# ON HUMAN MUSCULAR VARIATIONS AND THEIR RELATION TO COMPARATIVE ANATOMY, by JOHN WOOD, F.R.C.S. *Demonstrator in Anatomy at King's College, London; Assistant Surgeon to King's College Hospital.*

THE muscular system in man, and probably also in the lower animals, is subject to irregularities producing almost every variety of anomaly. From Albinus downwards these anomalies have attracted the attention of anatomists more or less powerfully. In the earlier times, when, for want of human subjects for dissection, such animals as apes, dogs, &c. were, perhaps, more commonly the subjects of investigation than they are now, the striking similitude of many of their muscles to the human variations occasionally found, has enforced attention on the observer. Such was the case, for example, with the *Sternalis brutorum* of Sandifort and Sabatier (1790). In later years, the gradual separation of the human from the comparative anatomist, and the specialization of their respective studies, have led probably to a less distinct apprehension of the relation of the varieties in the human system to the normal muscles of lower organizations. Numerous human abnormalities have indeed been recorded by Sharpey, Quain, Hallett, Macwhinnie, and Struthers, in this country, and by Meckel, Haller, Theile, Gruber, Gantzer, Rosenmüller and Isenflamm, by Luschka, Kelch, Wagner, Fleischmann, Otto, Cruveilhier, Henle, and others, in Germany and France; but these have usually been detached observations without special reference to the coexistence of other anomalies, or to the presence of similar muscles in animals. In this respect Meckel only may be considered as an exception; and even his extensive generalizations referred rather to the normal arrangement of the muscles in man, as compared to that of other creatures, than to the varieties met with in the human subject viewed in the same way. In this department of scientific anatomy I believe that I am not alone in thinking that much remains to be done by patient and detailed investigation; and if the results at all correspond to a reasonable anticipation, much light will be thrown from this quarter upon the interesting and much discussed question of the position of man in the animal kingdom, and his relation to his inferior fellow-creatures. If, in addition to the general resemblance of the muscular mechanism, there be found in the former fragmentary records of special apparatus which have, in the latter, the fuller development of a definite purpose, then these may be taken as at least of equal importance with other evidence of

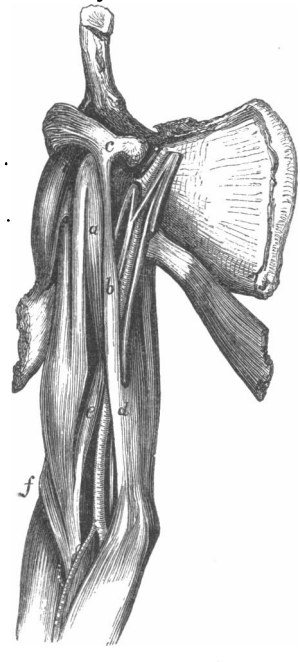
traces,—some may think, of a general unity of plan with varied teleological intentions;—and others,—of an ancient morphological relationship of a much closer character. But if, on the other hand, muscles are found which have no place in the various animal types, we may fairly take them as indications, valuable so far as they go, of progress still advancing towards a higher development of the human frame—of an increase in the distance already great which separates physically man from animals.

The present paper is a small contribution towards the attainment of a definite conception of the degree of relationship which exists between man and animals in respect of a muscle not usually considered as being very subject to variation, viz. the *coraco-brachialis;*—also of another, of the occasional existence of which I have found no record in the authors I have up to this time been able to consult. The last muscle I have called the *Flexor carpi radialis brevis* vel *profundus.*

*Coraco-brachialis.*—In the human subject I have observed three varieties of arrangement in the fibres of this muscle, which I will give in the order of their frequency.

First. The muscle usually described as arising from the tip of the coracoid process, partly tendinous and partly muscular, in common with the tendon of the short head of the *biceps.* Many of its muscular fibres also arise from the hinder surface of this tendon of the *biceps* half way down to its insertion. The insertion is into the middle of the inner surface of the humerus opposite to that of the *deltoid* (fig. 1 *a*). This muscle is sometimes, but not, perhaps, so frequently has as been described, perforated by the musculo-cutaneous nerve.

*Fig. 1.*




Second. Another slip is not uncommonly found (*b*) more or less connected with the preceding at its origin. It is, however, more fleshy than the latter, is placed internal to it, and is generally connected by a lunated aponeurosis (*d*) with the insertion of the *pectoralis minor* into the coracoid process. Passing down the arm, sometimes in front of the former so as to conceal it, but usually a little to the inner side, this portion of the muscle becomes inserted into the upper part of the internal condyloid ridge of the humerus, partly connected

with the internal intermuscular septum, and partly with a distinct, white, shining ligamentous band with vertical parallel fibres (fig. 1 *d*), which reach down as far as the internal condyle itself, upon the upper part of which it is implanted. This band covers the ulnar nerve, and is distinct from and placed posterior to the true intermuscular septum, which lies deep between the *triceps* and *brachialis* muscles. Its fibres are most distinct above, where they can be traced behind the insertion of the *coraco-brachialis* as high as the lesser tuberosity of the humerus, crossing the tendons of the *latissimus dorsi* and *teres major* muscles. Below the insertion of the *coraco-brachialis* they approach gradually towards the true intermuscular septum, connected meanwhile by the aponeurosis of the arm, and finally become blended and implanted with it upon the internal condyle. The distinction between this longitudinal band of fibres and the true intermuscular septum seems to be recognized by Henle (*Muskellehre*, s. 179), but was first especially insisted on by Struthers (*Anatomical and Physiological Observations*, 1854), who traced it as high as the *teres major*, and proposed for it the name of the *internal brachial ligament.*

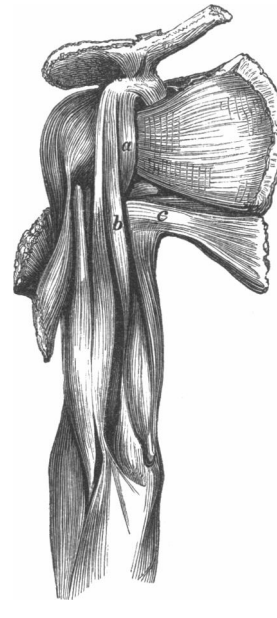
The last described portion of the *coraco-brachialis* is extremely variable in size when present. It is sometimes a very small slip, not conspicuous as a separate element of the muscle, from the upper part or bulk of which it is separated by a cellular interval, through which the *perforans Gasseri*, or *musculo-cutaneous nerve*, generally passes. In this condition it has been recognized by Theile (p. 215, *Jourdan's* translation of the *Cyclopédie Anatomique*, 1843). This author mentions also that the superficial portion is often found continuous with the fibres of the *brachialis anticus.* The same observation was made by Meckel (*Handbuch,—Muskellehre*, s. 498). When it is totally wanting the musculo-cutaneous nerve passes generally quite superficial to the *coraco-brachialis* muscle. When, on the other hand, this portion of the muscle is largely developed, as seen in the subject from which fig. 1 was taken, it may pass entirely superficial to and across the brachial vessels and median nerve, the tendon forming an aponeurotic opening for them between the first and last-described portions of the muscle, as they cross from the inside to the front of the arm. This arrangement has also been described and figured by Gruber (*Neue Anomal.* s. 28, Taf. I. fig. 1).

In many of such examples is found a tubercular projection, or a distinct spur-like process of bone, placed about two inches above the condyle, and a little in front of the condyloid ridge, which has been especially described by Otto (*De rarioribus scel. hum. c. anim. sceleto analogiis*, p. 25, Taf. I. figs. 10, 11), Knox (*Edin. Med. and Surg. Journal*, 1841, p. 125), and Struthers (*op. cit. Edin. Monthly Journal,*

Oct. 1848, and *Lancet*, Jan. 24, 1863), as homologous with the supra-condyloid arch in *Carnivora* and other animals. This process is described by the author last mentioned as either a rough line, a pointed tubercle, or a hook or spur, varying from $\frac{1}{10}$th to $\frac{3}{4}$ths of an inch in length. He had met with it in nine subjects, and had collected six more from Tiedemann, Quain, and other sources. I have myself seen it more or less distinctly developed in three cases. A case is also related by Wilbrand, quoted in the *British and Foreign Medical Review*, XIX. 571; and another by Barkow (*Anat. Abhandl.* s. 7, Taf. I. fig. 1), of the shape and size of the epitrochlear process. In all, the median nerve passed behind the process, and, in most, the brachial vessels also. In the subject from which the sketch (fig. 1) was taken, the supra-condyloid process was present as a tubercular projection into which the tendon of the lower or superficial portion of a large bifid *coraco-brachialis* muscle (*b*) was inserted. In the same arm were seen four heads to the biceps muscle, one (*e*) from the upper fibres of the *brachialis anticus*, and another (*f*) from those of the *supinator longus*, with an irregular distribution of the smaller arteries. An abnormal high origin of the *pronator teres* muscle is often present with the supra-condyloid process, as in the instances given by Tiedemann and Gruber (*op. cit.* s. 8).

Third. Much more rarely found as an abnormality in the human subject is another variation of the *coraco-brachialis* muscle. In a paper read before the Royal Society in 1864, I described and figured under the name of the *coraco-capsularis* a pretty strong bundle of muscular fibres arising from the under surface and outer border of the coracoid process near its root (fig. 2 *a*). Passing downward and slightly inwards across the tendon of the subscapularis muscle, the fibres dipped backwards below that tendon so as to become connected with the capsular ligament close to its insertion into the anatomical neck of the humerus, and was implanted upon the neck of the humerus close below the lesser tuberosity, between the *subscapularis* above, the long head of the *triceps* internally, and the *teres major* and *latissimus* (*c*) below. The latter tendons intervened between this insertion of the abnormal muscle and that of the normal *coraco-brachialis* (*b*), which was coex-

*Fig. 2.*



istent, of its usual size, and with its usual relation to the short head of the biceps. This abnormal *coraco-brachialis* I have now met with four times. In all the normal *coraco-brachialis* was present, and occupied the relation above described. In all the abnormal muscle was clearly defined by a somewhat more open areolar interval between it and the normal muscle.

A similar muscle has been observed in two subjects by Cruveilhier (*Anat. Descript.* 4to. ed. 1862, p. 659); and by Macwhinnie (*London Med. Gazette,* Jan. 30, 1846). A slip of muscle showing a tendency to the complete formation of a short *coraco-brachialis* is also mentioned by Henle under the head of variations of the *subscapularis* (*op. cit.* s. 172), as a flat slip, of a finger's breadth, attached to an abnormal tubercle of the humerus, placed below the lesser tuberosity, and connected with the ligamentous slip of fascia from the internal brachial ligament before described as bridging over the tendon of the *latissimus dorsi.* The muscular slip passed outwards and terminated tendinous upon the joint capsule and insertion of the subscapularis muscle, with which its fibres were partly blended. A like slip was observed by Theile (*op. cit.* p. 208); by Otto (*Neue seltene Beobachtungen.* s. 40. 1824); and by Gruber (*Müller's Archiv,* 1848. s. 425); but in the cases described by the two last-named authors a bundle of fibres connected with the root of the *coracoid* process was blended with the lower slip, resembling, as Henle remarks, a *coraco-brachialis.* By two of the three observers just mentioned the abnormal slip was, curiously enough, considered as a deep portion of the *deltoid.*

I find among my own sketches a slip of muscle precisely similar to that described by these authors, drawn from the left side of a muscular male subject. It is connected below very closely with the tendon of the *latissimus dorsi* and *teres major* and with the fascia on the inside of the arm.

Under the head of anomalies of the *coraco-brachialis,* Theile remarks only, apparently after Meckel (*op. cit. Muskellehre,* s. 498), that it is sometimes divided into two muscles entirely distinct, as in the monkeys.

Professor Rolleston has informed me that he has also met with a muscle answering to the abnormal *coraco-brachialis* here treated of.

The effect upon the humerus of the three portions of the *coraco-brachialis* muscle above described will vary somewhat. The median portion as usually found in the human subject, and which one may call, in reference to human anatomy, "the *coraco-brachialis proprius* vel *medius,*" acts as an adductor and elevator of the upper arm, raising it inwards and forwards towards the breast and

face. Still more extensively, by virtue of its longer leverage, will the second or long portion, which may be called "the *coraco-brachialis longus*," act upon the arm in the same direction. At the same time it will render tense the brachial fascia. The third, smallest or superior, portion will act chiefly by virtue of its backward direction as an external rotator of the humerus on its long axis during elevation of the arm, in the same direction as that of the supinators in the forearm, assisting the *infra spinatus* and *teres minor*. This action becomes more marked and important in the lower animals, in whom this form of the muscle is common, as observed by *Mivart* and *Murie* in observations on the anatomy of *Nycticebus tardigradus*, (*Proceedings of Zoolog. Soc. London*, Feb. 28, 1865.)

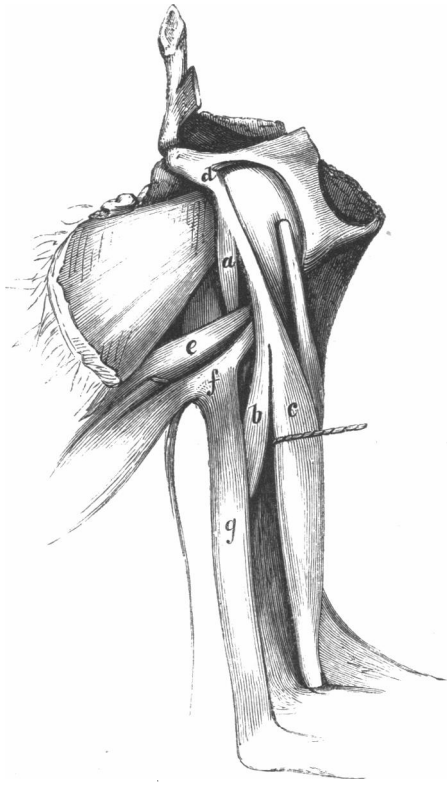
It may, therefore, justify the distinguishing name of "*rotator humeri*" or "*coraco-brachialis superior* vel *brevis*," which I have applied to this muscle. By virtue of its attachment to the lower part of the capsular ligament, the muscle will also draw it forward, and prevent its being rucked up into folds and pinched in extreme adduction, participating in this office with the lower fibres of the *subscapularis* and the outer fibres of the scapular head of the *triceps*.

The homologies of the *coraco-brachialis* in its triple form as just described are not difficult to find in the lower extremity. Viewing the coracoid as the representative either of the ischium or of the pubis, and the upper extremity as rotated backward in the manner propounded by Dr Humphry of Cambridge (*The Human Skeleton*, p. 599 and Plate), then the resemblance of the *coraco-brachialis* to the *triceps adductor femoris* is very striking. The short or upper part would correspond to the *adductor brevis*, the median portion to the *adductor longus*, and the long inferior portion to the *adductor magnus*. The resemblance of the first is increased by its backward position and its rotating influence; and that of the third by the analogous formation of a *supra-condyloid* opening (either tendinous or partly osseous), like the *adductor* opening in the thigh; for the passage of the main artery of the limb at its entrance into the space or hollow opposite the middle joint; and by the prolongation onwards to the condyle of a tendinous aponeurosis like that of the *adductor magnus*.

*Comparative Anatomy.*—I have examined the arrangement of this muscle in the bonnet monkey, the hedgehog, the cat, dog, guinea-pig, squirrel, rabbit, agouti, the three-toed sloth, armadillo, the kangaroo rat, the *Echidna hystrix*, and the *Ornithorhynchus paradoxus*.

In the *bonnet monkey* (fig. 3) the short and median varieties of the coraco-brachialis are both well marked, arising from the tendon which constitutes the coracoid head of the *biceps* (*c*). The short portion (*a*)

*Fig. 3.*




reaches by a few of its fleshy fibres the lower surface of the tip of the large and depressed coracoid (*d*), and is inserted, exactly as in the human variety, into the neck of the humerus above the tendons of the *teres major* and *latissimus* (*e* and *f*). The second or median portion (*b*) is inserted into the inner surface of humerus between the *triceps* and *brachialis anticus*, and is almost covered by the *biceps* (*c*) and *dorso-epitrochlear* (*g*) muscles. Such is its apparent dependence upon the biceps tendon for its origin, that it seems at first sight like a brachial insertion of that muscle.

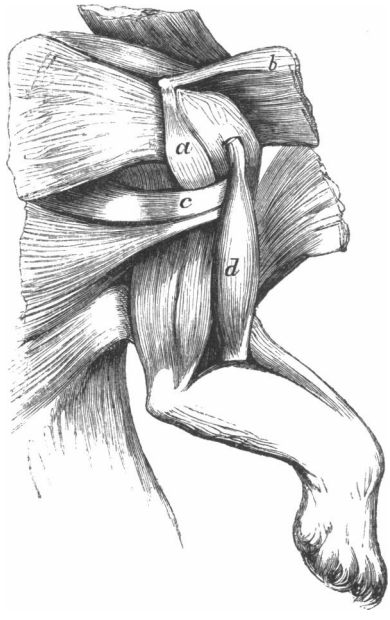
In the other *Quadrumana* this double insertion of the *coraco-brachialis* almost universally exists. It was found by Duvernoy in the *gorilla*, by Vrolik in the *chimpanzee*, and by Church in the *orang*. Its bifurcation in *monkeys* is mentioned by Cuvier (*Leçons d'Anat. Comp.* Vol. I. p. 395), and by Kuhl in *Ateles belzebuth* (*Beiträge z. Beschreibung mehrer Mammalien*, s. 16); by Burdach in the *Simiadæ* (*Berichte von der Kön. Anat. Anstalt zu Konigsberg.* s. 25), by Burmeister in *Tarsius* (s. 49, T. iij. fig. 2. 14 and 14 *b*), by Mivart in *Cercopithecus sabæus* (*Proc. Zoolog. Soc.* Jan. 10, 1865), and by

Meckel (*Traité général d'Anat. Comp.* Vol. VI. p. 281) in the *lemurs*. This author states that in the *loris* the upper or smaller one only is present, but that in the *Lemuroidæ* generally the lower or long portion is so large as to reach to the inner condyle of the humerus. This would correspond to the third form of the muscle before described. He also states that in the *magot*, the *marmozet*, the *mandrill*, *callithrix*, and *ateles*, the upper portion is separated from the lower by the tendons of the *latissimus dorsi* and *teres major*, and that the musculo-cutaneous nerve passes between them (*op. cit.* p. 282). In *Nycticebus tardigradus*, and in one of the lemurs also, Mivart and Murie found a double coraco-brachialis inserted as in the animals just mentioned. (*Proceed. Zoolog. Soc.* Feb. 28, 1865.)

In the *hedgehog* I have found the *coraco-brachialis* single, and inserted into the middle of the humerus, arising by a single pointed tendon from the small coracoid. Meckel, however, states that it is double in this animal (p. 280), and that its lower insertion is tendinous and prolonged downwards. In the three-toed sloth (*Bradypus tridactylus*) it is slender and single, and inserted *below* the *teres* and *latissimus* into the middle of the humerus, having no connection with the *biceps*. In the *armadillo* it is also single, and is implanted upon the supra-condyloid arch or foramen just above the inner condyle, thus presenting the long variety of the muscle. In the *Ruminants* it is also single, and inserted, according to Meckel, as low down as the internal condyle. In the *horse*, *camel*, and *roebuck*, however, he states that it is divided into two parts, a superficial, longer and larger one inserted very low down, and a smaller and deeper muscle. On referring to Dr A. G. Leiserung's valuable *Atlas der Anatomie des Pferdes und der ubrigen Hausthiere*, I find that he figures there in the *horse* a complete and single *coraco-brachialis* with a low insertion; and also another small slip of muscle close upon the shoulder-joint capsule, arising from the scapula below the coracoid, and inserted into the neck of the humerus. This he calls the "*Spanner des Kapsel-bandes, oder kleiner Schulter-armbein Muskel*" (Taf. 5, fig. 1). Whether this represents the real *coraco-brachialis brevis*, or a slip of muscle sometimes found in the human subject detached from the lower fibres of the *subscapularis*, I am not prepared at present to decide. In the *Hyrax capensis*, according to Mivart and Murie, it reaches to the middle of the humerus. (*Proc. Zool. Soc.* April 11, 1865.)

In the *dog* and *cat* I have found the *short* variety the only representative of the *coraco-brachialis*. It arises singly from a diminutive coracoid close to the attachment of the *pectoralis minor* (*b*), by a pointed tendon (fig. 4 *a*), which, terminating in a flask-shaped muscle, is inserted fleshy into the neck of the humerus above the *latissimus*

*Fig. 4.*



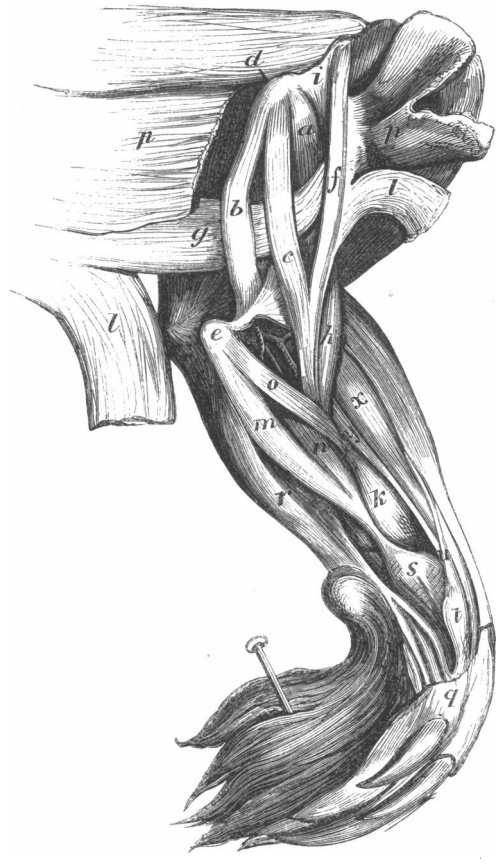

and *teres muscles* (*c*). In these, as in most of the lower mammalia, the *flexor* of the *radius* (*d*) has but one head from above the glenoid cavity, and cannot therefore be called a *biceps* muscle. Meckel states that the *coraco-brachialis* is single and very short in the *ichneumon, ratel, coati,* and *badger;* but that in the *marten* and *bears* it is double, the upper portion being inserted very high, and the lower reaching down as far as the epicondyle (*op. cit.* p. 281). This author also states that in the *otter* and *seal* he found *no* coraco-brachialis whatever. This is so singular an omission at this point of the animal scale, that it may be set down as requiring further confirmation, especially as it exists in the *Cetaceans* as a short muscle inserted close to the single brachial tuberosity. Professor Huxley found it present, though small, in the *porpoise* (*Lect. at Roy. Coll. of Surgeons*). In the *Bats* and *Moles* the short variety only represents the *coraco-brachialis.* In the *Rodents* a great variety of insertion is exhibited by this muscle. In the *guinea-pig* (*cavia aperæa*) and *rabbit* I have found it single, and inserted just below the *latissimus* and *teres,* and therefore belonging to the first or median variety. Meckel states that in the *hare* and *capybara* he has found it very short; double in the *marmot, beaver,* and *hamster,* one part inserted very high, and the other into the lower half of the humerus; and very long and strong, though single, in the *porcupine* and *squirrel,* extending, I have found, in the latter animal, as far down as the lower end of the humerus. This absence of uniformity in the *coraco-brachialis* does not coincide with

the presence or absence of the clavicle, or of the supra-condyloid foramen in these animals, but it does seem to refer to their habits, being double or longer and stronger in those which employ their fore paws for prehension.

In the *kangaroo* the *coraco-brachialis* is said by Meckel to be entirely wanting. This is the more striking, since it is present as a short variety, very small, and inserted above the *teres* and *latissimus* in the *kangaroo rat*, a closely related *Marsupial;* and in the next order of *Monotremata* we find it in its highest development. In the *Echidna hystrix* it possesses a larger proportionate bulk than in any I have yet seen. From the large coracoid bone arises a mass of muscle which at first sight might be taken for a part of the *triceps*. On further examination, however, it is found that a considerable portion of its superficial layer forms the only origin of the *flexor radii* (biceps), while the rest is inserted into the whole length of the inner side of the humerus from the tendons of the *latissimus* and *teres* down to the enormously prominent condyle. Under the lower part of its insertion is seen the small supra-condyloid foramen, as if bored through the substance of the humerus, and transmitting the brachial vessels and median nerve. Above this, the upper can be easily separated from the lower fibres in an areolar interval. The deepest portion of the muscular mass springing from the coracoid is separated from the rest by a distinct fascial interval, and forms a somewhat oval, wide, short muscle, which is implanted into the lower part of the transversely prominent inner or ulnar tuberosity of the humerus. My own dissections in this respect corroborate the observations of Mr H. G. Mivart, "On the Anatomy of the *Echidna*" (*Trans. Linn. Soc.* Vol. XXV.).

In the *Ornithorhynchus paradoxus* (fig. 5) the lower or long portion of the *coraco-brachialis* (*b*) is much smaller than in the *echidna*, the upper part of its fibres appearing to be given off to form the coracoid head of a double-headed *flexor radii*, or true *biceps* (*c*). The rest of the fibres are implanted below the brachial vessels and nerves upon the supra-condyloid arch or foramen, close above the epitrochlea (*e*), and represent the second part of the muscle as before described. The first or middle part is here wanting or incorporated with the biceps muscle. In both the *echidna* and *ornithorhynchus* the short muscle, or *rotator humeri*, called by Meckel (*De Ornithorhyncho*) the *coraco-brachialis superior*, is a very distinct and bulky muscle, of a somewhat fan-shape, springing from the broad coracoid (*d*), deeper than the biceps and longer portion, and implanted by a broad insertion into the lower border of the widely expanded inner or ulnar tuberosity of the humerus, above the insertions of the latissimus dorsi and teres major (*g*).

*Fig. 5.*




The outer or long head of the *biceps* arises fleshy from a tubercular projection placed above the capsule of the scapulo-humeral joint (*i*), which is placed between and behind it and the coracoid muscles. In the figure the *pectorals* (*p*) and the outer insertion of the *latissimus* (*l*) are cut and turned back. The action of the *rotator humeri* in these animals upon the humerus is very evident, its power of adduction being, however, limited from the close propinquity of the tuberosity of the humerus to the coracoid. The swimming and burrowing habits of these animals evidently call for much rotatory play of the arm-bones, the provision for which is found in the lower segment of the limb by the enormous size of the *supinator brevis*, especially in the *echidna*, in which animal it reaches along the whole length of the radius.

That the kind of *coraco-brachialis* muscle with which an animal is provided is not determined by its order, is seen clearly in the *Rodents*, since in them we have the short variety only in the *hare* and

*capybara*, the long variety only in the *squirrel* and *porcupine*, the median variety only in the *guinea-pig*, and two combined in the *marmot*, *beaver*, and *hamster*. Again, in the *Carnivora* we have the short variety only, as in the *dog*, *cat*, *ichneumon*, *coati*, and *badger*; and two varieties combined, as in the *martens* and *bears*.

It is somewhat remarkable also that in the *Rodentia* we have a like want of resemblance in the presence or absence of a clavicle, or an imperfect clavicle; of a supra-condyloid foramen, and of an inter-condyloid foramen, the two latter seeming to bear something of an opposing character, one being usually absent, while the other is present. The *rotator humeri* is found both in the claviculate *Quadrumana*, *Insectivora*, *Rodentia*, and *Monotremata*, and in the non-claviculate *Rodents* and *Carnivora*; while the *long coraco-brachialis* seems to be present in animals without as well as with a supra-condyloid foramen, and the double form almost equally indiscriminately found.

This very variable arrangement seems to point upon the whole much more directly to a "teleological" than to a "morphological" reason for existence, and to refer much rather to the wants and habits of the animal than to its pedigree or relationship. Those which use the fore-limbs for distinct prehension, digging, swimming, or climbing, have, as a rule, a larger and more highly developed *coraco-brachial* muscular apparatus.

*Flexor carpi radialis brevis* vel *profundus*.—In six out of about seventy subjects in the dissecting I have found an abnormal muscle on the flexor side of the fore-arm, connected with the carpus near the insertion of the *flexor carpi radialis*.

In that which I have considered as the best developed specimen, the supernumerary muscle arose from the outer side of the front surface of the radius above the *pronator quadratus*, and a little to the outside of and below the *flexor longus pollicis*. The fleshy belly of the muscle resembled in shape, and was nearly as large as that of the *flexor longus pollicis*, tapering much in the same penniform way. (See fig. 6 *a*). It terminated just above the carpus in a distinct rounded tendon, which, lying under the annular ligament upon the deep process which secludes the groove of the *flex. carpi radialis* and between it and the tendon of the *flex. pollicis*, finally spread out, and becoming flattened, was inserted into the base of the middle metacarpal bone (*c*) and os magnum, where it was connected with a slip of the tendon of the *flex. carpi radialis*, and gave origin to some of the fibres of the *flex. brevis pollicis*.

In two of the cases the muscle terminated in a somewhat smaller but equally distinct tendon, which passed with that of the *flexor carpi radialis* through the sheath in the annular ligament, was lodged

in the trapezoid groove, and became implanted on the inside of, but quite distinct from, the last-named tendon, into the ulnar side of the base of the *second* metacarpal bone. Even in this shape the muscle could not be considered as a division of the tendon, and still less of the muscular fibres of the *flexor carpi radialis,* inasmuch as its origin was so totally distinct, referring rather to the *flexor pollicis longus* in this particular.

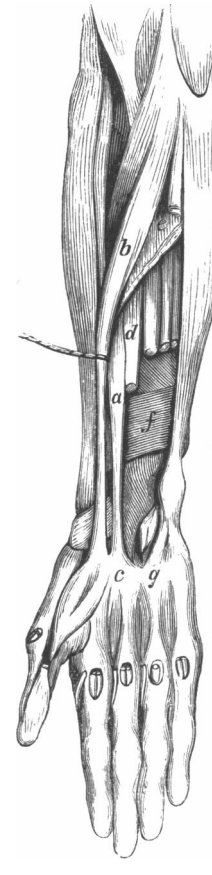
In another instance the muscle arose by a lunated aponeurosis as high as the oblique line of the radius, beneath the fibres of the radial origin of the *flexor sublimis digitorum.* The muscular belly was fusiform, beginning by a thick tendon from the lunated aponeurosis, and tapering downward rapidly into a thick flattened tendon, which was inserted into that deep process of the annular ligament which encloses the groove for the *flexor carpi radialis,* and is attached to the trapezoid, magnum, and middle metacarpal.

In another subject the fusiform muscle, having a similar origin, and lying at first on the outer side of the *flexor longus pollicis,* crossed in front of its tendon obliquely opposite the carpus, and became implanted into the deep surface of the annular ligament itself, sending numerous fibres into the deep surface of the middle portion of the palmar fascia. In the last form the abnormal muscle first presented itself to me, and I was led to consider it in the light of an abnormal palmaris, in consequence of its attachments to the deep surface of the palmar fascia. A properly formed *palmaris longus* was, however, coexistent in this case. Under the head *palmaris* Theile describes an abnormality in every respect like the last-mentioned, and lying, like it, *under* the flexor sublimis with the median nerve. In his case, however, the *palmaris longus* was absent (*op. cit.* p. 237). I had before met with a double *palmaris longus* of which the abnormal head was derived from the oblique line of the radius, but in origin and position quite *superficial* to the radial origin of the *sublimis. Rosenmüller* and *Henle* (*op. cit.*) have met with a variety somewhat similar; but in both cases the normal origin of the *palmaris* was entirely absent, and its place supplied by a tendon from the radial origin of the *sublimis.*

The subsequent discovery of other forms of this abnormal muscle forming a gradual serial transition to the complete form first described, and resulting in a distinct flexor attached to the base of the third metacarpal bone; together with the deep origin beneath the flexor sublimis of all these varieties, and the invariable presence of a normal *palmaris longus,* have induced me to form the conclusion that all these varieties belong to one type, which, in its complete development, is a *proper flexor of the third metacarpal bone.* The name of *Flexor carpi radialis brevis seu profundus* has appeared to

me most completely to include all the above-mentioned varieties:—viz. both those attached to the third metacarpal and magnum; those inserted into the second metacarpal and trapezium; and those inserted into the trapezium annular ligament and palmar fascia;—all arising from the radius, either below its middle, or from the oblique line below and beneath the radial origin of the *flexor sublimis*. In a muscular male arm which I dissected last session, now in the Museum of the Royal College of Surgeons, and from which the accompanying sketch (fig. 6) was taken, the special function of a proper flexor of the third metacarpal bone is clearly indicated by a distinct and separate insertion into the base of that bone. In the sketch the *flexor carpi radialis* (*b*) is drawn aside, shewing under it the *flexor carpi radialis brevis* (*a*), or special flexor of the middle metacarpal bone (seen at *c*), and arising from the radius beneath the radial origin of the *flexor sublimis* (*e*) outside the *flexor longus pollicis* (cut at *d*), and above the *pronator quadratus* (*f*). A few of the deep fibres of the *flexor brevis pollicis* are seen arising from the insertions of both the radial flexors. In the same arm was found a slip, given off from the tendon of the *flexor carpi ulnaris* to the base of the fourth metacarpal (*g*), as well as the usual slip to that of the fifth and annular ligament, beyond the pisiform bone. We have here then the remarkable development of a special flexor for each of the metacarpal bones (including the *opponens pollicis*). These are the more interesting in being associated in the same arm with a *special extensor* of the middle finger, and a double *extensor minimi digiti* with one of the tendons passing to the *ring finger*, thus forming a complete set of special extensors in addition to the common extensor tendons. In the leg of the same subject was a *peroneus quinti*, i.e. a tendinous slip from the *peroneus brevis* to the little toe, and an *abductor* of the fifth *metatarsal bone*, both ape-like peculiarities.

*Fig. 6*




A special flexor of the middle metacarpal bone, corresponding in all essential particulars with that just described, has been found also by Mr Norton, in a subject dissected at St Mary's Hospital during the past year.

Albinus records a case in which the tendon of the *flexor carpi*

*radialis* gave off a slip to the trapezium, and to the base of the third and fourth metacarpal bones, and *Fleischmann,* a case in which that muscle reached only to the annular ligament and the scaphoid and trapezium; quoted by Henle (*Muskellehre,* s. 191).

But I have not been able to find any mention of a distinct muscle like that under consideration in any anatomical author, English, French or German, that I have been able to consult. I have been equally unsuccessful in finding a similar muscle described by writers on the muscular anatomy of the lower animals. Nor have I found any muscle resembling it in any of the animals in which I have looked for it, except in the *Monotremata,* at a distance in the animal scale from which it is so far to fetch an homology of this kind, that I have hesitation in laying stress upon it. In the fore-limb of both the *Echidna hystrix* and the *Ornithorhynchus paradoxus,* from which latter fig. 5 was taken after dissection, I have found a second or deep head of the *flexor carpi radialis* (*n*), which seems to correspond to some extent with this abnormal human muscle. This deep head occupies entirely the position in front of the radius and interosseous ligament which is usually filled by the *flexor longus pollicis,* the latter muscle being in these animals entirely merged in the *common flexor of the digits* (*r*), which sends off from its palmar ossicle the tendon to the pollex (*q*). The deep head of the *flexor carpi radialis* is connected at its lower part by an intermuscular septum to the usual superficial portion of the muscle (*m*), and joins its tendon just above the carpal end of the radius. From thence it stretches upward, close to the radius and interosseous ligament (with which it is connected by aponeurotic fibres), and passing under the *pronator radii teres* (*o*), is placed in front of the elbow-joint, and connected with the lower end of the humerus, between it and the *supra-condyloid foramen,* through which may be seen in the sketch the median nerve and brachial vessels emerging upon the upper part of the muscle under consideration. The *brachialis anticus* (*h*) is placed externally, and is inserted in these animals entirely into the radius. The combined tendon of the superficial and deep portions of the double-headed *flexor carpi radialis* is inserted ultimately by an aponeurotic expansion into the bases of the metacarpals of the pollex (*t*), index, and middle digit, and into the trapezium. A supernumerary ossicle, however, intervenes between the tendon and its aponeurotic insertion over the site of the scaphoid-lunar bone. In the *ornithorhynchus* this ossicle is fairly imbedded in the tendon; but in the *echidna* the latter can be easily dissected from it, revealing the presence of a distinct bursal sac between it and the trapezium. In the *ornithorhynchus* also more of the deeper fibres are implanted upon the trapezium itself than in the *echidna.*

In the former animal the *pronator quadratus* (*k*) is much more developed than in the latter. One of the *radial extensors* (*v*) is connected at its insertion into the carpal bones with the expansion of the tendon of the flexor going to the pollex. The last-mentioned muscle is described by Meckel (*De Ornithorhyncho*) as a *supinator longus*. I think, however, that its want of attachment to the radius, its want of supinating power, its deep position, and its relation to the fellow muscle (*x*) of the same name, indicate its identity as one of the radial extensors of the carpus. The other radial extensor (*x*) is six or eight times larger, and its tendon is inserted into the bases of the second, third, and fourth metacarpals, so that it represents by its insertion (as is commonly found in the lower animals) *both* the radial extensors of the human subject. If this be so, in what light must we look upon the smaller muscle described by Meckel as a supinator longus? I am inclined to look upon it as the representative of a muscle which I have found occasionally in the human subject, and which I have described and figured in the paper before mentioned, in the *Proceedings of the Royal Society* of the present year, as the *extensor carpi radialis accessorius*. This muscle arises, with the ordinary *radial extensors*, from the external condyloid ridge, and is inserted into the base of the metacarpal of the pollex *with the extensor ossis metacarpi pollicis*. In the *ornithorhynchus* the tendon of the small deep muscle (*v*), though apparently lost on the dorsal surface of the scapho-lunar bone, is yet connected with a fascial expansion, which is carried onward to the base of the first metacarpal beneath the tendon of the *ext. ossis metacarpi pollicis* (*u*). In the *echidna* the corresponding muscle is considered by Mivart (*op. cit.*) to represent the *extensor carpi radialis longior*, and the much larger, and more superficial one, the *brevior*. In that animal, however, the tendon of the former (as in the *ornithorhynchus*) reaches no further than the scapho-lunar bone, while that of the *brevior* is inserted into the second, third, and fourth metacarpals. The deeper position and lower origin from the condyloid ridge of the humerus of the muscle in question, would seem opposed equally to this way of viewing it as to that of Meckel.