nearly the usual length, but is not thicker than the last two divisions of the forefinger. The lesser thumb at first diverges to the radial side, and then curves forwards at the metacarpo-phalangeal joint, which is somewhat loose. It has only one phalanx, which is $\frac{8}{10}$ inch in length, the two phalanges of the greater thumb measuring together $1\frac{1}{2}$ inch. The two thumbs move together in opposing the fingers. The lesser thumb is flexed and extended in common with the other, and has considerable power in flexion.

Her mother states that variety in the number of fingers or toes was previously unknown in the family.

4. W—— G——, æt. 3 months, Edinburgh (kindly sent to me by Mr Edwards), has the thumb of the right hand double. The thumb next the forefinger is of good size, and has the usual number of bones. The lesser thumb consists of one phalanx, which is attached, firmly but quite moveably, to the inner side of the proximal phalanx of the greater thumb beyond its middle. It is about half the thickness of the greater thumb, is half the nail's length shorter, and they are webbed together as far as opposite the beginning of the two nails.

The mother states that the variety was previously unknown in the family.

5. I am indebted to Dr Edward Robertson of Otterburn for a note of the case of T—— H——, æt. about 6 months, Northumberland, who had an additional thumb on the right hand. It was rather loosely attached at the radial side of the metacarpo-phalangeal articulation of the greater thumb, which, again, was rather smaller than the thumb of the left hand. Dr Robertson lately removed the lesser thumb, and I find that it contains one phalanx only.

The father, mother, and maternal grandmother, all state that nothing of the kind was before known in the family.

6. My pupil, Mr Purves of Dryburgh, has procured for me a note, by his father, of the case of J—— W——, Berwickshire, a

man who has a small-sized additional thumb on the left hand. It contains one phalanx, which is attached rather loosely at the end of the metacarpal bone, as if by dense tissue and skin, without connection with the joint. He has no voluntary power over it, but it is more sensitive to pain than the greater thumb is. It is over an inch in length, and has a well-formed nail.

He states that "there is no hereditary tendency in his family to such formations."

7. For this (and for case 10. of this group) I am indebted to Dr Gibson of Campbeltown. —— M'M——, æt. 14, Argyleshire, has a double thumb on the right hand. The metacarpal bone is much larger than its fellow in the left hand. The proximal phalanx is double, the two being wrapped in a common investment of skin, presenting a broad flattened appearance externally. The distal phalanges are separate, with a little space between them. They converge again at the points, giving the thumb a lobster's claw appearance. He is able to pick up small objects between the two points, and thinks such a thumb rather an acquisition, as in picking small things out of his vest pocket. He has the full use of the thumb in opposing the fingers.

He has three brothers and four sisters, none of whom have any digital variety. Neither have the father nor mother, nor do they know of any such variety in past generations of their families. The mother accounts for it from her seeing a man with a double thumb when she was pregnant, but says it was not the same kind of double thumb.

8. I am indebted to Dr Henderson of Fordoun for the particulars of the case of H—— K——, Kincardineshire, æt. 32, who has an additional thumb on the right hand. The thumb to the radial side, constituting the sixth digit, is considerably smaller and shorter than the other, and they are partially webbed. She can move the thumbs together so as to hold a pen between them.

A former child of the mother's, by a first marriage, had a sixth finger on the ulnar side of one hand, but lived only three weeks. No previous case is known in the family on either side. The mother has no story as to the cause.

Three Cases (two of them Brothers) presenting an Additional Little Finger on one Hand.

9. Dr Edward Robertson mentions to me also the case of John B——, æt. 5 years, Northumberland, from whom immediately after birth he removed a small supernumerary little finger from the left hand. A brother, who is now dead, had a similar supernumerary finger also on the outer side of the left hand.

The father and mother have never heard of any such variety in their ancestors, or in any relative of the family.

10. J—— G——, æt. 20 months, Argyleshire, has a sixth finger loosely attached to the outer side of the little finger of the left hand, near the middle of the proximal phalanx, and set at a right

angle to the little finger. It is $\frac{3}{4}$ of an inch in length, and has two phalanges. The little finger (fifth finger) is two inches in length. He is an only child. The father and mother have no such variety, and never heard of it occurring in the family before.

Three Cases presenting Six Toes on one Foot.

11. J—— S——, Liverpool, æt. 39, brother to one of my students, has six toes on the right foot. The external metatarsal bone is not broader at its middle than in the other foot, but becomes grooved and then bifurcated for a short distance at the head, supporting the fifth and sixth toes. I can make out three phalanges in the fifth toe, but the sixth seems to have only two. The long extensor tendon is felt and seen to bifurcate for the fifth and sixth toes. The five lesser toes form a regular series retiring outwards, with nothing to attract notice except the number. It was some months, he mentions, until his mother made the discovery that he had a toe more on one foot than on the other. There is no trace of any attempt to throw out a sixth digit on the other foot, or on the hands.

He states that variety of the toes or fingers was previously unknown in the family, and he can trace his ancestors for several generations back. He is one of six brothers, none of whom are married but himself, and he has no family, although there have been several miscarriages. He has five sisters, four of whom are married and have families, but none present any digital variety. He is a very tall man, standing six feet four inches in his shoes. The brothers are rather tall, but under six feet. The mother and sisters are not tall. The father was under six feet.

12. I am indebted to Dr Finlay of Trinity, Edinburgh, for the opportunity of examining this case, and also the two next :—

J—— L——, æt. 40, Newhaven, has six toes on the left foot. The fifth metatarsal bone is broader than the corresponding bone in the right foot, and supports the fifth and sixth toes. The fifth toe is narrower than the sixth, and has three phalanges, while the sixth seems to have only two phalanges. The extensor tendons of the fifth and sixth toes are seen to come forward together. The fourth and fifth toes are partially webbed.

No instance of digital variety is known to have occurred among his ancestors on the father's side, who have lived in Newhaven from time immemorial. The grandmother came from Edinburgh, and said that it was equally unknown among her ancestors. J—— L—— has a brother and four sisters; he himself has a family of four boys and one girl; his brother has one son; and three of his four sisters are married, and have families of sons and daughters; but no member or relative of the family has any digital variety except himself.

13. R—— L——, æt. 15, Newhaven, has six toes on the left foot. The fifth and sixth toes are supported on one metatarsal bone. The fifth is a small toe, the sixth thicker than the little toe

of the other foot. The fifth and sixth toes have each only two phalanges; the proximal phalanges are close together, but can be made to move past each other. Digital variety is unknown in the family on either side. R—— L—— is one of nine children, three boys and six girls. The father's family have, as usual with the Newhaven fishermen, always been in Newhaven. The grandmother came from the Highlands, and never knew of such a thing on her side of the family. Both the father and mother have brothers and sisters in Newhaven, all with families of sons and daughters. The mother states that her father's left little toe grew very awkwardly across the others, not in consequence of the pressure of the shoe, but naturally.

A friend showed me the other day a peculiar curve of his little finger, which two of his brothers also have. His father's mother had exactly the same peculiarity; also some of the children of a paternal uncle.

14. *Case in which one Hand presents Seven or Eight Digits, forming an approach to the condition of Double Hand.*

G—— S——, æt. 5, has seven digits on the left hand, and the one corresponding to the thumb double at its distal segment, constituting so far an eighth digit. In every other respect the boy is well formed. The appearance presented by the hand is seen in fig. 4. There are seven distinct metacarpal bones. The four fingers on the outer side present the usual form and proportionate length, each with its three phalanges. The fifth has the position and opposing action of the thumb. Besides the metacarpal bone, it has two segments, the distal of which contains two phalanges placed side by side, while the proximal phalanx is single. The twin distal phalanges can be made to move a little past each other, and the one to the inner or radial side ends partly by a prominent non-articular angle, as if its proximal phalanx were wanting. They are closely enveloped in a common integument, and their nails join at their contiguous edges. He moves the thumb independently and freely, so that all its tendons must be separate from those of the digits on either side. The sixth and seventh digits are like the ring and little fingers of a right hand, except that the little finger is proportionately small. Each has three phalanges, and they are webbed most of the way between the proximal phalanges. Their metacarpal bones are quite separate and moveable, and, as they pass up, have a direction forwards to the palmar aspect of the carpus. These two fingers are associated together in their movements, and can be moved independently of the rest of the hand, but there is a tendency to flex the other fingers at the same time. In general grasping, the thumb and sixth and seventh digits oppose the other four and clasp down upon them. The hand is flat where the ball of the thumb should be.*

* A somewhat similar case, in which the duplicity of the hand was more complete, with a rudimentary condition of the thumbs, by Mr J. Jardine

A grandfather and grandmother are still alive. The father has three brothers and three sisters, besides two sisters who died. Two of the brothers and the three sisters are married, all of whom have families of sons and daughters, except one of the brothers whose children are all daughters, and the father himself has three daughters and another boy besides G——. But no other case of such, or of any, digital variety has been or is known in the family, either on the father's or on the mother's side.

Group 2.—Cases of Increase in the Number of Digits, with Hereditary Origin.

15. *Case in which the Variety has been transmitted through at least Four Generations.*

I am indebted to Dr Hamilton of Falkirk for the following case (and for case 16), and have to thank him for the great trouble and interest he has taken in ascertaining the genealogy of the family.

The great-great-grandmother, Esther P—— (who married A—— L——), had a sixth little finger on one hand. Of their eighteen children (twelve daughters and six sons), only one (Charles) is known to have had digital variety. We have the history of the descendants of three of the sons, Andrew, Charles, and James.

(1.) Andrew L—— had two sons, Thomas and Andrew; and Thomas had two sons; all without digital variety. Here we have three successive generations without the variety possessed by the great-grandmother showing itself.

(2.) James L——, who was normal, had two sons and seven daughters, also normal. One of the daughters became Mrs J—— (one of the informants), and had three daughters and five sons, all normal except one of the sons James J——, now æt. 17, who had six fingers on each hand. The additional fingers in this boy's case were loosely attached at the metacarpo-phalangeal joint of the little finger, and were removed by Dr Hamilton a few days after birth.

In this branch of the descendants of Esther, we see it passing over two generations and reappearing in one member of the third generation, and now on both hands.

(3.) Charles L——, the only child of Esther who had digital variety, had six fingers on each hand. He had three sons, James, Thomas, and John, all of whom were born with six fingers on each hand, while John has also a sixth toe on one foot. He had also five other sons and four daughters, all of whom were normal.

(*a*) Of the normal children of this, the third generation, the five sons have had twelve sons and twelve daughters, and the four

Murray of Brighton, was lately communicated to the Royal Medico-Chirurgical Society of London. Noticed in "The Lancet," Dec. 20, 1862. I am aware of a case of a child with complete double foot, at least at the digital and metacarpal part, but have as yet seen only a sketch of it.

daughters have had four sons and four daughters, being the fourth generation, all of whom were normal. A fifth generation in this sub-group consists as yet of only two boys and two girls, who are also normal.

In this sub-branch, we see the variety of the first generation present in the second, passing over the third and fourth, and also the fifth as far as it has yet gone.

(*b*) James, had three sons and two daughters who are normal.

(*c*) Thomas, had four sons and five daughters who are normal; and has two grandsons, also normal.

In this sub-branch of the descent, we see the variety of the first generation, showing itself in the second and third, and passing over the fourth, and (as far as it as yet exists) the fifth generation.

(*d*) John L—— (one of the informants) had six fingers, the additional finger being attached on the outer side, as in the case of his brothers James and Thomas. All of them had the additional digits removed. John has also a sixth toe on one foot, situated on the outer side. The fifth and sixth toes have a common proximal phalanx, and a common integument invests the middle and distal phalanges, each having a separate nail.

John L—— has a son who is normal, and a daughter, Jane, who was born with six fingers on each hand and six toes on each foot. The sixth fingers were removed. The sixth toes are not wrapped with the fifth, as in her father's case, but are distinct from them. The son has a son and daughter, who, like himself, are normal.

In this, the most interesting sub-branch of the descent, we see digital increase, which appeared in the first generation on one limb, appearing in the second on two limbs, the hands; in the third on three limbs, the hands and one foot; in the fourth on all the four limbs. There is as yet no fifth generation in uninterrupted transmission of the variety. The variety does not yet occur in any member of the fifth generation of Esther's descendants, which consists, as yet, only of three boys and one girl, whose parents were normal, and of two boys and two girls whose grand-parents were normal. It is not known whether, in the case of the great-great-grandmother, Esther P——, the variety was original or inherited.

16. *Case of Additional Thumb, with distant Hereditary Origin.*

—— B—— æt. 3, Linlithgowshire, was born with an additional thumb on the left hand, which Dr Hamilton removed when she was a few months old. The upper end of the proximal phalanx was left, for security to the metacarpo-phalangeal joint, and has since grown to some extent. It was not much smaller than the thumb which was left. The only other child, also a daughter, is normal.

The mother's maternal uncle (W——) had a thumb of the same kind, which Dr Hamilton has seen. His five sons and five daughters, however, were normal. The mother of the girl B—— is one of a family of four brothers and five sisters, all of whom are normal, and

their children, twenty-four sons and twenty-seven daughters, were likewise all normal, except one of Mrs B——'s daughters, being the case under description.

The occurrence of it in the maternal grand-uncle, indicates the variety to have existed in some generation previous to his. The case shows it to have passed over at least two generations, the grandmother and the mother, and to have reappeared in the third generation in the case of the girl B——.

For this and the five following cases 17, 17 (*a*), 18, 18 (*a*), 19, 19 (*a*), I am indebted to Dr Gibson of Campbeltown, who has most kindly taken much interest and trouble in obtaining and sending me the information.

17. *Case of Additional Digit on one Hand, with Three Phalanges and a Metacarpal Bone; and Additional Digit on each Foot. Direct Hereditary Origin.*

W—— S——, æt. 73, Argyleshire, has, on his left hand, a sixth finger, placed midway between the thumb and fore-finger. It has three phalanges and a metacarpal bone, all clearly felt. It hangs pendulous, not having the power of extension. Its length is $3\frac{1}{2}$ inches, that of the thumb being $2\frac{1}{2}$, that of the fore-finger 4 inches. The thumb and fore-finger are each 3 inches in circumference, the intermediate digit $2\frac{3}{4}$.

He states that he has six toes on each foot, and that the additional toe is placed and formed in the very same way as in the hand. His children, four in number, are without digital variety, but it is hereditary, as fully given with the next case, that of a sister.

17 (*a*). *Case of Two Thumbs, one of them with Three Phalanges on each Hand; and Two Great Toes on each Foot, with an Additional Metatarsal Bone on one Foot. Direct Hereditary Origin.*

A—— S——, Argyleshire, has six digits on each hand and on each foot. The additional digit is on the inner side. One of the thumbs presents three phalanges, on each hand, and one of the additional great toes has a separate metatarsal bone.

The two thumbs are supported on one unbifurcated metacarpal bone. The thumb next the fore-finger is clearly felt to have three phalanges, while the lesser thumb has two phalanges. It is the same on both hands. The greater thumb is $2\frac{3}{4}$ inches in length on the left hand, and $2\frac{1}{2}$ on the right; the lesser thumb is 2 inches in length on both hands. The circumference of the greater thumbs on the left and right sides, respectively, is $2\frac{1}{2}$ and $2\frac{1}{4}$, that of the lesser thumbs being 2 inches. The two thumbs are webbed at their base. In each hand, it is the thumb next the fore-finger which is used.

In the *left foot* there are two great toes growing from one metatarsal bone, each having two phalanges, which are distinctly felt. The inner toe is the greatest, is $2\frac{1}{2}$ inches in length and $3\frac{1}{2}$ in circumference; the outer is 2 inches in length and 2 inches in circumference.

On the *right foot* there are six toes very regularly set, and six metatarsal bones. The great inner toe has two phalanges, is 2 inches in length, and $3\frac{1}{2}$ in circumference; the second is $1\frac{3}{4}$ in length, and $2\frac{3}{4}$ in circumference, and has two phalanges. The outer of the two great toes—that next the other toes—is therefore the lesser on both feet.

The variety is in the family. It came into the family through the paternal grandmother, who was a relative of the —— family, in which digital variation exists. This grandmother herself is not stated to have had the variety, but the father of A—— S—— had six toes on each foot and "very long thumbs." Of his seven children, a daughter and three sons have no digital variety; the other daughter has, as above described, six digits on each hand and foot; a son has the great toes double; and the remaining son, whose case is last described, has six digits on each foot and on one hand. This son has four children, who are all normal. Of the other sons, two, who are normal, are married and have fifteen children, all of whom are likewise normal.

18. *Case of Double Distal Phalanx of Thumb, with distant Hereditary Origin.*

J—— H——, æt. 70, Argyleshire, has the thumb on the right hand double at the distal phalanx, while the metacarpal bone, and the proximal phalanx, are single. The distal segment is at first much flattened, and then bifurcated for about half an inch; each has a separate phalanx, and a nail. The distal divided segment remains constantly extended.

Neither of his six brothers, or eight sisters, or father or mother, had any digital variety. His maternal grandmother, herself normal, was a member of the family already alluded to, among whom such variety exists; and the next case is that of a sister's grand-daughter.

18 (*a*). *Case of Additional Thumb on each Hand, with Additional Metacarpal Bones, and Double Great Toe on one Foot. Distant Hereditary Origin, connected with the preceding case.*

J—— D——, æt. 4, Argyleshire, has two thumbs of equal size on each hand, and a double great toe on the left foot. The two thumbs on each hand have each two phalanges, and also each a metacarpal bone. The two thumbs of each hand possess flexion and extension and other motions perfect, and are equally useful.

The metatarsal bone of the left great toe appears to be grooved

but not bifurcated. Each of the great toes which it supports has two phalanges. They are wrapped in a common integument, except near the point, where they separate. Each has a nail. The phalanges of the outer lie partly upon those of the inner great toe. She has a brother and two sisters, but no member of the family, later than the brother of her maternal grandmother (case of J—— H——, last related), has any digital variety. She is, through the same channel, a distant cousin of the family, already alluded to, among whom digital variety exists.

19. *Case of Additional Thumb on one Hand, with distant Hereditary Origin.*

J—— F——, æt. 8, Argyleshire, has an additional thumb on the left hand. The distal end of the metacarpal bone is bifurcated. The lesser thumb is situated on the inner side, and has two phalanges. It is $1\frac{1}{2}$ inch in length, the larger thumb being 2 inches. The distal phalanx of the lesser thumb remains in the flexed position, and cannot be extended voluntarily. The thumb of the right hand is longer than usual, and is somewhat finger-like.

He has one brother and two sisters, neither of whom have digital variety, nor have the father or mother. The father's great-grandfather is said to have had some digital variety. The thumb on the right hand is longer than usual, and somewhat finger-like.

19 (*a*). *Case of Additional Thumb on one Hand, with Additional Metacarpal Bone. Distant Hereditary Origin.*

S—— M——, æt. 7, Argyleshire, has an additional thumb on the right hand. It has two phalanges and a metacarpal bone, which articulates with the inner side of the metacarpal bone of the greater thumb, near the carpal extremity. The larger thumb is 2 inches in length, the lesser $1\frac{1}{2}$. It begins to leave the greater thumb opposite about the middle of the metacarpal bone of the latter, and its point reaches to the last joint of the greater thumb, along the side of which it lies. All the bones are clearly felt.

She has four brothers and five sisters, who, as well as the father and mother, have no digital variety. A first cousin, daughter of a maternal uncle, had a double thumb.

20. *Case of Six Fingers and Toes, with Interrupted Hereditary Origin.*

I am indebted to Mr J. Jardine Murray, F.R.C.S. Edinburgh, of Brighton, for a note of the case of C—— G——, æt. 12 months, who was born with six fingers on each hand, the additional finger being on the ulnar side, and six toes on the right foot. The sixth toe is on the outer side of the foot, and lies more upon the dorsum

than to the outer side of the fifth toe. Mr Murray removed the supernumerary fingers in July 1862.

A brother has the same variety. The grandmother, on the father's side, had the same variety; also a sister of the father's.

Section 3.—DIMINUTION IN THE NUMBER OF THE DIGITS.

21. *Dissection of Three Limbs of a Child, presenting Diminution in the Number of the Digits.*

The child was born with the right hand presenting only two fingers, webbed together; the right foot presenting but three toes; and the left foot with the fourth and fifth toes united at their base. I was indebted to the kindness of Dr Keiller for obtaining the limbs. I have no history to the case, but have thought it worthy of notice from the opportunity of ascertaining by dissection how far the variation affected the deeper parts—the bones, muscles, and nerves.

(1.) Dissection of Hand.—Externally there are two digits, one on the radial side considerably thicker than the other. It will be convenient to speak of the first as the pollex, and of the other as the little finger. They are webbed to the end, presenting a notch at the end on the palmar aspect. The nails are distinct, but close together. The palm is the same breadth as the forearm, and gradually tapers into the fingers. Both palm and fingers have the usual length in proportion to the forearm.

Bones.—Each digit has only two phalanges, the proximal about twice the length of the distal. There are two metacarpal bones. The four bones of the proximal carpal row are present, the second, or semilunar, small. The second row of carpals is represented by two bones, which are coalesced with, or prolonged from, the first row. The piece supporting the ulnar metacarpal, corresponds in position to the unciform, and is fused with the cuneiform. The piece supporting the radial metacarpal is fused behind with the scaphoid, and may represent the os magnum, trapezoid, or trapezium, or all three fused together. The bones and joints of the forearm are fully developed.

Muscles.—All the muscles of the forearm are present except one. The pronators and supinators are unusually large, as is also the Flexor Carpi Ulnaris. The *Flexor Sublimis Digitorum* is small, wants its radial origin, and ends in two tendons; one joins the tendon of the deep flexor, which goes to the little finger, the other ends in the annular ligament. The *Flexor Profundus Digitorum* is full sized, and ends in two tendons; one, the larger, ends in the annular ligament, the other forms a strong flexor tendon, going on to the distal phalanx of the little finger. The latter is joined at the wrist by the tendon of the superficial flexor, which is here pierced by the deep tendon, after which the two are incorporated.

The absence of a tendo perforatus proceeding separately to the finger corresponds to the fact of the absence of one of the phalanges. The *Flexor Longus Pollicis* is large, arising also from the edge of the ulna. It proceeds entirely to the distal phalanx of the pollex. It is not joined by any slip, except that, above, the fleshy slip which usually descends to the muscle from the condyloid origin of the flexor sublimis is unusually large.

The short muscles of the little finger are all present with the usual attachments. So also the short muscles of the thumb, with some modification. The Abductor is large. The Adductor arises from the annular ligament. The Opponens is small, much smaller than the opponens (flexor ossis meta-carpi) minimi digiti. The Flexor Brevis Pollicis, undersized, arises from the two sides of the metacarpal bone; the ulnar head appearing like a second interosseous. There is one *Interosseous* muscle for the little finger, along its radial side.

Extensor Muscles.—The *Extensor Carpi Radialis Longior* sends a small tendon to the base of the metacarpal bone of the pollex, and a large tendon to between the bases of both metacarpals, chiefly to the ulnar. The *Extensor Carpi Radialis Brevior*, also large, goes to the carpus just above the ulnar metacarpal. The *Extensor Carpi Ulnaris* is entirely wanting. The *Extensor Communis Digitorum* gives a tendon to each finger, that to the pollex only a little the largest. The *Extensor Minimi Digiti* is quite distinct from the latter as a muscle. Its only tendon goes to the little finger, joining with the tendon to that finger from the common extensor, the latter being the larger. Two muscles form the deep layer. One has the fleshy attachments of the Extensor Ossis Metacarpi Pollicis, but its tendon goes to the first phalanx, and is therefore the Extensor Primi Internodii. The other muscle has the fleshy attachments of the long extensor of the thumb, and the extensor of the fore-finger. Besides two tendinous slips to the back of the carpus, it ends in two tendons which join the tendons of the long common extensor. One of them, therefore, represents the *Extensor Secundi Internodii Pollicis;* the other the *Extensor Indicis*, going to the only remaining finger.

Nerves.—The *Ulnar* supplies the ulnar side of the little finger, and unites with the median for the supply of the radial side of the same finger. The *Median* supplies both sides of the pollex, and is also the principal nerve for the ulnar side of the little finger. The interdigital space receives for its supply, as above described, a series of nerves, three from the median and two from the ulnar, as if the nerves of the wanting fingers had been crowded into the cleft.

(2.) Dissection of Right Foot.—This foot presents three toes, the internal having the usual characters of the great toe.

Bones.—Each of the lesser toes has the three phalanges—the great toe the usual two. The *metatarsal* bones are three in number, the internal having its usual great size. The second *tarsal* row presents a bone for the support of each metatarsal—two cuneiform bones and the cuboid—but the latter is fused with the os calcis.

The part corresponding to the cuboid has a separate bony nucleus, smaller than the nucleus of the os calcis. Of the first row, the astragalus is fused with the os calcis, and the scaphoid is wanting or fused with the astragalus.

Muscles.—The *Flexor Brevis Digitorum* sends tendons to the two lesser toes, that to the external being much the largest. The *Flexor Longus Digitorum* and *Flexor Longus Pollicis* are separate muscles in the leg, but at the ancle form a common tendon, which at the middle of the foot, after receiving a large accessorius, divides into two, one for the great toe, the other for the second toe, which perforates the tendon of the short flexor. There is one *Lumbricalis*, arising from both sides of the long tendon to the second toe, and going to the tibial side of the same toe. Two muscular bundles arise from the abductor minimi digiti, besides the usual tendon of that muscle, and proceed one to the fibular side of the second toe, the other to the tibial side of the outer toe. They are like large lumbricales, or additional short flexors. The *Flexor Brevis Minimi Digiti* is wanting. There are two plantar *Interossei*, one for the tibial side of each of the two lesser toes; and one dorsal, in the outer space, for the middle toe.

Extensors.—The *Extensor Brevis Digitorum*, gives five distinct digital tendons, three to the middle toe, one of which is larger than the tendon to the outer or to the great toe. All of the five come, as usual with the tendons of this muscle, from separate portions of the muscle. A sixth portion and tendon passes to the external metatarsal bone, and here represents the peroneus tertius, which is wanting in its usual situation. The *Extensor Longus Digitorum* is small, and gives at the ancle a tendon to join the extensor longus pollicis, the rest of the tendon ending on the os calcis. It is just possible that an intra-uterine fracture of the tibia which had taken place, with angular union, may account for the atrophy of this muscle, but the other muscles of the leg are well formed. The *Extensor Longus Pollicis* is large and separate throughout, except that it receives a tendon from the extensor longus digitorum.

The muscles not alluded to in these notes present their usual arrangement.

Nerves.—The distribution of the plantar digital nerves is somewhat remarkable. The *external plantar* sends a nerve to the fibular side of the outer toe, and a second to both sides of the outer interdigital cleft. The *internal plantar*, which has the usual preponderance in size, sends, first, a nerve for the tibial side of the great toe; second, a branch to the internal cleft which gives off first one and then a second set of subdivisions to the sides of the cleft, the double nerve on each side keeping a plantar course; third, a branch to join with the external plantar in supplying both sides of the outer cleft. Also there is a twig from the deep or muscular division of the external plantar, through below the flexor brevis digitorum muscle, to join one of the branches of the internal plantar to the fibular side of the great toe. A similarly derived and similarly

placed connecting twig passed from the ulnar nerve to the median in the right hand.

The distribution of the internal plantar nerve, taken alone, would indicate that the wanting toes are the two outer; while the distribution of the external plantar, taken alone, would indicate that the second and third are the wanting toes; but the double apparatus of nerves to each cleft, and their source, is exactly explained by supposing the second and fourth to be the wanting toes.

(3.) Dissection of Left Foot.—The fourth and fifth toes are united at their bases. The foot is in the condition of talipes varus.

Bones.—The bases of the proximal phalanges of the fourth and fifth toes are united in a single piece, and in front of this they are held together by a strong transverse ligament, with an anterior concave edge. Each of the lesser toes has three phalanges, except the fifth, in which the distinction between the second and third phalanges is not evident, but the softness and smallness of the parts render it difficult to pronounce as to this. It has, however, a tendon from the flexor brevis digitorum muscle. The fifth *metatarsal* bone is wanting. The fourth is double sized, broader but not bulkier than that of the hallux, but it presents no trace of duplicity externally, and a section shows one large medullary canal. The *tarsal* bones present no variety, except that the cuboid is narrower than usual, having only one metatarsal bone to support, and that the astragalus is fused with the os calcis.

Muscles.—The fourth and fifth toes receive no tendon from the *Extensor Brevis Digitorum*, and but one tendon from the *Extensor Longus Digitorum*, which divides at the metatarso-phalangeal joint into a tendon for each of the partially united toes. The external tendon of the *Flexor Brevis Digitorum* divides in the same manner at the head of the metatarsal bone to supply these two toes. So does the external tendon of the *Flexor Longus Digitorum*, after crossing the metatarso-phalangeal joint.

The most external of three *Lumbricales* is double-sized and goes to the tibial side of the fourth toe. The first lumbricalis, besides going to the tibial side of the second toe, sends a slip to the fibular side of the great toe. A muscle arises partly with, partly behind, the adductor pollicis, and goes to the neighbouring sides of the second and third toes. Of the two plantar *Interossei*, the external is very large and goes to the fourth toe. The *Flexor Longus Digitorum* and *Flexor Longus Pollicis* form a common muscle and tendon. The muscle splits naturally enough into two, but the outer portion comes mainly from the tibia and partly from the upper part of the fibula, the usual place of origin of the flexor longus pollicis from the fibula being unoccupied. The tendons of these two portions form one indivisible tendon above the ankle, which after receiving the accessorius, divides into four tendons, the internal for the hallux being the greatest, the external, as already noticed, for the two partially united outer toes.*

* It is an error to regard the so-called "Flexor Longus Pollicis" as a flexor of the great toe only, or to consider the presence of a tendon from it to

PART II.—VARIATION IN THE NUMBER OF PHALANGES.

Section 1.—DIMINUTION IN THE NUMBER.

22. *Case in which all the Fingers and Toes want a Phalanx, in several Members of a Family.*

I am indebted to Dr Oswald H. Bell of St Andrews for the description and history of this case, and for affording me an opportunity of seeing the boy.

David M——, æt. 18, St Andrews, wants a phalanx in each of his fingers and toes, and has a brother and sister similarly formed. The two hands are precisely similar. The thumb consists of a short metacarpal bone ($\frac{5}{8}$ inch in length) and of one phalanx, $1\frac{1}{8}$ inch in length, the joint between them being loose, as if composed of some soft intermediate tissue. The fore finger is so much longer than the others as to suggest the appearance of a hand in the act of pointing. This is due to the greater length of its metacarpal bone, which is 3 inches in length, while the next two metacarpals are under half that length. The metacarpal of the little finger is just $1\frac{1}{2}$ inch in length, but, from its obliquity, does not project so far as the fourth. The proximal phalanx of the fingers measures, in the index $1\frac{3}{8}$, in the middle $1\frac{3}{8}$, in the ring 1, in the little finger $1\frac{1}{8}$; the distal phalanx, in the index and middle, $\frac{7}{8}$, in the ring and little fingers $\frac{5}{8}$ inch. On the left side, the distal phalanx of the index finger is proportionately shorter. Except in the case of the fore finger, the five digits present their usual relative projection. The metacarpo-phalangeal joints, especially of the index and middle fingers, are considerably sunk behind the web, and are loose, while the joint between the two phalanges does not bend down with the usual degree of angularity.

He can easily seize and retain minute articles as a needle or pin, between the thumb and index finger, and can write with comparative ease. Being a groom, he can drive tolerably well, though he is apt to let the reins slip, being unable in the usual way to form the digital hook which the third phalanx naturally completes.

The feet are well formed as far forward as the distal ends of the metatarsal bones. The toes are short, pulpy, and very loosely articulated. The lesser toes have two phalanges each, and are much turned up at the interphalangeal joint; the great toe has its usual proportionate greatness, but, like the thumb, has only one phalanx. The pads below the anterior end of the metatarsal bones, behind both the great and lesser toes, are more developed than usual. No

the second toe as an occasional occurrence only. The tendinous slip commonly described as passing between the Flexor Longus Pollicis and the Flexor Longus Digitorum, in the sole of the foot, is nothing less than a tendon from the former to at least the second toe, of good size when the proportionate size of the two toes is considered. It is, normally, the principal flexor tendon of the second toe, and the first lumbricalis muscle is attached chiefly to it. (See communication by the author to the Edin. Medico-Chirurgical Society, "Edin. Medical Journal," July 1863.)

one would suspect from his gait any deficiency in the feet. He is 5 feet 2 inches in height, healthy and active.

Family history.—He is one of a family numbering ten in all, who were born in the following order. First, a son, and then successively three daughters, all normal. Fifth, a son, the first member of the family who presented the digital variety. Sixth and seventh twin girls, normal. Eighth and ninth, twin boys, one normal, the other whose case is above described. Tenth, a girl, with fingers and toes as in this boy, and, in addition, the feet turned in. Neither Dr Bell nor I have seen the brother and sister who have the variety, but the boy states that their fingers and toes are the same as his, the hands so like that when the arms are covered and the hands presented promiscuously, the mother cannot say to which brother they belong. The brother is a clerk and is said to write an excellent "hand." We have no information as to the ancestors, but neither of the parents, uncles, aunts, or cousins, had or have any deformity.

23. *Case in which four Fingers of one Hand possess but one Phalanx each, the Thumb having two Phalanges.*

Dr Henderson of Fordoun sends me a note and sketch also of the case of A—— W——, æt. 3½ years. The four outer digits of the left hand are short nipple-like processes containing one phalanx each, so loosely attached to the metacarpals that they can be easily twisted round. Each has its little nail. The thumb contains two phalanges, is as large as that of the other hand, projects a long way beyond the fingers, and she makes great use of it.

Her father has an aunt with two thumbs on the left hand, similar to the case of H—— K—— (No. 8).

24. *Case in which the Fingers are formed so as to give the Hand a resemblance to a Foot.*

I am indebted to Dr Grierson of Thornhill for the description, and for sketches of the hand, of this case, a cast of which I had previously seen, obtained through Dr A. Mitchell and Dr A. Simpson.

J—— M——, æt. 16, Dumfriesshire. The hand may be described, generally, as having a remarkable general resemblance to a foot, in the size and straight direction of the thumb, and the little development and outward lessening of the fingers. The sketch (fig. 5) will give a correct idea of the form of the hand. The thumb is the longest and thickest of the digits, and lies parallel to the fingers. It can be abducted, and only half crossed over the palm. It has two phalanges, besides the metacarpal bone. The distal end of the latter extends a little way beyond the separation between the thumb and next finger. The thumb alone has a nail. The next two fingers project for about an inch, the index more, the middle less. The ring and little fingers appear only as fleshy finger points. There is a bone projecting some way into the index and also into the

middle finger, either a phalanx or a prolongation of the metacarpal bone. The fourth and fifth fingers have no phalanges. The fingers have no voluntary motion. Viewed on the palm, the "ball" of the thumb is flat and narrow, but the eminence formed by the muscles of the little finger is prominent.

The other hand and the feet are normal. She is the third child in a family consisting of six daughters and three sons, all the rest of whom, as well as the father and mother, are normal. No such formation is known to have been presented by any ancestor. The mother's story is that in her third month of pregnancy she had a vivid dream that she saw a man killed and his fingers cut off, at her own door; that she told this at the time to her husband and neighbours, and could not for long get rid of the idea of the cut-off fingers.

25. *Case of Five Rudimentary Digits on one Hand.*

Mr James R. Crease of Gateshead, sends me the particulars and a sketch of the case of a female child, M—— J—— T——, ten days old, whose right hand presents a very rudimentary condition. The four fingers are present as mere rudiments, without nails; the thumb is about $\frac{1}{4}$ inch in length and has a nail. After the radius and ulna there are no bones to be felt in the hand, except one supporting the thumb. The rest of the limb is well formed.

Digital variety was previously unknown in the family history. There are three other children, boys, all well formed. An aunt by the father's side, had all the fingers, but not the thumb, of the right hand amputated, but the mother had not seen her for many years. When the mother was three months pregnant, her attention was attracted by a woman singing in the street who had a deformed right hand. For a time she always thought she saw this woman, but had no idea that anything would be wrong with the child.

SECTION 2.—INCREASE IN THE NUMBER OF PHALANGES.

26. *Case of Additional Phalanx in the Thumb, on both Hands. Probably of Hereditary Origin.*

J—— J—— æt. 21, Roxburghshire, now in Edinburgh, has the thumb on both hands of unusual length and form, as represented in Fig. 6, which is taken from a photograph. In examining the thumbs I was surprised to find an additional joint, giving three phalanges besides the metacarpal bone, the additional bone being placed in the position of a middle phalanx. A case so unusual deserves careful examination.

The metacarpal bone is $2\frac{1}{4}$ inches in length and appears to be quite normal. The first phalanx is $1\frac{3}{4}$ inch in length, and is, therefore, longer than usual. The *additional bone*, occupying the position of a middle phalanx, is broader on the inner, or radial, side than on the side next the index finger, having a triangular or wedge-shaped figure, which gives the distal phalanx an inclination towards the index. It measures along the radial side $\frac{5}{8}$ inch, along the ulnar

side $\frac{1}{4}$ inch, and $\frac{1}{2}$ an inch along the middle. The position of the base of this wedge-shaped additional bone is shown in the sketch by the double protuberance on the radial side. Between these a depression may be felt corresponding to the short shaft between the two articular ends. The distal phalanx is an inch in length. The measurements were made exactly from the joints, avoiding the error of including the knuckle twice.

When the thumb is straightened, its point passes a sixth of an inch beyond the joint between the proximal and middle phalanges of the index finger. The thumb of the right hand scarcely advances so far as that joint. The unusual length of the thumbs in this case is gained by the proportionately greater length of the proximal phalanx and by the presence of the additional bone, while the distal phalanx is a little shorter than usual. At the joint on the proximal side of the additional phalanx there is the usual extent of flexion and extension. Between it and the distal phalanx passive motion is free and readily felt in both thumbs, although it cannot be carried so far as to cause an angle or additional knuckle. Some motion in the lateral direction also can be made at this joint. The utility of the thumb is not impaired. The fingers are longer than usual (their lengths, from the metacarpo-phalangeal articulation, are, fore-finger $3\frac{7}{8}$, middle $4\frac{3}{8}$, ring $4\frac{2}{8}$, little $3\frac{1}{2}$, inches. The whole hand is 8 inches in length), present the usual proportionate length, and have three phalanges each. The great toes present the usual length, size, and number of phalanges. He is of full average stature, his height being 5 feet $9\frac{1}{2}$ inches.

A maternal aunt had the same kind of thumb on the right hand, being the only instance of the occurrence of the peculiarity in any relative of the family. This aunt has a son and three daughters. The mother had other three sisters and two brothers, all of whom, except one of the sons, have families of sons and daughters. The mother never heard that any of her ancestors had it.

REMARKS.

As some of the cases in the hereditary group show the tendency to have passed over at least two generations and then to have reappeared, it is possible that some of the cases recorded as original, may be cases of distant inheritance. But it must have had a beginning in these too. Careful inquiry was made in all the cases, and the previous occurrence of such a thing in the family is pretty sure to be brought up when a child is born with it. The cases one would feel most inclined to doubt on this score, are those in which it appeared in more than one child of the family, as in cases 1, 8, and 9.* In such cases we may suppose the

* I am indebted to Dr Strachan, of Dollar, for a case (which has arrived too late for detailed insertion at present) closely resembling Case 1. In a

cause which determined the occurrence in one child might equally determine it in another, or it might be held that the first case having occurred spontaneously, the circumstance had operated by an impression on the mind of the mother.

In all the cases of original variation, except in Case 1, and in one of the children in Dr Strachan's case, it appeared on one limb only.

This was not to any marked extent on one side of the body more frequently than on the other. The greater acquired strength of the right hand and foot might be supposed to operate on the offspring, but in the above cases it so happens that it appeared rather more frequently on the left side. Throughout the animal kingdom, when one side is more developed than the other, the right side is not selected more frequently than the left.*

The variation begins more frequently on the hand than on the foot. In the non-hereditary group of cases in which it affected either a hand or a foot only, it appeared on the hand in eleven of the cases, on the foot in four cases. The hereditary cases, by multiplying the fact, show a still higher proportion affecting the hand than the foot; and in the cases in which it occurs on three of the limbs, it is on a foot more often than on a hand that the sixth digit is wanting. None of the cases show hereditary transmission of the peculiarity on the feet alone, while the cases of hereditary transmission on the hands only are more numerous than those showing it on the hands and feet. This greater frequency of its appearance on the hand may be connected with the zoological fact that in those mammals in which the digits differ in number on the two feet, the greater number is on the fore foot; or, more generally, with the fact that greater separate use is made of the digits on the hand than on the foot.

The additional digit appears nearly equally on the outer or on the inner side of the limb. In the non-hereditary group, reckoning the first case as one, it appeared in 7 cases on the outer side, and in 7 cases on the inner side, as an

family of 8 brothers and 3 sisters, 3 brothers and one sister were born with digital increase. Two had an additional outer toe, one an additional outer finger, one had it on all the four limbs. It was unknown in the family as far back, at least, as the great-grand-parents.

* See a paper by the author in the "Edin. Medical Journal," June 1863.

additional thumb. Three of the seven external cases were on feet, on the outer side. In the hereditary group, taken as families, it is on the inner side in the majority of the cases. In one family only [cases 17, 17 (*a*), 18 (*a*)] does it affect the big toes. As far as these cases show, it would, therefore, seem to be more common on the outside of the foot, and, on the hand, more frequent on the inner than the outer side. Were we to connect these facts with the facts regarding the order in which the toes appear, or disappear, among the mammalia, we would require to consider not only the fact that the inner digit is the last added, but that the increase, or decrease, takes place alternately on the inner and outer sides.

On the hand, the additional digit was smaller than the next, always so in the case of an additional little finger, and nearly always so in the case of an additional thumb, but in case 18 (*a*) the two thumbs were equal, and in case 2 nearly equal. On the foot, in cases 12 and 13, the sixth toe is thicker than the fifth, although it has a phalanx less, but the thickness does not seem to depend on the bones. Among the hereditary cases, in case 17 (*a*) the internal of the two great toes is the larger.

Cases of non-hereditary increase in the number of the digits appear to be of not unfrequent occurrence. Most surgeons have met with cases, and it is a common practice to remove the additional digit early. The above cases show that the removal of the digit, in cases in which it is inherited, does not eradicate the atavic influence. But most of the cases of original variation do not appear to transmit the tendency, for, besides the facts mentioned in some of the cases, cases of original variation are much more common than hereditary cases, even reckoning each member of the existing family as a separate case.

Hereditary Transmission of the Variety.—The transmission of a newly acquired variety has to depend on whether the new influence or the prior normal influence proves the stronger; and, if the former prevails, it has, so long as only one parent presents the variety, farther to depend for its continuance on its chance of the fact that one parent may exert more influence than the other on some of the young. Thus if not itself at the beginning overcome by

atavism, it is liable to be lost at every new union, and, we would suppose, liable to be worn out at last. The case of the L—— family (case 15) illustrates various phenomena of variation and transmission. (1.) In the line of descent through Andrew L——, we see three successive generations without the variety, and it is apparently extinguished. (2.) In the line through James L——, he and his children were normal, but it re-appears in his grandchildren, having passed over two generations. In case 19, it had passed over three, and in case 16, over at least two, generations. In case 18 (*a*) although the grandmother's brother had it, the great-grandparents had not, so that it had passed over three generations in the direct line and reappeared in the fourth.

(3.) We see uninterrupted transmission in the line of descent through John L——, from Esther in the first (if she was the first), to Jane in the fourth generation. The six-fingered tendency had here maintained itself against three successive unions with five-fingered persons. In the first offspring it succeeded, as far as we know, in only one out of 18. In the offspring of this one (Charles L——) it succeeded in 3 out of 12. In two of these three it did not appear in the next generation ; in the third of them it succeeded in one out of two children, thus being directly transmitted to the fourth generation.

It is interesting to notice, too, how the variety so far from being weakened had gathered force in each new generation, even although it had not the advantage of the greater development attending utility, to enable it to increase its hold on the organism. In the first known ancestor (case 15) it occurred on one hand ; in the second generation on both hands ; in the third on both hands of two brothers, and on both hands and one foot of a third brother ; and in the fourth generation on all the four limbs —thus, so far from becoming weaker, making its way to an additional limb in each successive generation.

Besides thus extending itself symmetrically and serially, it may extend in depth, beginning as one phalanx and extending at length to the metacarpal or metatarsal region. In some of the cases of original variation, there was only

one phalanx, in most of them two phalanges. Among the hereditary cases, in case 19 (*a*) there is a metacarpal bone besides two phalanges; and, in case 18 (*a*), the same occurs in both hands, while on the six-toed foot it has not extended to the metatarsal bone. In case 17 (*a*) one of the thumbs on each hand presents three phalanges without an additional metacarpal, while the two great toes have, on both feet, two phalanges each, and one foot has an additional metatarsal bone. In case 17 there is an additional metacarpal bone and three phalanges. We do not know how it was with the ancestors of these cases, but in none of the cases of non-hereditary variation did it extend so deeply into the limb.*

When the variety is transmitted it is on the same side of the limb. In case 15, the additional digit was external, both on the hands and feet, in all the ramifications of the descent. Also in case 20. In cases 17, 17 (*a*) 18, and 18 (*a*), in which the variety is derived from a common ancestor by different lines of descent, it is on the inside of the hand or foot, or on the inside of both hand and foot. Also in case 16. In none of the cases was it external on one limb and internal on another limb of the same person, or in the same family. In case 8, of two children in the same family, one had an additional little finger, the other an additional thumb, but the case is one of the non-hereditary group, and there is the curious fact that they were the children of different fathers, though of the same mother. The influence of sex does not appear to any marked extent in the hereditary transmission in the above cases.

Diminution in the Number of the Digits.—Diminution in

* When the additional digit is supported, as it generally is when well formed, on one end of a more or less bifurcated metacarpal or metatarsal bone, it might be supposed that this indicated the original presence of an additional metacarpal or metatarsal bone, which had become more or less confluent with the next, as in the development of the metacarpus and metatarsus in the ruminant. But while this can be easily shown in the ruminant, there is no proof that here there is anything but a more or less extensive bifurcation of one bone. In the dissection of the left foot in case 21, in which the fourth and fifth toes were partially united and supported on one metatarsal bone, the fifth metatarsal being wanting, the fourth metatarsal was twice the normal thickness, but presented no trace of double origin, externally or internally, although the foot was that of a new-born child.

the number of the digits appears to be a much less frequent variation than increase, both in man and in mammals generally, although many mammals have normally less than five. Among these the occurrence of an additional digit is generally but the development of the concealed rudiment of a suppressed digit. In man, although he normally possesses the full mammalian number, the tendency is to farther increase rather than to decrease in the number.

Variation in the Number of Phalanges.—In this group of cases there was diminution of the number of phalanges in four cases, in none of which was it hereditary, although one of the cases embraces two brothers and a sister.*

From cases 23, 24 and 25, in which the fingers were more or less rudimentary, while the thumb was either not at all or less reduced, it would seem as if the thumb were the last to suffer reduction. Two cases have been mentioned to me, however, although I have not seen them, in which the thumb alone is wanting, in one of the cases on both hands. Homologically considered, we would expect

* See a case of hereditary transmission of deficient phalanx by Alf. Robert, mentioned in an able paper by Mr Sedgwick "On the Influence of Sex in the Hereditary Transmission of Disease" (*Brit. and Foreign Med. Chir. Review*, April 1863). Also a case by Dr Kellie of Leith (*Edin. Med. and Surg. Journal*, 1808, p. 252); but the mother's statement that it had been transmitted for ten generations must be received with caution, when we consider what ten generations implies. Among the more interesting cases of hereditary transmission of increased number of digits on record are—The case of the Maltese family, by Commander Godehew (*Mémoires de l'Académie Royale des Sciences*, 1751), more fully related by Reaumur (*L'Art de faire eclorre et d'elever des Oiseaux Domestiques*, tom. ii. p. 377): The case by Sir A. Carlisle (*Philosophical Transactions*, London 1814, p. 94): A case by Dr Crawford of Peebles (*Edinburgh Monthly Journal of Medical Science*, Oct. 1851, p. 356): A case by Mr J. B. Thomson of Perth (*Edin. Medical Journal*, 1858–59, p. 502); and a case noticed in "Medical Times and Gazette," Dec. 20, 1860, from the "American Medical Times," possibly a branch of the family whose case is related by Sir A. Carlisle. On this subject may be also consulted, Haller (*Elementa Physiologiæ*, t. viii. pp. 97, 98, 99, 1766): Morand (*Mem. de l'Acad. des Sciences*, 1770): Isodore Geoffroy St-Hilaire (*Histoire Générale et Particulière des Anomalies de l'Organisation*, 1832–36): and A. W. Otto (*Monstrorum Sexcentorum Descriptio Anatomica*, 1841). The oldest recorded case is that of one of the sons of the giant of Gath (2 Samuel, ch. xxi., v. 20; and 1 Chronicles, ch. xx., v. 6) who had six fingers on each hand and six toes on each foot. Pliny notices two cases, among the Romans, of six fingers on each hand (XI. Book, ch. 43). Anne Boleyn is said to have had six fingers on each hand.

the thumb to be the first, teleologically considered, the last, to suffer reduction.

Increase in the number of phalanges occurs in the thumb only, or as in cases 17 and 17(*a*), in the digit serially corresponding to the thumb when six digits are present. None of the cases presented a higher number than three, the full number in the mammalian type. Case 26, in which, without any increase in the number of the digits, the thumb presents an additional phalanx, is a very remarkable one when we consider the mammalian law. Not unlikely, it may have been the same in the father of cases 17 and 17 (*a*), who is described as having had very long thumbs, while his son and daughter had three phalanges in the corresponding digit, and a thumb with two phalanges added by its side.

On the absence of a Bone in the Thumb and great Toe, as compared with the other Digits ; and on the Nature of the "Metacarpal" or "Metatarsal" Bone of the Internal Digit.

The occurrence, normally, of a bone less in the thumb or great toe than in the other digits, is part of a law exemplified in the inner digit of all five-toed mammals,* and may be supposed to find its explanation in the fact that the internal is the small toe, and the one which has disappeared when the number is reduced to four. Whatever be its meaning, this law is maintained in the few cases in which the internal digit undergoes great teleological development, as in the seal and walrus,† in which the internal digit is longer and thicker than the three middle digits, and in

* This law is not without exception in cases of variation, as in case 26; and I have lately been presented by Mr Robertson of Kelso with a pig's foot, presenting five toes, in each of which there are three phalanges besides the metacarpal bone.

† I have seen a skeleton of the walrus with three phalanges in the pollex, but on trying with my penknife, I found one of them to be a piece of wood. In the skeleton of a seal I once saw three natural phalanges in the inner digit, but the first and fifth toes had been transposed. The phalanges and metacarpals and metatarsals of the seal are arranged and developed exactly as in man, and the presence of only two phalanges in the pollex and hallux is easily felt in the living seal.

man in whom the great toe and thumb are the most important of the digits. As the erect posture requires a great toe on the inner side of the foot, and a long one, the phalanges of the inner digit are, accordingly, developed in length as well as in thickness. The thumb, again, being better adapted for opposition by being shorter, is developed in thickness, and still retains its character as the shortest digit.*

It has long been a discussion in human anatomy, whether the wanting bone in the thumb and great toe is a phalanx or a metacarpal or metatarsal bone. The view that it is the middle phalanx which is wanting is supported by the arrangement of the muscles,—(*a.*) by the absence of the tendo perforatus; (*b.*) by the attachment to the first phalanx of the short muscles which correspond to the short muscles of the little finger, which are attached to its first phalanx; (*c.*) by the attachment to the metacarpal bone (with its resulting prismatic form) of the muscles which correspond to those which are attached to the metacarpal bone of the little finger; and (*d.*) by the position of its metacarpal bone in the metacarpal range.

Opposed to this view is the one fact, that the so called metacarpal bone of the thumb is developed like a phalanx, having its epiphysis at the proximal end, while the other metacarpal bones have their epiphyses at the distal end. The discussion stood there, the difficulty being to say what value should be given to the developmental fact. There might be some special reason for the changed position of the epiphysis, although it would be difficult indeed to suggest any such reason, either on the longitudinal growth, or on the elasticity, theories of the use of epiphyses, especially

* I have been in the habit of pointing out the interesting fact, that the relative length of the digits on the human hand indicates the order in which the digits disappear in the downward progression from the five to the one toed mammal,—the internal disappearing first, next the external or fifth, next the index or second, lastly the ring or fourth,—the extreme digit disappearing on alternate sides, beginning on the inner, until the middle digit alone remains in the foot of the horse, as demonstrated by Professor Owen in his work "On the Nature of Limbs." Nor need this correspondence be regarded as a mere coincidence, when we consider the relative function of the digits in an ordinary five-toed limb. The exceptions presented to this, in the human foot, and in the lateral toes of the pinnigrade carnivora, are special adaptive modifications of certain digits.

in the case of the great toe, the distal end of whose metatarsal bone is the most developed. Comparative anatomy, however, sets this question at rest. I find that the distal position of an epiphysis on a metacarpal and metatarsal bone, and its proximal position on the phalanges, belongs to other mammalia as well as to man, and is adhered to notwithstanding the most varied proportionate size which the two kinds of bones, or their two ends, attain.* In the horse and ruminant, in which the great metacarpals and metatarsals attain enormous size, they have still only one epiphysis, while the radius and humerus have an epiphysis at both ends; and the metacarpals and metatarsals have their epiphysis distal, while on the phalanges it is proximal. The short and flat thigh-bone of the seal has epiphyses at both ends, while the greatly elongated metacarpals, metatarsals, and phalanges, have but one epiphysis each, placed as on the corresponding bones in the human hand and foot. A still more striking example of this law is presented in the development of the rudimentary metacarpals and metatarsals of the horse; the large upper ends of which, serving an articular function, are developed without an epiphysis, the epiphysis being kept for the little "button" which terminates the tapering lower end. The more we compare the muscles of the two limbs, and in the limbs of different animals, the less dependence do we place on their attachments for the determination of homology; and the above facts in comparative osteogeny show, that the position of the epiphysis is decisive in establishing the view that the bone which is wanting in the human thumb and great toe, and in the internal digit of other five-toed mammals, is the metacarpal and metatarsal, although custom and convenience lead us to apply these terms to the bone which homologically is the proximal phalanx.

* The cetacea present an exception to the mammalian law of three phalanges, in the occurrence of more than three in the longer digits of the paddle, making an approach in this respect to the digital type of the fish. I have observed that the cetacean digits present another exception in the presence of epiphyses at both ends of each phalanx, and also at both ends of the metacarpal bones. In contrast with this, we have the great distal phalanx of the horse, ruminant, pig, and some others, developed without an epiphysis, while in man it is present on the distal phalanx as well.