owing to the weight of the liver, and that this causes a greater development of the muscles there. It is possible that several of these causes may have had an effect upon the matter. An efficient cause may be found in the situation of the heart upon the left side. A savage soon learns that his enemy is vulnerable there, and takes pains to protect himself by withdrawing the left side and using the weapon with the right. The constant persistence of this use of the right arm as the weapon-bearing member has probably resulted in organic dextral preference, and left-handedness may be considered an atavism.

Frank Baker.

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HANDS AND FINGERS, DISEASES AND DEFORMITIES OF.—The hand is such an important and essential factor in the practical economy of life that the pathological conditions to which it is subject and which tend to impair its usefulness form an important field of medical science and practice. It is a topographical region so well marked off, and is subject to such special pathologic and etiologic factors, that the morbid conditions which affect it make up quite a distinctive and well-marked group of diseases. The diseases to which the hands and fingers are subject comprise a considerable variety of conditions, diverse in their nature and cause, with the only element of unity resting in their common site. A comparative consideration of all these various conditions may prove of advantage in questions of differential diagnosis; and some of the rarer affections may be pointed out which from not being often observed may prove puzzling when cases are met with.

Special Pathological and Etiological Factors.—The hand exhibits a number of characteristics that exert special influences in determining and bringing about the morbid conditions to which it is subject.

Among these special causative factors is the peculiar anatomical construction of the hand. The hand is essentially a delicate motor mechanism and arrangement of joints, ligaments, tendons, and the like, all so nicely adjusted that slight impediments (as in trigger finger) may result in material deformity or impairment of function.

Another condition that subjects the hand to certain forms of disease is its use and its exposed situation, rendering it especially liable to mechanical, traumatic, atmospheric, irritative, and other influences. The constant usage of the hand incident to various occupations produces corresponding reactions and morphological and pathological consequences, as in writer's cramp and the stiffening and hardening effects of manual labor. The hand is much exposed to injuries, mechanical, chemical, thermic, while its being habitually uncovered by clothing and thus exposed to meteorological and other irritative influences makes it subject to certain skin affections.

The situation of the hand at a distance from the circulatory centres is another factor that gives rise to various pathological conditions. The great distance of the hand from the heart causes a relative weakness of the circulation in this member, which results in the occurrence of circulatory disturbances like stasis, clubbed fingers, œdema, and Raynaud's disease in this locality.

Its distant situation also renders the hand liable to suffer consequences of injuries or lesions primarily located at points between it and the trunk or the bodily centres. The motor mechanism of the hand is located chiefly in the forearm, while the vascular and nervous trunks that supply it course along the entire upper extremity, so that diseases or injuries of any of these structures in any part of their course may result in morbid conditions seated in the hand.

Other conditions there are which affect this region exclusively or peculiarly, for physiological reasons that, though obscure or unknown to us, are yet real and operative. These may be regarded as idiopathic pathological factors and diseases of the hand, exemplified by Dupuytren's contraction.

Classification.—The affections of the hand and fingers include those that are peculiar to or affect this region exclusively; those that may occur elsewhere, but show a predilection for, or exhibit special features or modifications in, this locality; those conditions affecting the hands equally and indifferently with other parts of the body; and the manifestations, exhibited by the hand, of general disease. The conditions of most pertinence to the present subject are those more or less peculiar to the hand or those that exhibit special features in this locality.

It is not easy to formulate a completely satisfactory and logical classification of all the affections of the hand and fingers on any uniform basis. There are several grounds on which classification may be based, but no one of them alone in the present state of our knowledge is sufficient to afford a practical and adequate classification.

From one standpoint a division can be made, with reference to the manner in which the etiological factors are brought to bear, into conditions arising: from local causes, either external or internal; from extension (by continuity or contiguity) from neighboring structures that are affected; from causes (nutritive, toxic, metastatic) brought to bear through the medium of the circulation; or from impressions derived from the nervous system. The difficulty with a strictly etiological classification consists in the fact that identical pathological conditions may result from very different causes.

Another basis of classification of diseases of the hand rests upon their pathological nature, as parasitic and infectious conditions, neoplasms, traumatisms, senile conditions, etc. The adequacy of such a classification is impaired by our ignorance of the essential pathological nature of many obscure affections. Another division is to be found in the different regions, tissues, and anatomical structures involved, as the affections of the nails, the fascias, the skin, the ligaments, the joints, etc. This division applies well in many cases, but in those conditions in which more than one set of tissues or structures is involved a satisfactory arrangement would be difficult.

The considerations mentioned enable us to mark off some well-defined groups of diseases of the hand, while other morbid conditions are not easily susceptible of classification. The following arrangement of the diseases and deformities of the hand and fingers will be followed in this article:

Congenital and developmental anomalies:
- Acheiria.
- Ectrodactylism.
- Hypophalangism.
- Polycheiria.
- Polydactylism.
- Polyphalangism.

Syndactylism.
Cleft hand.
Congenital constrictions.
Deflections of the hand and fingers.
- Club-hand.
- Congenital deflections of the fingers.
- Lateral deflections of the fingers.
- Backward deflections of the fingers.

Microcheiria and microdactylism.
Hypertrophy of hand and fingers—cheiromegaly and dactylomegaly.
Neoplasms.
Cysts.
Traumatisms and injuries.
Inflammatory conditions.
Infectious and parasitic conditions.
- Suppurative and allied conditions.
- Tuberculosis.
- Syphilis.
- Other infections and parasites.

Necrotic conditions.
Ulcers.
Cicatricial contractions.
Acquired deformities.
Effects of occupation on the hand.
Affections of the nails.
Affections of the skin.
Affections of the bursæ.
Affections of the bones.
Affections of the joints.
Affections of the tendons and tendon sheaths.
Affections of connective-tissue structures:
- Dupuytren's contraction of the palmar fascia.
- Contraction of the digital fascia.
- Hammer finger.
- General palmar induration.

Trigger finger.
Circulatory disorders.
Muscular affections.
Nervous affections.
Senile changes.
Condition of the hand in general diseases.

Congenital and Developmental Anomalies.

The class of developmental anomalies in general should include all aberrations or faults of development manifesting themselves at any time during the period of development, including not only conditions arising in the prenatal period (as polydactylism), but also those that make their appearance in childhood and up to the time of maturity and complete physical development (as certain forms of hammer finger). In this section it is proposed to consider only certain congenital abnormalities of the hand which develop during the intra-uterine period of existence.

The anomalies of development under consideration embrace the following conditions:

1. Conditions in which there is a deficient degree of development, either (*a*) a deficiency in the *number* of the structural parts affected, or (*b*) a deficiency in their *size*. The congenital numerical deficiencies pertaining to the hand are: *acheiria*, in which the hand is lacking altogether; *ectrodactylism*, in which one or more fingers are missing; and *hypophalangism*, in which the number of phalanges in a digit is below the normal. The congenital deficiencies in size of the hand and fingers will be considered in connection with microcheiria and microdactylism.

2. Conditions in which there is an excessive development; either (*a*) an excess in the number of structural parts, *polycheiria*, *polydactylism*, and *polyphalangism*, or supernumerary hand, fingers, or phalanges respectively; or (*b*) a congenital excess in size, or hypertrophy, which will be considered in connection with cheiromegaly and dactylomegaly.

3. Conditions of perverted development (qualitative or morphological rather than quantitative); as syndactylism, the union of fingers; cleft hand; congenital constrictions; deflections of the hand and fingers (club hand, etc.); congenital dislocations; congenital neoplasms; and various unclassifiable deformities and conditions.

In many cases anomalies of the types mentioned exist separate and distinct; in many other cases anomalous conditions of different types are associated together and coexist in the same member, as where a supernumerary finger is of rudimentary structure, or a club-hand is ectrodactylous.

Subjects exhibiting congenital anomalies of the region under consideration, especially numerical deficiencies, often exhibit other developmental faults or abnormities in other parts of the body, as harelip or cleft palate, thus testifying to the existence of a deep-seated and general developmental vice. Such anomalies of the hand are especially associated with corresponding anomalies of the foot. In many cases hereditary transmission of the deformity is marked.

The causes of these congenital anomalies are obscure. They arise largely from deep-seated and innate tendencies to aberrant development, often hereditary. The aberrant tendency is sometimes very definite and fixed, precisely the same abnormity appearing in different generations. Some cases may perhaps be due to abnormalities of the early environment of the developing embryo.

Another class of causes that produce congenital deformities of the hand is to be found in intra-uterine traumatisms or other prenatal pathological processes. Thus, intra-uterine amputation may cause loss of the entire hand or parts of it; prenatal ulcerations may be followed by abnormal union or adhesions of parts, as in some cases of syndactylism; deformities may perhaps arise from cicatrization or from adhesions to other parts of the fœtus or afterbirth, or in other ways. Deformities caused by such prenatal morbid conditions are, of course, not real developmental aberrations; but as the results produced in the two ways are rarely distinguishable they may be considered together.

Maternal impressions during pregnancy are sometimes adduced in explanation of congenital anomalies of the hand (as elsewhere); as in the alleged case of an officer's wife, who after her husband lost his right hand gave birth to children exhibiting the same deformity. It is very doubtful if maternal impression really plays any part in the production of such deformities. Some alleged instances are coincidences; others are afterthoughts, a past incident being recalled after the birth of an affected child. Considering the difficulty that is found in demonstrating the hereditary transmission of acquired characters, it is obvious that to prove that a developing fœtus can be influenced by maternal impressions is a matter of far greater difficulty.

The use of the *x*-rays now affords means of investigating and diagnosing the precise condition of the bony

parts in these deformities that were lacking to the early observers.

Acheiria, or total congenital absence of the entire hand, occurs very rarely. It might arise either as a de-

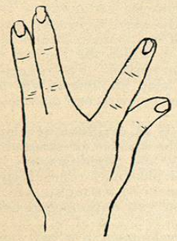

Fig. 2457.

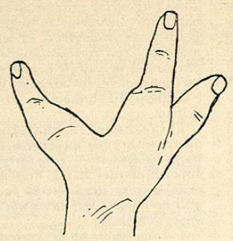

Fig. 2458.

Fig. 2459.

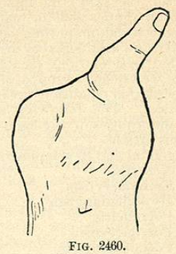

Fig. 2460.

Figs. 2457 to 2460.—Ectrodactylism.

Fig. 2457.—Congenital Absence of Middle Finger. (Fort.)
Fig. 2458.—Absence of Middle and Ring Fingers. (Clutton.)
Fig. 2459.—Absence of Index, Middle, and Ring Fingers—"pince de homard." (Annandale.)
Fig. 2460.—Absence of Four Digits. (Annandale.)

velopmental abnormity or from intra-uterine amputation. It would naturally occur in connection with a greater or less deficiency in development of the upper extremity, as when the limb is entirely wanting (ectromelia) or is partly wanting (hemimelia). When the upper extremity is only partly developed, it is more usual for a rudimentary hand, or one or more fingers rudimentary or well developed, to be present on the stump than for all trace of a hand to be absent. Typical acheiria may, however, occur, as in a case reported by James Finlayson (*Archives of Pediatrics*, Philadelphia, 1890, vol. vii., p. 674).

Phocomelus is the rare condition in which the hand (or foot) is attached directly to the trunk, like the flipper of a seal, the upper (or lower) extremity uniting it to the body being absent or extremely abbreviated.

Ectrodactylism consists in the congenital absence of one or more fingers (or toes), resulting either from defective development or intra-uterine amputation. It is one of the less common forms of congenital abnormity of the hand, occurring considerably less frequently than polydactylism or syndactylism. In the cases that do occur

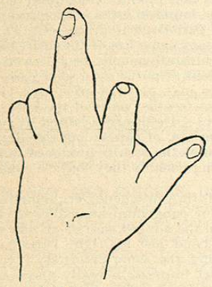

Fig. 2461.

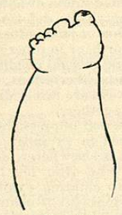

Fig. 2462.

Figs. 2461 and 2462.—Hypophalangism. (Annandale.)

Fig. 2461.—Absence of Distal Phalanges of Three Fingers.
Fig. 2462.—Absence of all the Phalanges of all the Fingers.

both hands are usually affected simultaneously; less commonly either hand may be affected alone. Other deformities of the hand or upper extremity, or of the foot or other parts of the body, are apt to coexist with ectrodactyly. The finger involved may alone be wanting, the corresponding metacarpal bone being present; or the metacarpal bone may also be lacking; even the corresponding portion of the carpal bones is sometimes wanting. Owing to the association of other deformities and abnormal conditions the fingers present may be useful and functional, or not. The influence of heredity in reported cases is well marked. Some cases of apparent ectrodactylism may arise from intimate union of two digits.

Any of the fingers, and from one to four in number, may be lacking. The particular fingers that may be involved, and the extent to which the metacarpus and carpus may be affected, give rise to an indefinite number of possible combinations that may occur. There are two or three particular conditions that occur with such comparative frequency, however, that they may be specially mentioned.

In a considerable proportion of cases the thumb alone is missing. This occurs especially in association with congenital absence or deficiency of the radius. Non-development or partial development of the radius is in nearly all cases accompanied by absence of the thumb, its metacarpus, and one or more of the corresponding carpal bones (Figs. 2475, 2476, 2477). In the case of absence of radius illustrated in Fig. 2477, there is a rudimentary thumb present, but articulated to the head of the metacarpal bone of the index finger.

It is rare for any of the digits other than the thumb to be lacking alone, it being more common for two or three fingers to be absent than one of them only.

One of the common forms of ectrodactylism consists in the absence of the index, middle, and ring fingers. This leaves the thumb and little finger, often opposed to each other, somewhat like the jaws of pincers; the term "pince de homard" (lobster claw) has been applied to this particular condition (Fig. 2459).

Little can be done in the way of treatment to improve ectrodactylism, unless by amputation or other operation an unsightly deformity may be removed or some impediment to function obviated.

Hypophalangism is the congenital absence of one or more phalanges and the corresponding soft parts from a digit. It is an abnormity of somewhat similar character to ectrodactylism, the deficiency being less in degree. In hypophalangism either one, two, or all three phalanges may be lacking, the finger in the cases in which all three phalanges are missing (Fig. 2462) being represented simply by a rudimentary nodule of soft tissue perhaps surmounted by a nail. When all traces of the hard and soft tissues of the finger are lacking, the condition becomes one of ectrodactylism. Hypophalangism is a very rare deformity, and may occur in association with polydactylism or ectrodactylism, supernumerary fingers being

often only partially developed. The condition is one form of brachydactylism or short finger.

Congenital anonychia or absence of the nails will be spoken of in connection with the affections of the nails.

Polycheiria, or *supernumerary hand* (double hand, dicheiria, also called, not very aptly, bifurcated, or bifid, hand). The development of a supernumerary hand, in addition to the normal hand, is a conceivable condition, but is exceedingly rare. A very few cases are on record which may be classified as double hand, though such cases merge into polydactylic conditions. In these cases the double hands each possessed from eight to twelve fingers in all; the two hands, which were not normally developed, were either united more or less along the adjacent sides, or the two parts were separated by a bifurcation extending to the carpus. Each hand had its own set of muscles and tendons, so that the two parts could close over and grasp each other; this feature is a distinguishing characteristic between double hand and simple polydactylism. The only treatment called for is the removal of useless or unsightly digits to improve the appearance or function of the member.

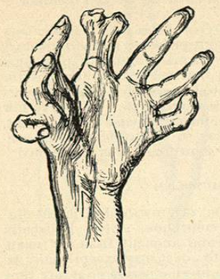

Fig. 2463.—Double Hand. (Clutton.)

Polydactylism, or *supernumerary finger* (or toe), is the presence on the hand or foot of more than the normal number of digits. The supernumerary fingers vary in the degree of their development from those that are rudimentary to those that are quite perfect and well developed. This is one of the commoner of the developmental anomalies of the hand. More often there is only one supernumerary finger, but a greater number may be present. One case is recorded in which the subject possessed thirteen fingers on each hand and twelve toes on each foot; another case had twelve fingers on each hand; several cases of ten fingers on the hand have been observed and from that number down the cases become more numerous. It is more usual for both hands to be affected together than for one hand to be involved alone, and the feet are apt to exhibit a corresponding abnormality.

Syndactylism is sometimes associated with polydactylism. Hereditary transmission has been observed in numerous cases. The cause of the anomaly evidently rests in an innate aberrant developmental tendency.

All the parts that enter into the structure of normal fingers may also be present to a greater or less degree in supernumerary digits, bones, joints, tendinous and muscular attachments, nails, etc. The most perfectly developed supernumerary fingers are as complete and mobile and useful in all respects as the ordinary fingers; from this perfectness the degree of development ranges down to rudimentary structures which are distinguishable from congenital tumors only by the presence of bony or cartilaginous tissue or a rudimentary nail. The muscular connection and the movability and functional value also range from a good degree of usefulness down to immovable and useless digits.

There is an indefinite variety in the possible forms and combinations in which the deformity may be manifested.

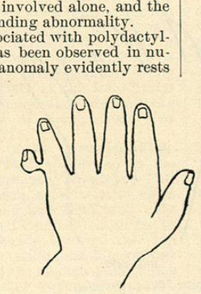

Fig. 2464.

Fig. 2465.

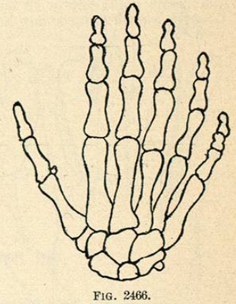

Fig. 2466.

Fig. 2464, 2465, and 2466.—Polydactylism. (Annandale.)

Thomas Annandale's classification, which seems as satisfactory as any proposed, is as follows:

1. Cases in which the supernumerary digit is a rudimentary and deficient structure attached to the hand or another digit by soft tissues or a narrow pedicle and without any articulation (Fig. 2464). The most rudimentary of this class of supernumerary finger may practically amount simply to a tumor, the digital nature of which is shown only by the presence of bony tissue in its interior or a rudimentary nail. Supernumerary digits of this kind are usually situated on the ulnar side of the hand or little finger, but they occasionally occur on the radial side or any other portion of the hand. These digits usually have very little mobility or functional action.

2. Cases in which the supernumerary digit, more or less well developed and free in its distal portion, is given off from and articulates with the side or head of a metacarpal or phalangeal bone belonging to a normal digit, or common to the two digits (Fig. 2465). Some of these cases appear as if a finger were bifurcated, the two divisions being nearly equal and symmetrical: in other cases one of the digits from its less development or asymmetrical position is evidently supernumerary. Often the extra digit is not very movable or useful, but sometimes it has good functional power.

The supernumerary digit may articulate with (*a*) the side of the metacarpal or phalangeal bone common to it and the normal finger, in which case it has its own articular and synovial structure entirely distinct from the corresponding articulation of the normal finger; or it may articulate with (*b*) the head of the common metacarpal bone or phalanx. In the latter case there may be two separate articulations, with separate joint cavities, or there may be only one synovial cavity common to the articulations of the two digits. Sometimes the metacarpal or phalangeal bone to which the two digits are attached bifurcates and has a separate articulation on each of the two heads. It is important to bear in mind the nature of the articulation in amputating in these cases.

The thumb is not uncommonly the seat of this form of polydactylism, being either bifurcated (Fig 2465) or giving off a supernumerary thumb from its side.

3. Cases in which the supernumerary finger is a practically perfect and fully developed digit, complete in itself in all its parts, and distinct from the other fingers, having its own phalanges, metacarpal bone, and attachment to the carpus (Fig. 2466). Such fingers are usually as useful and good as the normal fingers. Some cases of double hand may be partly regarded as instances of this form of polydactylism. Supernumerary fingers in rare instances are associated with a corresponding excess of development in the forearm, as with a supernumerary radius.

4. Cases in which the supernumerary digit is intimately

united along its whole length to the normal digit—that is, a combination of syndactylism with polydactylism. The supernumerary digit may be more or less well developed, having separate metacarpal and phalangeal bones of its own, or possessing only phalanges which are articulated to the metacarpal bone or a phalangeal bone common to it and the normal digit. Such a double finger is broad and is apt to possess two nails. The thumb is said to be oftenest affected in this manner.

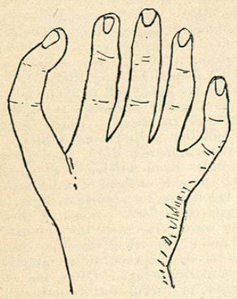

FIG. 2467.—Polyphalangism, the Thumb Possessing a Supernumerary Phalanx. (Annandale.)

The treatment of polydactylism consists in amputation of the supernumerary digits, for the purpose of improving the appearance of the hand or removing useless structures that may be an actual impediment to the function of the hand or impair its proper development. As a supernumerary digit tends to retard and impair the development of the normal finger to which it may be attached, amputation should be performed as early in life as is practicable and convenient. In some instances there has been observed a tendency for new rudimentary digits to grow out from the stumps of amputated supernumerary fingers.

In considering and practising amputation, however, careful attention must be paid to the danger and consequences of injuring a joint of one of the normal fingers and thus causing an ankylosed and stiffened digit that may be worse than the original polydactylic condition. When the supernumerary finger is connected by soft tissues only, or has its own distinct and separate articulation and joint cavity, the operation is simple and void of evil consequences if properly carried out so as not to interfere with other joints. But in those cases in which the extra digit has an articulation in common with the normal digit or articulates with the common carpal joint, it must be remembered that the process of disarticulation will necessarily cause an opening to be made into the joint of the finger that is to be left, thereby rending it extremely liable to ankylosis. In such cases it may be preferable to amputate by cutting through the base of the bone near the joint, but without opening the joint itself. This will necessitate leaving a small portion of the proximal end of the supernumerary digit, but any slight deformity thus occasioned may be preferable to the impairment of function that will be caused by a stiffened finger. In such cases the use of the *x*-rays prior to operation may afford valuable information as to the precise relations of the articulations.

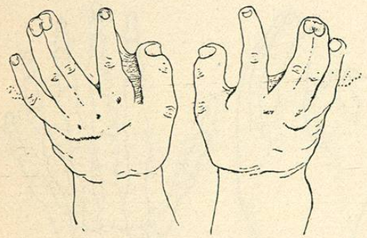

FIG. 2468.

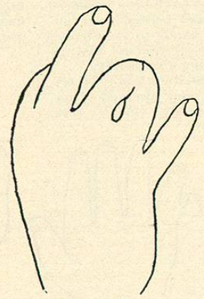

FIG. 2469.

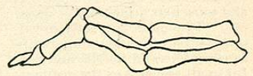

FIG. 2470.

FIGS. 2468 TO 2470.—SYNDACTYLISM.

FIG. 2468.—Syndactylism. (Clarke.) The dotted lines represent amputated supernumerary fingers.
FIG. 2469.—Union of Distal Portions of Fingers. (Annandale, after Otto.)
FIG. 2470.—Fusion of Distal Phalanges. (Annandale, after Otto.)

POLYPHALANGISM (or "hyperphalangism") is the very rare condition in which a digit possesses a supernumerary phalanx, or more than the normal number of phalanges (Fig. 2467). In the cases that occur the thumb is the digit oftenest affected, though cases involving the index and middle fingers have been observed. In a very few instances in which a supernumerary phalanx was present, the phalanges generally were so shortened that the condition of brachydactyly or short finger was manifested.

SYNDACTYLISM

consists in the union, fusion, or growth of adjacent digits to each other by their contiguous sides. It usually arises as a true developmental anomaly from an innate aberrant tendency of growth; or it may exceptionally be acquired, either in the intra-uterine period or at any time during life, from the adhesion or growth together of ulcerated digital surfaces or from cicatricial contractions. The site of union may extend the entire length of the fingers; or it may involve only the proximal portion of the fingers, to a varying extent, leaving the distal portions free and separate; or, rarely (probably from the union of ulcerated surfaces), the distal portions of the fingers may be united and the proximal portions separate (Fig. 2469). The union may consist of a thin fold or web of skin stretching across, between, and connecting the two fingers, the true "webbed fingers"; or the connection may be more intimate, involving more or less of the subcutaneous and internal tissues of the fingers, ranging up to cases in which even the bones are united. Cases have been observed in which the distal phalangeal bones were fused together, while the proximal phalanges were separate (Fig. 2470). Two fingers alone may be united, or three, or four, may be connected together; rarely all the digits are bound together in an unshapely deformed mass. The index and middle fingers are not uncommonly united.

Syndactylism is not a very uncommon condition, and is one of the most frequently observed developmental anomalies of the hand. In the true congenital or developmental form of syndactylism, hereditary transmission is often observed, and both the hands are frequently involved together, though the fingers affected may be different on the two sides. The hands and feet are often involved simultaneously. In acquired syndactylism heredity is of course not observable, and only one hand would ordinarily be affected.

Treatment.—The only treatment of this condition is operative. The best age for operating is usually stated as from four to six years, when the fingers are of sufficient size for easy management and control, and before

growth is materially interfered with by the deformity. In most cases it is easy enough to effect a separation between the digits, but to prevent the raw surfaces from growing together or to obviate a recurrence of the deformity from cicatricial contraction, is often a matter of some difficulty and requires special plastic surgical measures. It is necessary to pay special attention to the denuded surface in the interdigital angle.

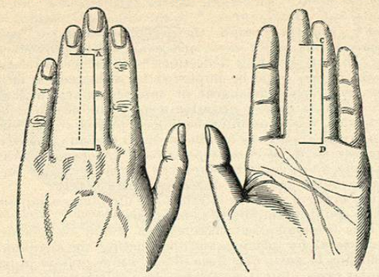

FIG. 2471.—Didot's Operation for Syndactylism, Dorsal and Palmar Views, Showing Primary Incisions. (After Stedman.)

When the web is broad and thin successful and permanent separation of the united digits may be obtainable by the simple method of cutting the web in two longitudinally down its middle line, and suturing the edges of the incised skin together over each finger. The edges of the wound in the interdigital angle should especially be brought together and sutured. The fingers should, as in all operations for syndactylism, be dressed separately, so as to keep the wounded surfaces apart until healing is complete. Recurrence may, however, follow this procedure.

In some cases, especially when the union is very close, as the preliminary step in treatment an opening may be made through the tissues connecting the digits at the proximal end of the contemplated separation. In this opening a glass or metal tube, wire, or a bundle of silkworm gut is kept until the sides of the hole heal over and become completely lined with epithelium. When this is well accomplished the fingers are cut apart for the remainder of the distance, and the edges of the wounds are approximated and sutured in the best manner practicable. The preliminary establishment of a healed surface at the interdigital angle or commissure prevents the recurrence of union from that point.

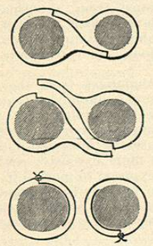

FIG. 2472.—Didot's Operation for Syndactylism, in Cross Section, Showing Method of Dissecting Off and Suturing the Flaps. (After Stedman.)

Didot's plastic operation (Figs. 2471 and 2472) appears to be the most frequently employed for syndactylism, especially for cases with a long and thick web. By this method longitudinal incisions are first made through the skin along the middorsal line of one finger and the median palmar line of the other finger (Fig. 2471). Beginning at these incisions rectangular flaps are then dissected off, and the tissues uniting the two fingers are cut through so that one of the digits has a flap adhering to its dorsal surface and the other a flap adhering to its palmar surface. Each flap is then brought around the finger to which it is attached and its margin sutured neatly to the edge of the skin so as to cover the surface denuded by dissecting off the flaps. The method of forming the flaps and of suturing them in their new positions is graphically illustrated in Fig. 2472. This procedure keeps the healing surfaces well separated, and thus obviates readherence. It is probable that flaps

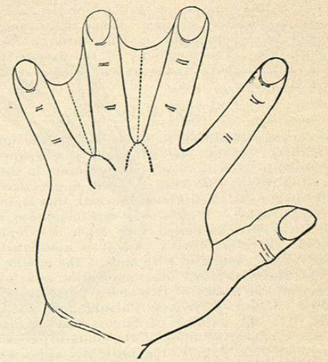

FIG. 2473.—Norton's Operation for Syndactylism. (From Bradford and Lovett.)

should also be drawn together and sutured in some such manner as is employed in Norton's operation in order to close and cover the raw surface in the interdigital angle. From the stretching of the flaps sometimes necessitated there may at times be some tendency to sloughing of the tissues; but in general the results of Didot's operation are very satisfactory and successful.

Norton's operation (Fig. 2473), which is recommended for cases in which there is a short but ample web, consists in the formation of horseshoe-shaped flaps, dorsal and palmar, which are stretched and sutured together so as to cover the interdigital angle. The web is divided lengthwise, and the divided edges are brought together along each finger.

Zeller's operation (Fig. 2474), which is recommended for cases similar to those for which Norton's is employed, consists in the formation of a triangular dorsal flap, which after section of the web is brought into the interdigital angle and sutured in place. Agnew's operation is similar to Zeller's.

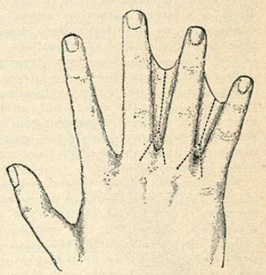

FIG. 2474.—Zeller's Operation for Syndactylism, Showing Lines of Incision and Outlines of Flaps (which are not shown sufficiently long). (Treves.)

Fowler's operation (Dennis' "System of Surgery," vol. ii., p. 186) is recommended for obstinate and intractable cases. In this procedure a preliminary longitudinal opening or slit is made through the web between the proximal ends of the proximal phalanges, at the site of the future interdigital angle. From the dorsum of the hand two long narrow flaps are then cut, one on each side of this opening and with their attached bases near the slit. The flaps are then twisted around a quarter of a circle and drawn through the slit so that the skin surfaces of the flap are opposed to each other and their de-

nuded surfaces are brought in contact with the raw surfaces of the slit, with which they are designed to become united. The flaps should be long enough to project through the palmar aspect of the slit about a centimetre, and they do not require to be sutured in place. The areas left by the removal of the flaps on the back of the hand can be closed by sutures. When the wounds heal, there will be a permanent opening through the web, lined with skin. The remainder of the web is then divided, and the healed commissure will prevent recurrence of the mal-union.

Cleft Hand.

The contrary condition to syndactylism, the union of parts normally separate, is cleft hand, or a separation of parts normally united. Cleft hand consists in the separation of, or division between, adjacent fingers extending farther toward the carpus than normal, that is, into the metacarpal region. It is a very rare condition, and is almost invariably associated with other developmental anomalies. In nearly every case it is associated with ectrodactylism, especially with lack of the middle finger (see Figs. 2457 and 2458); other anomalies, as syndactylism, may also be present. In a case reported by Charles N. Dowd (*Annals of Surgery*, Philadelphia, vol. xxiv., 1896, p. 211), the number of fingers was normal, but there was syndactylic union of the metacarpal bones of the ring and little fingers; the unsightly appearance of this case was relieved by a plastic operation. This condition should not be confounded with dicheiria, to which the term "bifid hand" is often rather inappropriately applied.

Congenital Constrictions.

Congenital annular constrictions of the fingers, as well as of other portions of the extremities, have been observed, but are very rare. They are apparently produced by tight turns of the umbilical cord or of amniotic bands around the members, constricting the tissues; they are hence produced in the same manner as are intra-uterine amputations but with the constriction not carried to a sufficient degree to cause complete amputation.

Deflections of the Hand and Fingers.

A large proportion of the deformities of the hand consists of deflections or deviations of the hand, fingers, or phalanges from their normal direction or position. The deflection may be in a forward or palmar direction (that of flexion), a backward or dorsal direction (superextension), or a lateral direction (either to the radial or to the ulnar side), or in intermediate directions. These deviations are often called contractions; but this designation is not very satisfactory as a general term, since all the deflections are not due to a contraction or pull.

The point of deflection is in almost all cases at one of the joints, either the wrist joint, or the metacarpo-phalangeal joints, or the interphalangeal joints. Occasionally the deflection may arise in the course of the bones, as in mal-union at an angle after fracture, or curvature of the bones in osteomalacia.

No complete and systematic classification and nomenclature for these deflections have been formulated. Deflections of the hand at the wrist joint in the different directions, especially the congenital cases, have been called "club hand," after the analogy of club foot. No such designations as club finger or club phalanx have been employed, though such terms or their equivalents would be useful. The term "clinodactyly" has been employed as a generic designation for deflections of the fingers (Fort), but has not come into general use.

Using as a basis the situation and the direction of the deflection, the following scheme for the anatomical classification and nomenclature of the various deflections of the hand and fingers is proposed and will be used here:

Deflections of the hand at the wrist joint—"club hand"; forward deviations, *manus flexus;* backward deviations, *manus superextensus;* deflection to the radial side, *manus varus;* deflection to the ulnar side, *manus valgus.*

Deflections of the fingers—"clinodactyly": forward, *digitus flexus;* backward, *digitus superextensus;* to the radial side, *digitus varus;** to the ulnar side, *digitus valgus.** For the thumb, the terms *pollex flexus, pollex superextensus, pollex varus,* and *pollex valgus* can be used for the corresponding deflections. These terms relating to the fingers could be employed for deflections at either the metacarpo-phalangeal or interphalangeal articulations; but if greater precision were desirable where the deviation was at an interphalangeal joint and the bending involved only the middle or distal phalanx, the terms *phalanx flexa, phalanx superextensa, phalanx vara,* and *phalanx valga* could be employed for the forward, backward, radial, and ulnar deflections respectively.

For deflections in the intermediate directions compound terms could be employed as in talipes.

This terminological classification would be practical and useful for placing and designating the anatomical condition or particular form of deviation present in particular cases; but it would not be a satisfactory classification from an etiological or pathological standpoint or for clinical purposes, since different deflections may be produced by the same cause, or the same deflection may arise from different causes. In most cases the deflections are simple and distinct enough to permit of ready classification.

Deflections of the hand or fingers may be congenital, arising from developmental anomalies, or acquired. They occur in connection with a considerable variety of etiological and pathological conditions, which may be briefly summarized as follows:

Dermatogenous deflections, in which the deformity is produced by lesions of the skin, as scleroderma.

Desmogenous deflections, produced by lesions of connective-tissue structures, fascias, ligaments, etc., as cicatricial contractions, Dupuytren's contraction of the palmar fascia, hammer finger, contraction of the digital fascia.

Arthrogenous deflections, produced by lesions of the articulations, as arthritis of various forms (gouty, rheumatic, rheumatoid, tuberculous, etc.), dislocations, altered configuration of joints (developmental, senile, inflammatory), ankylosis in malposition.

Osteogenous deflections, from lesions in the bones, mal-union after fracture, osteomalacia, abnormal development.

Tendinous deflections, from injuries, division, or adhesions of tendons.

Muscular or myopathic deflections, from abnormal muscular conditions, as abnormal development, myositis, atrophies, ischæmic paralysis, and abnormal innervation.

Nervous or neuropathic deflections, from paralytic, spastic, or trophic conditions.

Deflections of the fingers and phalanges from their normal position and direction are much commoner than are deflections of the hand at the wrist joint, partly because the small digital articulations are more subject to arthritic conditions, partly because the muscular and motor mechanism of the fingers is more extensive and more complicated, and hence more exposed to morbid influences. Of the deflections of the fingers the forward deviations are much the commonest and most varied as to cause, while the lateral and backward deviations are much less frequent.

As there is so great a diversity in the etiological and pathological nature of these deflections, it is more satisfactory to treat the different varieties in connection with the various pathological conditions with which they are associated than to consider all the hand and finger deflections in one general group. Consequently at this point consideration will be given only to club hand, congenital deflections of the fingers, lateral deflections of the fingers, and backward deflections of the fingers, reserving the remaining forms of deviation for treatment in their appropriate connections.

* These designations are as proposed by Joachimstal.

Club Hand.—This term in its most general sense could be applied to all deflections of the hand at the wrist joint, congenital or acquired, but as ordinarily used it is chiefly employed to designate only the congenital forms of the deformity.

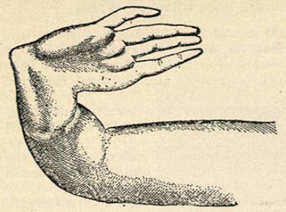

Fig. 2475.—Congenital Club Hand, with Absence of Radius and Thumb. (Hoffa.)

The cases of congenital club hand, which is a rare condition, may be divided into some three classes, as follows:

1. The first class comprises those cases depending on contractions and altered anatomical conditions of the carpal structures in a manner entirely analogous to congenital club foot. This form of congenital club hand is exceedingly rare, as the hand is very little subject to the developmental anomalies and intra-uterine conditions that give rise to talipes.

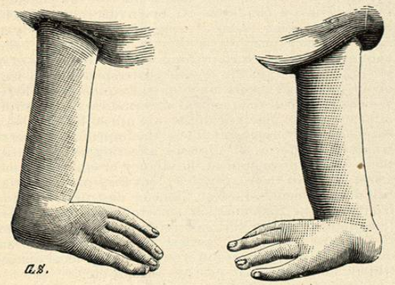

Fig. 2476.—Congenital Club Hand, with Deficiency of Radius, Dorsal View.

2. Of the rare cases of congenital club hand that do occur, the largest proportion consist of anomalies associated with developmental deficiency or absence of the radius. This and the following class of deformities are caused by conditions quite different from those that give rise to ordinary talipes; the term club hand is, however, generally extended to the cases associated with defective development of the bones of the forearm. In this form of club hand the radius is either totally absent or only partially developed, the distal extremity being deficient in the latter case. The hand is articulated on the lateral aspect of the ulna in the position of manus varus (Figs. 2477, 2478) at a considerable and even a right angle to its normal situation. The thumb and corresponding carpal bones are usually lacking, though exceptionally present, as in Fig. 2477, in a rudimentary condition and transposed situation.

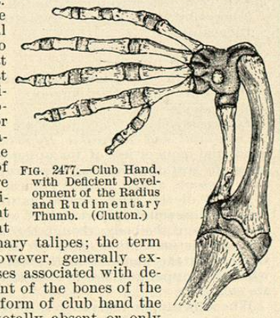

Fig. 2477.—Club Hand, with Deficient Development of the Radius and Rudimentary Thumb. (Clutton.)

3. Much more rarely than the radius, the ulna is absent or defective, giving rise to an abnormal position and ectrodactylous condition of the hand corresponding to the radial deformity.

The treatment of congenital club hand, if undertaken sufficiently early in life while the joint structures are pliable and adaptable, consists of gradual correction of the deformed position with maintenance of the hand in the improved position until permanent results are attained. Violent and abrupt measures are not generally desirable, but the correction should be accomplished by gradual steps, apparatus (Fig. 2479), splints, or plaster-of-Paris dressings being employed in the intervals to maintain and render permanent each step gained. Massage and electricity may be useful to improve the nutrition of the muscles of the forearm.

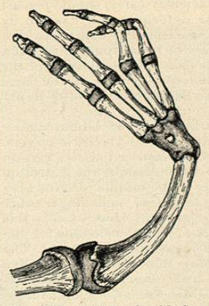

Fig. 2478.—Club Hand, with Congenital Absence of Radius and Thumb. (Clutton.) From same case as that illustrated in Fig. 2477.

In older patients the joint is apt to become so fixed that attempts at correction of the deformity may result in impairing the usefulness of a hand, which, though deformed and unsightly, still has good functional power and is a useful member. Treatment in such cases should be very conservative, and utility should not be sacrificed for the sake of appearance.

Congenital and Developmental Deflections of the Fingers.—Congenital deflections of the fingers are rare, while the acquired deviations are common. The common form of hammer finger is a developmental anomaly scarcely manifest at birth but gradually appearing during the period of development. Tamplin reported an instance of congenital contraction of the thumb in a flexed and adducted position, in a case of double talipes and contraction of the knee. Congenital deflections of the digits or phalanges are most commonly in a lateral direction.

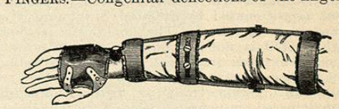

Fig. 2479.—Apparatus for Treatment of Club Hand. (After Dubreuil.) At the wrist is a universal joint to allow for movement and fixation in various positions.

Lateral Deflections of the Fingers or Phalanges may be congenital and developmental, or acquired. The acquired forms arise chiefly from cicatricial contractions, joint changes (especially arthritis deformans), dislocations, injuries, ankylosis in malposition, senile changes, or in association with hypertrophied fingers. Of these a general deviation of the four ulnar fingers toward the ulnar side is a com-

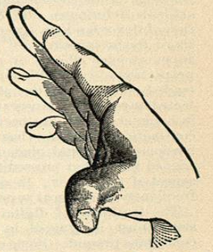

Fig. 2480.—Congenital Radial Deflection of Distal Phalanx of Thumb. (Gross.)