viz., the anterior thoracic. The muscle is regarded by Sir William Turner, Dr. Dobson, and others as a remnant of a skin muscle. Henle, Theile, Bourrienne, and others look upon it as a prolongation downward of the sterno-mastoid. Halbertsma thought it a muscle *sui generis* peculiar to man, and having no animal representative. D. J. Cunningham thinks it a new inspiratory muscle appearing in man, and is of opinion that

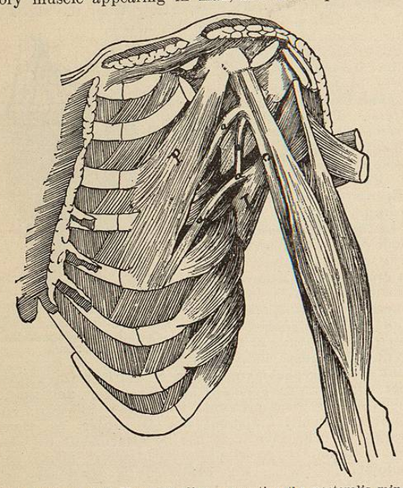

FIG. 3446.—*a*, *a*, *a*, Muscular slips connecting the pectoralis minor (*P*) with the coracobrachialis (*C*) and the latissimus dorsi (*L*). (Shepherd.)

it occurs more commonly in females, costal inspiration being more pronounced in them. In dissections of anencephalous monsters made by the writer the nerve supply was traced, in nearly all the specimens examined, to the anterior thoracic. These dissections convinced him that this muscle belongs to the pectoral and not the panniculus group (see *Jour. Anat. and Phys.*, vol. xix.).

Pectoralis Minor. The origin of this muscle varies considerably. It may arise from the second, third, and fourth ribs, instead of the third, fourth, and fifth. Not infrequently it arises from four ribs, and the writer has occasionally seen it arise by five digitations from the five upper ribs. It has been described as attached to only two ribs, and Testut, in his work on "Muscular Anomalies," describes a case in which it arose by a single digitation from the fourth rib; in this case the subclavius muscle was of large size. Sometimes the pectoralis minor is divided into a number of slips corresponding with the ribs from which it arises. It is occasionally connected with the great pectoral. In one case the writer saw it connected by muscular slips with the latissimus dorsi and coracobrachialis, and these two slips were connected together by a third (see Fig. 3446).

The variations of insertion of the pectoralis minor are numerous. The muscle not infrequently passes over the coracoid process and is inserted into the capsule of the shoulder-joint and great tuberosity of the humerus. It very frequently is united at its insertion to the coracobrachialis. In one case the writer saw it inserted into the coracobrachialis by a tendinous expansion, 5 cm. broad; in this case the coracoid process received no fibres of insertion. In many of the carnivora and quadrumana this muscle is normally inserted into the humerus. In rare cases the pectoralis minor is divided into two layers which have distinct insertions, and sometimes it is absent.

Pectoralis Minimus. Gruber has described a slip, to which he gives the above name, arising from the first piece of the sternum and cartilage of the first rib; from this origin it passes outward between the subclavius and lesser pectoral to be inserted into the coracoid process. Some regard it as a variety of the chondro-scapular muscle of Wood.

Subclavius. The subclavius is not infrequently inserted into the coracoid process as well as the clavicle; occasionally it has no clavicular attachment, but is wholly inserted into the root of the coracoid process. It has been described as double by some anatomists, but the supernumerary muscle will be described below as the sterno-scapular. Walsham describes a case in which the subclavius had an insertion into the humerus, as is normally seen in birds. The subclavius is sometimes absent, its place being taken by the sterno-scapular.

Sterno-chondro-scapular (Wood). Syn.: Scapulocostalis minor (Macalister), subclavius posticus (Rosenmüller). This is a supernumerary muscle of a somewhat cylindrical shape, which is attached externally to the root of the coracoid process or upper border of the scapula, passes inward over the subclavian artery and brachial plexus of nerves, beneath the clavicle and subclavius muscle, to be attached by a round tendon to the costal cartilage of the first rib, first piece of the sternum, or both (see Fig. 3447).

Sometimes this muscle passes over the clavicle in place of beneath it, and occasionally it does not reach as far as the coracoid, but may be inserted into the anterior

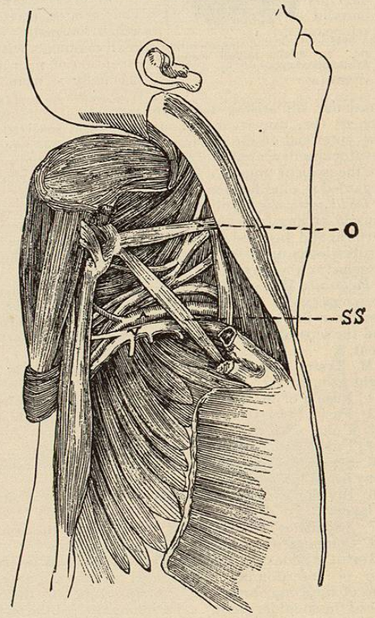

FIG. 3447.—*SS*, sterno-scapular muscle; *O*, omo-hyoid. (Wood.)

border of the clavicle (sterno-clavicular anterior). A variety of the sterno-clavicular muscle which the writer has seen is one which reaches from the sterno-clavicular articulation to the anterior border of the trapezius. In its course it passes over the clavicle and across the subclavian triangle, covering the third portion of the subclavian artery (see Trapezius). In ligature of the subclavian it is

well to bear this anomaly in mind. When the sterno-scapular muscle exists there is sometimes absence of the subclavius muscle; the writer has seen this occur once only out of seven cases; in three cases, however, the subclavius was much reduced in size. W. Gruber saw absence of the subclavius in seven out of eleven cases of sterno-scapular muscle.

Comparative anatomy: In the Norway rat, guinea-pig, wombat, etc., the sterno-scapular muscle is normally present. In the horse it is a well-developed muscle. In animals without clavicles having a sterno-scapular muscle it is regarded as the homologue of the subclavius.

Chondro-coracoid is a small muscle described by Wood as arising from the first costal cartilage by a round tendon, and, passing outward below the subclavius, is inserted into the coracoid process superficial to the coracobrachialis.

Many other supernumerary clavicular muscles have been described, such as the scapulo-clavicular, coracoclavicular, supraclavicular, infraclavicular, etc., but they are so rare that it is only necessary to mention them and refer readers wishing to learn more about them to the special works on muscular anomalies mentioned in the introduction to this article.

Serratus Magnus. The serratus magnus may arise from nine ribs instead of eight, and occasionally it receives a slip from the tenth. Again, some of the highest or lowest digitations may be wanting, the muscle thus being attached to only six or seven ribs. Occasionally some of the central digitations are absent, and the muscle is then divided into two portions. Wood has described two large muscular bands, distinct from the serratus, arising from the ninth and tenth ribs, and inserted into the inferior angle of the scapula. He regards these bands as homologues of the depressor scapulæ of birds. Sometimes there is more or less complete fusion of the serratus with the levator anguli scapulæ. In many mammals it forms one muscle with the levator.

MUSCLES OF THE SHOULDER.—*Deltoid.* This muscle is not subject to many variations. It is sometimes divided into several distinct portions, viz., the clavicular, acromial, and spinal, as in carnivora. The clavicular and acromial portions are often separated by an interspace; not infrequently the clavicular portion is intimately connected with the contiguous part of the great pectoral, the division between them being determined only by the cephalic vein. The clavicular portion may also, in some cases, be continuous with the fibres of the trapezius, as in animals without clavicles.

The insertion of the deltoid varies in position and extent; in some cases it is inserted much lower than usual. Macalister has described a rare anomaly of this muscle, viz., the prolongation of its tendon as far as the lower end of the radius; he considers this to be the homologue of the extensor plicæ alaris of birds.

Testut has described a slip going from the clavicular portion of the deltoid to the internal condyle, crossing in its course the brachial vessels; he calls it the *cleido-epitrochlearis*. The deltoid not infrequently receives accessory slips from the axillary or vertebral borders of the scapula, and also from the spine and subspinous aponeurosis.

Supraspinatus. Variations of this muscle are extremely rare. It is very constant both as to its size and attachments. Occasionally fibres of the great pectoral are inserted into it. The writer once saw its tendon pass over the capsule of the shoulder-joint in a pulley-like depression, and become continuous with the deep portion of the insertion of the pectoralis major (see Fig. 3448).

Infraspinatus is occasionally fused with the teres minor. It may be connected with the deltoid by a strong fasciculus, and, again, it may be divided into several slips.

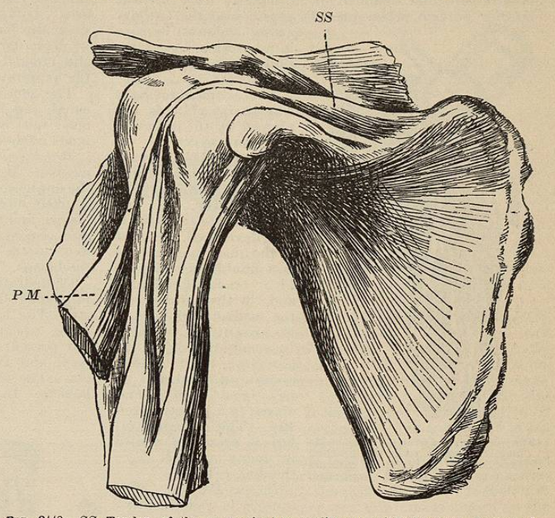

FIG. 3448.—*SS*, Tendon of the supraspinatus, continuous with the deep portion of the tendon of the pectoralis major (*PM*). (Shepherd.)

Teres minor is occasionally divided into two portions, the lower being called the teres minimus.

Teres major may be reduced to the size of the teres minor. It is sometimes inseparably connected with the latissimus dorsi, as in some of the lower animals. A fasciculus has been described descending on the fascia of the arm externally. It is analogous to the tensor fasciæ of the leg.

Subscapularis. Varies but little. A small accessory muscle (subscapulocapsularis, subscapularis minor) has been described by W. Gruber, Macalister, and others, which goes from the axillary border of the scapula to the capsule of the shoulder-joint or humerus. Knott describes some fibres given off from the lower border of the subscapularis and inserted into the aponeurosis and skin of the axilla. These are regarded as remnants of the panniculus carnosus muscle of the lower animals.

Curnow, Walsham, and others have described a muscle arising from the inner bicipital ridge, or the groove itself, and passing up to be inserted into the capsule of the shoulder-joint near the insertion of the coracobrachialis. Testut describes this muscle under the name of *brachiocapsularis*.

Coraco-brachialis. Professor Wood (*Jour. of Anat.*, vol. i.) considers that this muscle consists typically of three portions—superior, middle, and inferior. In man the middle and part of the inferior portion exist most constantly, the two portions being separated by the musculo-cutaneous nerve. Both the superior and inferior divisions are, however, occasionally seen in addition to the middle division (*coracobrachialis proprius*. The superior (*coracobrachialis superior vel brevis*), when it exists in man, arises from the coracoid process, passes over the subscapularis muscle, and is inserted below the lesser tuberosity, or more rarely into the capsule of the shoulder-joint (*coracocapsularis*). This is the normal arrangement in many animals, as the dog, cat, etc.

The inferior division (*coracobrachialis longus*) is also occasionally seen. It may be of large size and be in-

serted into the internal condyle or into a supracondyloid process when that anomaly exists. It is sometimes represented at its lower portion by a fibrous band; this is the internal brachial ligament of Struthers. As a rule, the inferior portion, when present, passes over the axillary artery, and must be kept in mind when ligaturing that vessel (see Fig. 3449).

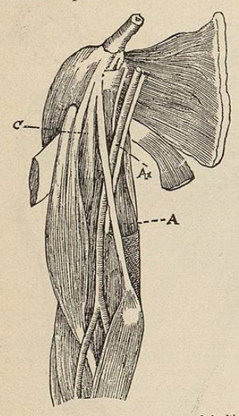

FIG. 3449.—*A*, Coracobrachialis longus passing over the brachial vessels (*Ax*) to reach the internal condyle; *C*, normal coracobrachialis. (After Wood.)

The coracobrachialis occasionally is not pierced by the musculocutaneous nerve.

Comparative Anatomy: In animals which swim or climb, as the beaver, bear, etc., the *coracobrachialis longus* is well developed. In most of the quadrumana there is a double insertion of the coracobrachialis, and, in the guinea-pig, the median variety only is present, as in man. In some animals, as the kangaroo, the muscle is absent altogether. It has once been found absent in a human monster. The coracocapsularis is present normally in many animals, *e.g.*, the dog, cat, etc.

Biceps Brachii. This muscle is rich in varieties. The most common is the presence of a third head, which arises near the insertion of the coracobrachialis, and in close connection with the brachialis anticus. The proportion of subjects having a third head is, in the writer's experience, one in seven; Theile makes it one in nine; Hallett, one in fifteen; Wood and Macalister, one in ten. In two hundred and fifty subjects examined the writer found it five times on both sides of the same subject. The third head generally soon joins the coracoid head about its middle, but it is occasionally seen quite separate as far as the bicipital fascia, into which it is inserted. The third head usually lies outside the vessels, but sometimes is seen covering them. It may arise from the bicipital groove, one of the ridges, or even from the great tuberosity. The writer has seen it arise from the lower edge of the great pectoral near its insertion (see Fig. 3450).

The third head is regarded by some as an offshoot from the brachialis anticus. Struthers has described a muscular slip which comes off from the inner border of the biceps, passes over the brachial vessels, and is inserted into the internal intermuscular septum or internal condyle.

The biceps has been seen with as many as four and even five heads. The supernumerary heads, as a rule, have their origin from the bicipital groove, body of humerus, coracoid process, capsule of shoulder-joint, or tendon of the pectoralis major. The coracoid and glenoid portions of the biceps muscle may fail to unite, being completely separate to their insertion. The long head is occasionally absent, the muscle being uniceps instead of biceps, as in some animals. The *long* or *glenoid head* may not pierce the capsule, but arise from the capsule itself, the humerus, or the great pectoral tendon. The tendon of the biceps sometimes pierces the tendon of the pectoral (see Fig. 3450). This is a very rare anomaly. It is not uncommon in old joints that have become dry from rheumatic disease to find the long tendon worn through, and perhaps attached to the groove outside the capsule, or to the head of the humerus, or absent altogether. This pathological condition must not be confounded with the anomaly above described.

The *short* or *coracoid head* may also in rare cases be absent.

The biceps may send a slip of insertion to the coronoid process, capsule of the elbow-joint, or fascia of the forearm. It is sometimes connected with the pronator teres, supinator longus, brachialis anticus, and palmaris longus, by muscular slips. In one case, in which the muscular slip crossed the artery and went to the pronator teres, the bicipital fascia was given off from it.

The semilunar fascia is often of larger extent than usual, and may have a high origin. It may be developed into an almost true tendon. It not infrequently sends offshoots to neighboring parts.

Brachioradialis (Wood). The writer once saw this muscle. It arose from the supracondyloid ridge above the supinator longus, and between it and the deltoid; it coursed down the arm between the long supinator and biceps, and was inserted into the oblique line of the radius immediately above the insertion of the teres. Wood looks upon this muscle as a variety of a fourth head to the biceps.

Comparative Anatomy: A third head is the normal arrangement in many animals, *e.g.*, bat, seal, rhinoceros, etc. The long or glenoid head is absent in many animals, especially birds. The short or coracoid head is not present in many animals, as the seal, porcupine, paca, and the carnivora, as the dog, cat, bear, hyena, etc. The glenoid head in these comprises the whole muscle. In some, as the American bear, the coracoid head is represented by a very thin tendinous strand.

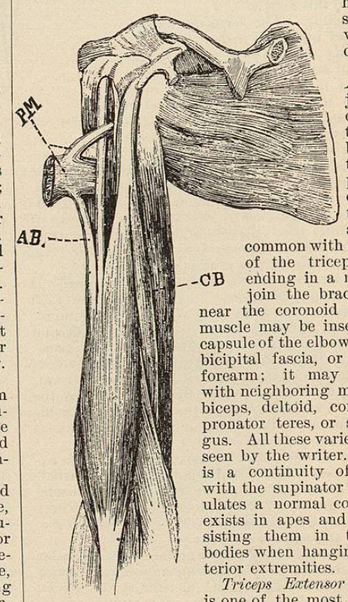

FIG. 3450.—*AB*, Third head of biceps, arising from the pectoralis major (*PM*), which is perforated by the long tendon of the biceps; *CB*, coracobrachialis. (Shepherd.)

Brachialis Anticus. Subject to frequent variations. It may be divided into two or three portions. On one occasion the writer saw a slip arise in common with the outer head of the triceps, and after ending in a round tendon, join the brachialis anticus near the coronoid process. The muscle may be inserted into the capsule of the elbow-joint, radius, bicipital fascia, or fascia of the forearm; it may be connected with neighboring muscles, as the biceps, deltoid, coracobrachialis, pronator teres, or supinator longus. All these varieties have been seen by the writer. When there is a continuity of this muscle with the supinator longus it simulates a normal condition which exists in apes and monkeys, assisting them in twisting their bodies when hanging by their anterior extremities.

Triceps Extensor Cubiti. This is one of the most constant muscles in the body as to its insertion. One of the most common varieties is a fourth head arising from the inner side of the humerus. This fourth head may come from the axillary border of the scapula. The scapular head may have a more extensive origin than usual. The writer once saw a strong muscular slip, continuous with the deltoid and separated by a bursa from the teres minor, have a tendinous insertion into the scapular head near its origin.

In some animals, as the American black bear, the scapular head is of huge size, and arises from the whole axillary border of the scapula.

Gruber, Macalister, and Testut each report a case of a slip going from the coracoid process and capsule of the shoulder-joint to the triceps. In one instance the writer saw a fleshy slip between the triceps and teres major.

Dorsoepitrochlearis (accessorius tricipitis). Occasionally the muscle to which the above name is given, and which is common in quadrumana and other animals, is seen in man. It has already been described with the latissimus dorsi.

Epitrochleoanconeus. Exists frequently in man. Gruber found it in one in three; Macalister, one in four; and Wood, one in seventeen. It is triangular in shape, the apex being attached to the back of the internal condyle and the base to the olecranon process. The ulnar nerve passes beneath it and supplies it (see Fig. 3451). This muscle is exceedingly common in mammals. According to Galton, it is universally present in the edentata, less frequent among the primates, disappears among the anthropoid apes, and emerges again occasionally in man as an anomaly. Mr. Galton considers that it, like the supracondyloid process, is now "an almost functionally useless heirloom, which has descended to us from remote ancestors." Mr. J. B. Sutton (*Jour. of Anat. and Phys.*, April, 1885) says that when the epitrochleoanconeus is not represented as a muscle, its place is occupied by a collection of fibrous tissue having the exact shape and attachments of the muscle, and forming a bridge under which goes the ulnar nerve.

Subanconeus. This consists of a few muscular fibres, which are seen on removing the triceps from the lower part of the humerus; they extend from the lower end of the humerus to the capsule of the elbow-joint. It is homologous with the subcrureus muscle found in the lower limb beneath the quadriceps extensor. It is looked upon by many anatomists as a dependent of the triceps.

Anconeus. May vary as to the closeness of its connection with the triceps or extensor carpi ulnaris.

Pronator Radii Teres. The coronoid head is sometimes wanting, in most animals it does not exist. Occasionally there is a third head which arises from the internal intermuscular septum, or from a supracondyloid process when that variation is present; in such cases the direction of the brachial artery is often changed.

Sometimes the third, or supernumerary, head arises from the tendon of the biceps or brachialis anticus. The pronator teres may have its insertion lower down the radius than usual. It may also be divided into two portions, as in birds. The coronoid portion may be separated entirely from the condyloid, or there may be a doubling of each of these portions.

The pronator teres may be connected with the palmaris longus, carpi radialis flexor, or sublimis digitorum in the forearm and the biceps, brachialis anticus, and coracobrachialis in the arm.

Flexor Carpi Radialis. It may receive an additional slip of origin from the biceps tendon and fascia, the coronoid process, or the radius. It may have an insertion partly into the annular ligament, trapezium, scaphoid, or fourth metacarpal bone.

Palmaris Longus. This is one of the most variable muscles in the body. It is absent in about ten per cent. of individuals, and in rare cases is represented only by a tendinous band. It does not exist in the solipeds, ruminants, or pachyderms. The form varies considerably. There may be a central fleshy portion, with a long, slender tendon at each end; the muscular portion may be at the distal end. It has been seen muscular throughout, and again has been seen to consist of two bellies united by tendon. The palmaris longus is occasionally double; when a second muscle exists it generally arises by tendon, or is connected with the carpi ulnaris, or sublimis digitorum muscle. It may arise from the intermuscular septum between the two last-mentioned muscles, by a tendinous origin, and continue as part of the ulnaris as far as the middle of the forearm, then form a large belly which ends in a tendon near the wrist. The writer has seen it furnish the origin of the flexor brevis minimi digiti; a somewhat similar arrangement exists in the cebus and magot. Occasionally it receives an additional slip of origin from the coronoid process or radius. It sometimes terminates variously in the fascia of the forearm, muscles of the little finger, annular ligament, scaphoid, and pisiform bones, and tendon of the flexor carpi ulnaris.

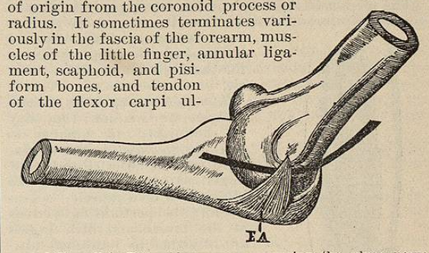

FIG. 3451.—*EA*, Epitrochleoanconeus covering the ulnar nerve. (Sutton.)

The writer once saw the tendon of this muscle near the wrist give off a broad muscular slip, which was inserted into the base of the first phalanx of the little finger. Most of the anomalies of this muscle correspond to the normal arrangement in some of the lower animals.

Flexor Carpi Ulnaris. Is frequently inserted into the fifth metacarpal bone. It has been seen sending a slip of insertion to the fourth metacarpal. It sometimes gives off a slip to the annular ligament, but this is regarded as a supernumerary palmaris longus, as are also those cases in which a separate portion from the epicondyle passes down to be inserted into the pisiform bone. It is in rare cases double. I have once seen this muscle absent on the left side of a female subject.

Flexor Sublimis Digitorum. The radial origin of this muscle is sometimes wanting. The muscle is occasionally subdivided, each of the tendons being connected with a separate fleshy belly. This is more common with the index and little fingers, and may be classed among the anomalies called progressive. The tendon to the little finger may be absent, or the superficial flexor may be connected by slips with the deep flexor and the long flexor of the thumb. This is the arrangement in most mammals, and in man, and his order only, is seen the marked differentiation of the flexors. One of the lumbrical muscles occasionally arises from the sublimis digitorum. This muscle may send a muscular slip to the annular ligament and palmar fascia; this is the arrangement in the bear, and is supposed to represent the palmaris longus.

Flexor Profundus Digitorum. In many animals this muscle is intimately blended with the foregoing, but in man is generally quite distinct; not infrequently, however, it is connected with the sublimis digitorum and also with the flexor pollicis. It occasionally has an additional origin from the internal condyle and coronoid process (the *accessorius ad flexorem profundum* of Gantzer), which may join any one of the perforating tendons, commonly those going to the index and middle fingers (Wood). This is the normal arrangement in many mammals. The writer saw this coronoid slip very well developed on both sides of a negro subject. He also, some years ago, found a strange variety of the *accessorius* muscle occurring on both sides of the same subject. The muscle arose from both the internal condyle and inner side of the coronoid by fleshy fibres, developed into a large muscular belly which divided into two portions, each ending in a tendon, the innermost going to the terminal phalanx of the little finger, and the outermost to the terminal phalanx of the index, superficial to the tendon of the sublimis. On both sides, near the origin of this accessory muscle, a large slip went to the profundus digitorum.

The profundus digitorum may have an origin from the radius; when this occurs it joins the indicial portion of the muscle.

Flexor Indicis. The indicial portion of the profundus

may be quite distinct from the rest of the muscle. In one case the writer saw it connected with the flexor longus pollicis by a tendinous intersection. A flexor indicis is found in the gorilla and chimpanzee.

The tendon to the little and middle fingers may also be quite separate and distinct from the rest of the profundus. Accessory slips are not infrequently found going to join the various tendons of the muscle.

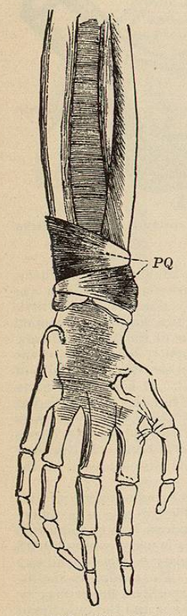

FIG. 3452. — The Pronator Quadratus, *PQ*, consisting of two triangular portions with bases reversed. (Fenwick.)

Lumbricales. Varieties of these muscles are common; they may be diminished in number to three, or increased to five or six. Two may be inserted into one finger, or one into two by the bifurcation of a muscle. Occasionally the perforating tendons of the fourth and fifth fingers are furnished by lumbrical muscles. The third muscle is more frequently abnormal than the others. The writer has seen the lumbrical muscle of the little finger arise in the middle of the forearm from the sublimis digitorum by a round tendon, this, after passing under the annular ligament, developed a large fleshy belly which was inserted into the fifth finger. This might be regarded as a case of absence of the fourth lumbrical muscle, its place being taken by a slip from the sublimis.

Flexor Longus Pollicis. Has frequently a slip of origin from the coronoid process and internal condyle. This slip has been seen to pierce the radial nerve. The muscle may be connected by a slip with the superficial and deep flexors, and also with the pronator teres. It is sometimes fused with the profundus digitorum so as to form a single muscle, as is the case in nearly all mammals. It is sometimes fused with the indicial portion of the profundus, when that part forms a distinct flexor indicis, as in the gorilla. It has been observed sending a slip to the index finger and also to the first lumbricalis.

Pronator Quadratus. The pronator quadratus is sometimes entirely wanting; it may consist of two, three, and even four layers crossing each other. The attachment to the bones of the forearm may be greater than usual. It occasionally sends a muscular slip from its ulnar or radial attachment to the carpus. It may consist of two distinct triangular portions with the bases reversed; the anterior arising from the ulna by aponeurotic fibres and inserted into the radius by fleshy fibres, the deeper and inferior portion inserted into the ulna by fleshy fibres, and arising by aponeurosis from the radius (Fenwick, Sappey, and Macalister). (See Fig. 3452.)

The muscle may consist of a single triangle, as in some animals, *e.g.*, the macaque, seal, etc.

Flexor Carpi Radialis Brevis (Wood) (Radio-carpus of Fano). This is a small muscle occasionally seen. It arises from the anterior surface of the radius below the oblique line, and is inserted into the annular ligament, trapezium, os magnum, or other part of the carpus. It may also be inserted into one of the metacarpal bones. A variety of this muscle is, in rare cases, seen arising from the ulna (ulno-carpus).

Supinator Longus. The varieties of this muscle are few in number. It sometimes has a higher attachment to the humerus than usual, and its insertion into the styloid process may be extended upward along the radius. It may have no attachment directly to the external condyle of the humerus, and in such a case it is closely connected with brachialis anticus. The writer once saw a slip from the supinator attached to the middle of the outer border of the shaft of the radius.

The tendon of the supinator may be divided into two or three slips. In cases of absence of the radius this muscle is wanting.

Occasionally it is double, the accessory portion (*brachio-radialis*) arising with it and being inserted into the radius in the neighborhood of the oblique line. It not infrequently is connected with neighboring muscles, viz., the deltoid, brachialis anticus (as in monkeys), flexor carpi radialis longior, and the abductor pollicis. The tendon may be pierced by the radial nerve.

Extensor Carpi Radialis Longior et Brevior. These muscles are sometimes completely fused. In many mammals (horse, pig, etc.) they form a single muscle, which ends in two tendons. In man the fusion may be only partial. The tendons of one or other of the muscles may be subdivided. The *radialis longior* may have an additional insertion into the second or third metacarpal bone. Wood has described a muscle which he calls the *extensor carpi radialis accessorius*. It arises from the humerus below the *radialis longior*, and is inserted into the first metacarpal bone, first dorsal interosseous muscle, abductor, or short flexor of the thumb. The writer has seen a digastric slip given off from the extensor carpi radialis longior, which joined the abductor pollicis. Testut has described an *abducteur huméral du pouce*, arising from the external condyle, and inserted into the first phalanx of the thumb. The long extensor is occasionally united with the supinator longus. Macalister has recorded absence of the short extensor.

Extensor Communis Digitorum. The varieties of this muscle relate chiefly to the increase or diminution of the tendons of insertion. The tendon going to the little finger may be absent, and also that going to the index finger. It is more common to have an increase than a diminution of tendons. Any one of the tendons may be subdivided, and as many as eleven have been observed by Perrin and Rüdinger, due to doubling of some tendons and tripling of others. Curnow in one case saw twelve tendons go to the inner four digits and five to the thumb, making seventeen in all. Five and six are commonly seen, the tendons of the little and index fingers being most often duplicated. The extensor communis occasionally sends a slip to the thumb.

The indicial portion of the muscle may be completely separated from the rest, and the extensor minimi digiti may be inseparably connected with the larger muscle.

Extensor Minimi Digiti. Sometimes fused with the common extensor or carpi ulnaris. It may be double, the additional tendon being inserted into the ring finger. It may have an ulnar attachment, and may be inserted into the annular ligament. Complete absence of the muscle has been observed.

Extensor Carpi Ulnaris. An accessory or short extensor, going from the lower end of the fourth and fifth metacarpal bone, has been described. The tendon is not unfrequently prolonged downward to the first phalanx of the little finger (*ulnaris quinti*). It is also frequently connected with the abductor minimi digiti. Sir William Turner has lately reported a case of absence of this muscle; its place was taken by a slender band of fibrous tissue. Curnow has also recorded absence of this muscle.

Supinator Brevis. An accessory supinator brevis has been observed going from the external condyle of the humerus to the radius or ulna. The extent of attachment to the radius may be much greater than usual. A sesamoid bone is sometimes found in the tendon of the muscle. This occurs normally in some animals, and is also seen in the popliteus, of which the short supinator is supposed to be the homologue.

Extensor Ossis Metacarpi Pollicis. The tendon of this muscle is frequently double, and sometimes is triple. When double, usually both are inserted into the metacarpal bone, or one into this bone and the other into the trapezium, as is the normal arrangement in apes. The supernumerary tendon may be inserted into one of the short muscles of the thumb. The muscle may be double throughout, and Curnow has in one case seen it triple.

Extensor Primi Internodii Pollicis. Is sometimes absent, or is not differentiated from the extensor ossis metacarpi. Curnow describes a case of doubling of this muscle. It is found only in man.

Extensor Secundi Internodii Pollicis. Doubling of the muscles is not uncommon. Additional muscles are occasionally present, and have been described by Curnow (*Jour. Anat. and Phys.*, vol. x., p. 596).

Extensor Primi Internodii Pollicis et Indicis. In some rare cases there is an accessory extensor present, which arises between the extensor indicis and the extensor secundi internodii pollicis; it divides into two tendons, one of which goes to the first phalanx of the thumb, and the other to the index finger. This muscle exists normally in the dog and many other carnivora.

Extensor Indicis. The tendon of this muscle is frequently divided into two portions, one going to each side of the index finger; sometimes one of the tendons goes to the middle finger. This latter is occasionally seen as a distinct muscle (*extensor proprius digiti medii*). It arises from the lower part of the ulna or posterior ligament of the wrist-joint, and is inserted into the base of the first phalanx of the middle finger. It exists normally in apes.

A short *extensor indicis* is occasionally seen taking its origin below the long extensor, from the back of the wrist or a carpal bone; it is inserted with the long extensor into the index finger. The writer has seen this accessory muscle arise from the radius, and pass through a separate compartment in the annular ligament to be inserted into the index finger. The extensor indicis may have a more extensive attachment to the radius than usual. The writer has seen it connected by a tendinous slip with the extensor secundi pollicis. Curnow describes one case in which the muscle divided into three tendons—one inserted normally, one with the secundi internodii, and one with the aponeurosis over the middle finger. A somewhat similar arrangement is seen in the hedgehog, kangaroo, and manis. It is rarely absent.

Extensor Pollicis and Indicis (see above).

Extensor Brevis Digitorum. Very rarely met with. It arises from the back of the wrist, post-annular ligament, from the carpus itself, or the bases of some of the metacarpal bones by fleshy fibres; it sends tendinous slips to one, two, or three fingers. The writer has seen them going to the ring and index fingers and to the middle finger. It is probable that the extensor brevis indicis and extensor medii digiti are varieties of this muscle. (See Fig. 3453.)

This muscle is common in reptiles, and survives only in a few anomalous mammals of the order Edentata (Curnow).

MUSCLES OF THE HAND.—*Palmaris Brevis.* Varies considerably as to its degree of development. It is occasionally altogether wanting.

Abductor Pollicis. Some anatomists describe the muscle as normally consisting of two portions—an outer and inner. It may receive a third belly from the opponens pollicis, or be connected with it by a muscular slip. It may also receive an accessory slip from the extensor carpi radialis longior, ossis metacarpi pollicis, palmaris longus, or from the radius. Not infrequently a thin, muscular slip is seen going from the skin of the ball of the thumb opposite the tuberosity of the trapezium to the abductor pollicis. Some regard this latter as a skin-muscle.

Flexor Brevis Pollicis. The deeper belly of the muscle is often with difficulty differentiated from the adductor pollicis.

Adductor Pollicis. This muscle is frequently blended with the deep portion of the short flexor of the thumb.

Abductor Minimi Digiti. Sometimes divided into two or even three slips. It is often united with the flexor brevis minimi digiti. It may have an accessory slip, arising from the tendon of the ulnar flexor, the annular ligament, fascia of the forearm, and tendon of the palmaris longus. The writer has seen an accessory head arise from the intermuscular fascia beneath the flexor radialis and ulnaris. The accessory slip may pass down and cover the ulnar artery.

Flexor Brevis Minimi Digiti. May be absent or replaced by a slip from the abductor minimi digiti or opponens. An accessory head may spring from the lower third of the inner border of the ulna, from the carpi ulnaris, or fascia of the forearm. A doubling of the muscle has been observed.

Opponens Minimi Digiti. May be closely connected with neighboring muscles, or receive a second head from the fascia of the forearm (Henle.)

M. Pisiuncinatus. This is a muscle described by Calori, and stretches between the pisiform bone and unciform process of the unciform bone.

Interosseous. These muscles do not vary to any great extent. They may be double in one or two interosseous spaces. Henle describes a *palmar interosseous* muscle of the thumb as normal. It arises from the metacarpal bone of the thumb, and joins the inner head of the flexor brevis pollicis. The arrangement of the interosseous muscles of the hand has been observed, in rare cases, to be similar to that of the foot.

Accessory Palmar Abductor Indicis. The writer once saw a small muscle arising from the third metacarpal bone, beneath the adductor pollicis and inner head of the flexor brevis pollicis. After ending in a round tendon, it was inserted into the base of the first phalanx of the index finger.

MUSCLES OF THE LOWER LIMB.—*Gluteus Maximus.* The great size of this muscle is peculiar to man, principally on account of his erect position. In the human species the muscle always covers the ischial tuberosity; in apes, this is uncovered. The variations are important. The muscle may be considerably reduced in size. Macalister reports a case in which the muscle was attached above to the last two sacral vertebræ only. The superficial portion of the muscle is often separated from the deep by a layer of cellular tissue. The lower edge of the muscle is sometimes quite distinct, and represents the *agitator caudæ* of the lower animals; it may be inserted into the femur or the femoral aponeurosis. The gluteus maximus is occasionally blended with the tensor fasciæ, as in the elephant and some monkeys.

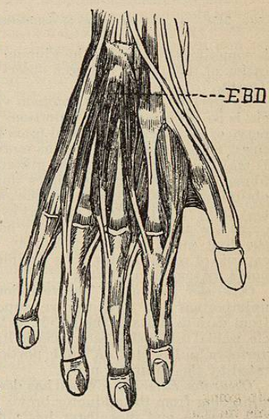

FIG. 3453.—*EBD*, Extensor brevis digitorum. (After Wood.)

Ischio-femoral. The writer has only once seen this muscle. It arose from the inner edge of the great tuberosity by a round tendon, which soon developed into a triangular-shaped muscle of considerable size; it was separated from the gluteus maximus by the great tuberosity, and joined it near the femur. It was inserted into the lower end of the gluteal ridge of the femur. The *ischio-femoral* muscle exists normally in the gorilla, certain apes, and other animals.

Gluteus Medius. The deeper fibres of this muscle may

end in a separate tendon, which is attached to the upper border of the great trochanter. Its upper or lower border may be separated from the rest of the muscle. Occasionally a bursa is interposed between the tendon of the gluteus medius and the pyriformis. Some of its fibres may be inserted into the pyriformis, or its posterior border may be completely fused with that muscle.

Gluteus Minimus. Occasionally divided into anterior and posterior portions; may send slips to the hip-joint, to the pyriformis, gemelli, or vastus externus muscles.

Accessory Gluteus Minimus (fourth gluteal; scansorius). The fibres of the anterior border are in some cases separated from the muscle, and inserted variously into the anterior border of the great trochanter, into the capsule, or near the lesser trochanter, where it is connected with the iliacus tendon. It represents the scansorius muscle of apes. Testut looks upon it as representing the extra-pelvic portion of the iliacus muscle.

Tensor Vaginæ Femoris (tensor fasciæ). Varies but little. May have a supernumerary origin from the abdominal fascia, iliac crest, and Poupart's ligament. It

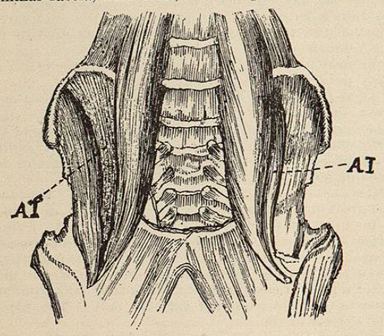

FIG. 3454.—*AI*, *AI*, Examples of double superficial iliacus muscles.

is sometimes fused with the gluteus maximus. A duplication of the muscle has been observed by Macalister and Testut.

Pyriformis. The most common variation of this muscle is its division into two portions by the great sciatic nerve or its external popliteal branch. It is occasionally fused with the gluteus medius more or less completely. It may be connected with the gluteus minimus by a few fibres. Its tendon is sometimes united with that of the obturator internus, or receives the gemellus superior. It may have its origin from as many as five sacral vertebræ, or as few as one. It frequently has no attachment to the first sacral vertebra. It may be inserted into the capsule of the hip-joint. Its complete absence has been noted by several observers.

Obturator Internus. The variations of this muscle are unimportant. It may receive supernumerary fasciculi from various parts in the pelvis, as the psoas minor muscle, ischial tuberosity, sacro-sciatic ligaments, third sacral vertebra, pubes, etc. A pubic portion is sometimes separated by the obturator nerve.

Obturator Externus. Wood has described a large fleshy slip going from the adductor brevis to join the tendon of this muscle, and Macalister has noted a separation of a pubic fasciculus by the obturator nerve.

Gemelli. The *superior gemellus* is not infrequently absent, or very small in size. The *inferior gemellus* has also been observed absent, but more rarely. Doubling of the *superior* has been noticed; it has also been seen fused with the pyriformis and gluteus minimus. The gemellus inferior and quadratus femoris are frequently inseparably united to the obturator internus.

Quadratus Femoris. This muscle may be much reduced in size, or absent altogether; in such a case, the inferior gemellus is larger. It has been described as sometimes double. It may be united above with the gemellus inferior, and below with the adductor magnus.

Biceps Flexor Cruris. The two heads may be quite separate, as in the orang and chimpanzee. The short head may be divided into several fasciculi, or, in rare cases, absent altogether. This latter arrangement is the usual one in a large number of mammals. There is sometimes a third head, which may arise from the femur, from the ischial tuberosity, coccyx, sacrum, fascia lata, or gluteal fascia. The third head generally joins the long head, though when it arises from the linea aspera, or inner condyloid ridge, it joins the short head. The third head has been looked upon as homologous with the caudal origin of the biceps in the lower animals. In rare cases a slip (*ischiocalcaneus*) has been seen going from the long head to the gastrocnemius, external tuberosity of the tibia, femoral aponeurosis, and even to the tendo Achillis. This arrangement is a modification of that seen in the lower animals, especially the bear.

I have seen a muscular slip arising from the biceps near its insertion and inserted by a tendinous expansion into the fascia covering the lower third of leg.

Semitendinosus and *Semimembranosus.* These two muscles may be fused into one. The *semimembranosus* may be absent altogether. It has been seen double. Occasionally, it derives its origin for the most part from the great sacro-sciatic ligament.

The *semitendinosus* may have a supernumerary origin from the coccyx, and sometimes gives off a muscular slip about its middle, which is inserted into the fascia of the leg. This arrangement is normal in some of the lower animals.

Psoas Magnus. Varies somewhat in volume, according as its origin is more or less extensive. It occasionally forms a muscle quite distinct from the iliacus. It may be divided into two portions, between which passes the anterior crural nerve. This is merely an exaggeration of the normal condition. An accessory psoas is sometimes seen arising from the transverse processes of some of the lumbar vertebræ. The writer, in a male subject, saw this accessory psoas of considerable size; it arose from the transverse process of the fourth lumbar, and as it descended widened out into a broad muscle, which joined the magnus in the middle of the iliac fossa.

Psoas Parvus. Frequently absent and occasionally fused with the magnus. It usually arises from the bodies of the last dorsal and first lumbar vertebræ, and soon becomes tendinous; it then passes down to the inner side of the magnus, and ends by being inserted into the ilio-pectineal line and pectineal eminence. It has been noted as having an insertion into the lesser trochanter, as in the seal, guinea-pig, etc.

Although inconstant in man, it is a large, well-developed, and constant muscle in the lower animals. Gruber in 450 subjects found absence of this muscle on both sides in 183, and on one side in 69; Perrin in 112 subjects found it present in only 32; Theile found it in only 1 out of 20 subjects examined; and Testut, 6 out of 32.

It is occasionally double.

Iliacus. May be divided into several distinct portions. The deep portion is not infrequently separated from the superficial by a well-marked cellular interval, and thus constitutes a separate muscle.

Superficial Iliacus. Sometimes seen arising from the crest of the ilium, last lumbar vertebra, or upper border of the sacrum. In one subject, the writer saw this muscle on both sides: on the right side it was a broad, flat muscle, arising from the posterior third of the crest of the ilium, and on the left a fusiform muscle, which arose from the body of the last lumbar vertebra and upper border of the sacrum. Both muscles ended in strong tendons, which were pierced by the anterior crural nerve, and joined the iliacus below Poupart's ligament (Fig. 3454).

Iliocapsularis vel Iliacus Minor. Arises from the anterior inferior spine of the ilium and capsule of the hip-joint; it may be inserted into the lower part of the

anterior intertrochanteric line, lesser trochanter, or ilio-femoral ligament. In one subject the writer saw a well-marked bursa separating it from the iliacus.

Sartorius. A case of absence of this muscle has been reported by Meckel. It is occasionally double in its whole course. An accessory portion has been seen having an insertion into the femur, patella, or tendon of the normal muscle.

The sartorius, in addition to its tibial attachment, may have an insertion into the femoral aponeurosis, the capsule of the knee-joint, or the femur itself in the neighborhood of the internal condyle. All these various insertions are seen normally in mammalia. A tendinous inscription in rare cases is seen in this muscle. The writer has only once met with this anomaly.

Quadriceps Extensor Cruris. Not subject to many variations. Occasionally the acetabular origin of the *rectus* is wanting, or it may be reinforced by an additional origin from the anterior superior spine. The *vasti* muscles may be divided into two portions, superficial and deep; this bilaminar arrangement is the normal one in many birds. The two vasti muscles are often closely united.

The *Subcrureus* is a muscle which is very variable in volume. It is often divided into two or more separate muscular bundles.

Accessory Head to Quadriceps. The writer once saw, on the left side of a male subject, a supernumerary muscle which arose by a double tendinous origin from the anterior portion of the capsule of the hip-joint and the anterior border of the great trochanter. The two tendons soon united to form one strong tendon, which passed down the thigh between the iliacus and tensor fasciæ, lying on the vastus externus; about the middle of the thigh it developed into a strong muscular belly three inches long. After passing beneath the rectus it joined the common tendon of the quadriceps.

Gracilis. The variations are unimportant and consist chiefly of a greater or less extent of origin and insertion. An accessory head is sometimes seen.

Pectineus. May be occasionally divided into two portions, as in some of the lower animals, each portion supplied by a different nerve—the inner by the obturator, and the outer by the anterior crural. In one case the writer saw it divided into a superficial and a deep portion; the superficial arose from the pectineal line, two inches outside the pubic spine, and was inserted into the linea aspera, with the adductor magnus. The deep portion was the normal muscle.

The pectineus is not infrequently united with the adductor longus; this occurs normally among the Rodentia, Carnivora, and Quadrumana. It may be sometimes inserted into the capsule of the hip-joint.

Adductor Longus. May be divided into two portions by the passage of blood-vessels. It is often inserted low down on the femur, and its tendon is inseparable from the magnus. It is sometimes fused with the pectineus.

Adductor Brevis. Occasionally divided into two or three portions—may be continuous with the magnus. It has been reported as united to the tendon of the obturator externus.

Adductor Magnus. The upper part of this muscle is so often separated from the main portion that Henle, Macalister, and other anatomists describe it under the name *adductor minimus* or *quadratus.* Its upper border is occasionally completely united with the quadratus femoris. The different parts of the muscle are not infrequently separated; the portion inserted into the internal condyle is frequently quite distinct (*ischio-condyloid*).

Tibialis Anticus. This muscle has been seen arising from the femur, as occurs so generally in the higher mammals. In the case reported the leg was congenitally deformed. The tendon is occasionally double, the extra tendon being inserted into the astragalus or base of the first metatarsal, as in apes. The tendon has been seen divided into three portions, and occasionally a sesamoid bone is formed in it.

I have seen a muscular slip from the tibialis anticus end in a tendon which was inserted into the proximal phalanx of the fourth toe. I have also seen this slip inserted into the first phalanx of the great toe.

Tibiofascialis Anticus. A small muscle described by Wood, Macalister, and Humphry, which arises from the lower third of the anterior edge of the tibia, over the tibialis anticus, and is inserted into the annular ligament and deep fascia. It is sometimes represented by a tendinous slip from the tibialis anticus, which is inserted into the fascia of the dorsum of the foot. Gruber describes a *tibio-astragalus anticus* arising from the tibia and interosseous ligament behind the tibialis anticus, and inserted in the neck of the astragalus.

Extensor Proprius Hallucis. Is occasionally united with the extensor communis digitorum, or short extensor of the toes. The muscle or its tendons may be double, and have a supernumerary insertion into the metatarsal bone or first phalanx of great toe. It is sometimes inserted into the second toe. Its tendon may be divided into three portions (*extensor hallucis longus tricaudatus*).

Extensor Ossis Metatarsi Hallucis is a small muscle arising from the extensor hallucis, tibialis anticus, extensor communis digitorum, or as a separate muscle close to the extensor hallucis, going through the same compartment in the annular ligament as the hallucis; it is inserted into the metatarsal bone of the great toe.

Extensor Primi Internodii Hallucis. In one-half the subjects examined Professor Wood found this muscle; it is generally an offshoot from the extensor hallucis, but sometimes arises separately.

Extensor Longus Digitorum Pedis. Varies considerably in the mode of origin and the arrangement of its tendons. The number of tendons may be increased by the doubling of any one. It is not uncommon for the tendon going to one toe to give slips to adjacent toes. It may have an additional insertion into the metatarsus. Occasionally a supernumerary tendon is seen going to the great toe. The tendons may be united on the dorsum by slips, as in the hand. It may be united to a greater or less extent with the extensor proprius hallucis, or extensor brevis digitorum. Each of the tendons may have a separate muscular belly in connection with it. Wood reports a case in which the four tendons had each a separate muscular belly. All these abnormal arrangements have their corresponding normal conditions in the lower animals.

Peroneus Tertius. Sometimes of large size, and occasionally inserted entirely into the fourth metatarsal bone. Its tendon may unite with that of the extensor going to the fourth or fifth toe, or it may unite with the fourth dorsal interosseous. The muscle may be absent altogether or be double.

Peroneus Longus. Occasionally fused with the brevis. In one case it has been noted as arising from the femur, as in many lower animals, *e.g.* the bear, hyæna, etc. It may have a supernumerary insertion into one of the metatarsal or cuneiform bones, as occurs in some animals. The tendon sometimes gives origin to the flexor brevis minimi digiti and outermost plantar interosseous (Wood).

Peroneus Accessorius. This is a small muscle which arises from the fibula between the peroneus longus and peroneus brevis, and ends in a tendon which joins the long peroneal.

Peroneus Brevis. The tendon of this muscle is occasionally divided into two portions, the supernumerary one going to the fourth metatarsal or cuboid bone, or to the proximal phalanx of the fifth toe, joining the extensor tendon of that toe. It may also be inserted into the abductor minimi digiti.

Peroneus Quinti Digiti. It arises from the fibula beneath the peroneus brevis, and is inserted into the extensor aponeurosis of the little toe. It is seldom seen as a distinct muscle, being generally united with the peroneus brevis. It is seen normally in some animals, as the bear and the cat.

Peroneus Quartus. A muscle which is not infrequently seen arising from the back of the fibula, between the peroneus brevis and flexor hallucis, or from the fascia of the deep muscles of the calf; it is inserted into the external malleolus, peroneal tubercle of the os calcis, or the