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The Muscles of the Fore and Hind Limbs in Dasypus sexcinctus.

By JOHN CHARLES GALTON, Esq., M.A., Exeter College, Oxford. M.R.C. S.

Read June 4th, 1868.

(Plate XLIV.)

PROFESSOR ROLLESTON, F.R.S., my friend and former instructor, having, in the early part of the present year, placed at my disposal, and afforded me every facility for dissecting in the University Museum at Oxford, a specimen of the Six-banded Armadillo (*Dasypus sexcinctus*), I now beg leave to lay before the Society the results of my investigations.

Through the courtesy of W. H. Flower, Esq., F.R.S., Conservator of the Museum of the Royal College of Surgeons, I have been enabled to check and confirm my observations by the examination of a male specimen of a *seven*-banded variety¹ of the species which forms the subject of the present communication. The left side only, however, of this specimen was available for my purpose. The Oxford specimen was also a male, which had been procured from a travelling menagerie, and had been placed in spirit in May 1866. Its weight was 5 lb. 3 oz., and the principal measurements were as follows:—

From tip of snout to extremity of tail $22\frac{1}{2}$ in.; from tip of snout to posterior border of pelvic shield 16 in.; from posterior border of pelvic shield to extremity of tail $6\frac{3}{4}$ in.; from anus to extremity of tail $7\frac{1}{4}$ in.; from tip of snout to posterior border of frontal shield $4\frac{1}{4}$ in.; length of ear nearly $1\frac{1}{2}$ in. The specimen belonging to the College of Surgeons was very slightly smaller.

¹ This specimen must be regarded, apart from a striking superficial resemblance, as belonging to the genus *Dasypus*, since it had five toes on both fore and hind feet, a prominent heel, together with evidence of a plantigrade gait, ears placed far apart, a series of small shields under the eye, and a depressed body. As the specimen was not in the condition of a skeleton, I could not with certainty determine the presence or absence of the intermaxillary tooth, so characteristic of the genus *Dasypus*. The placing of the animal in the digitigrade genus *Tatusia* (the only other alternative) was out of the question. (See Dr. Gray on the "Genera and Species of Entomophagous Edentata," Proc. Zool. Soc. 1865, p. 370 *et seq.*)

In *Dasypus encoubert* (Desm.), *D. 6-cinctus* (Linn.), "the number of moveable bands varies from seven to eight, according to the individual." (Art. ARMADILLO, Cyclopædia of Natural History, vol. i. London, 1856.)

Azara, moreover, mentions a female of this species which had seven bands. (This specimen was of the same size as another female, which possessed but the ordinary number of six bands.) He proceeds to say "J'ai vu d'autres exemples de tout ce que je cite ici; d'où il résulte que les bandes varient de six à sept, et peut-être les nouveaux nés n'en ont-ils que cinq." (Essais sur l'Histoire Naturelle de Quadrupèdes de la Province du Paraguay, par Don Felix D'Azara—traduits sur le Manuscrit inédit de l'Auteur, par Moreau Saint-Méry. Paris, 1801. Vol. ii. pp. 148–9.)

Since the first part of this note was written, I have seen, among the collection of stuffed specimens of Bruta preserved in the British Museum, one presenting all the external characteristics of, and, moreover, labelled as, *Dasypus sexcinctus*, which had seven, well-marked, dorsal bands.

My observations have been confined to the muscles connected with the fore and hind limbs only, since these are of the most importance for the determination of general and serial homologies.

Recourse has frequently been had to the beautiful plates, illustrating the myology of the Armadillo, contained in Cuvier's splendid work upon Comparative Anatomy¹; but I had better here, since I concur in the conclusion, borrow the language of a countryman of the great anatomist, in order to clear myself completely from suspicion of being biased by insular prejudices: "Mais les dessins qu'il en donne sont assez imparfaits, et n'ont pu nous être que d'un faible secours"².

Rapp, in his excellent monograph on the Edentata³, has described the muscles of the limbs in *Myrmecophaga tamandua* only; but I shall nevertheless have, from time to time, occasion to refer to his descriptions, for the purpose of comparison.

Upper Extremity.—Great extent of motion seems denied to this member; for, upon reflecting the skin merely, the forearm will be found flexed upon the arm, and this latter again closely applied to the side and bound down by fascia, leaving perfectly free and unembarrassed movement to the carpal joint only. The forearm, moreover, does not appear to be capable of being extended from the upper arm to a greater degree than a right angle. This limitation of motion seems to be in a great measure due to the high attachment along the humerus of the *extensor carpi radialis*. With regard to the rotation of the forearm, the extent of supination is small; and this is probably owing to the hindrance occasioned by the attachment of the *pronator teres*—the utmost limit attainable being a position exactly halfway between that of extreme pronation and supination, the palm of the hand facing inwards towards the body. The impingement of the olecranon against the external condyle of the humerus however, appears, to be the greatest obstacle to complete supination.

The complete absence, too, of a *pronator quadratus*⁴ in this animal must be associated, in the way either of cause or of effect, with the limitation of rotation of the forearm, as also the very feeble condition of the *supinator brevis*, which is rendered the more striking by the full development of surrounding muscles, and notably of its antagonist, the *pronator teres*,—a condition to be regarded by some as the expression of a pre-determined plan⁵, by others as the promise of future increase⁶, and by others, again, as the sole heirloom remaining to posterity out of the substance of a neglected property⁷.

¹ Cuvier, Laurillard et Mercier, 'Anatomie Comparée, recueil de planches.' Fol. Paris, 1855.

² Georges Pouchet, 'Mémoires sur le Grand Fourmilier.' I^e livraison. Paris, 1867.

³ Anatomische Untersuchungen über die Edentaten, von Wilhelm von Rapp. Tübingen, 1852.

⁴ In compensation for ("dagegen") this, however, according to Meckel, the *pronator teres* is very broad, and has an extensive insertion. (System der vergleichenden Anatomie. Halle, 1828. Dritter Theil, p. 530.)

⁵ "As the study of comparative osteology leads us to the conclusion that there is a typical skeleton, of which all vertebrate skeletons are modifications, so the study of myology teaches us that there is a typical vertebrate *myozoon*, of which the individual vertebrate muscular systems are modifications." (Dr. A. Macalister, "Contributions towards the formation of a correct system of Muscular Homologies." Ann. & Mag. of Nat. Hist. 4th ser. vol. i. p. 314.)

⁶ See Agassiz on "Prophetic Types." (Essay on Classification. London, 1859: p. 175.)

⁷ See Darwin, 'Origin of Species,' 3rd ed. London, 1861, p. 151 *et seq.*, also p. 487; 'Variation of Animals and Plants under Domestication,' London, 1868, vol. ii. p. 317. Paget, 'Lectures on Surgical Pathology,' edited by Dr.

Rhomboidei.—These muscles appear to have been fused together into one, and are, moreover, scarcely to be differentiated from the upper portion at origin of the *latissimus dorsi*. They take origin from the spines of the six upper dorsal vertebræ—that part which arises from the two uppermost being fleshy from the beginning, while the rest of the muscle takes origin from an aponeurosis continuous with that from which the *latissimus dorsi* arises. They are inserted into the whole length of the base of the scapula.

This fusion of the *rhomboides* into one muscle occurs, according to Church¹, in animals as high in the scale as the Orang and Chimpanzee. Meckel², however, describes these muscles as distinct in the Armadillo, the anterior passing to the occiput, the posterior being fused with the *latissimus dorsi*.

Henle states³ that Albinus has seen the *rhomboides major* fused with the upper edge of the *latissimus dorsi* in Man.

Occipito-scapular.—This muscle, which is slightly, but not very clearly, indicated by Cuvier⁴ as the “*rhomboides de la tête*,” is enormously developed. It arises from the whole extent of the occipital crest, being covered by that portion of the *trapezius* which takes origin here, and is inserted, partly into the fascia covering the *supraspinatus*, partly into the upper angle of the base of the scapula. Each muscle meets with its fellow in the middle line.

This muscle, I think, answers to one which Mr. Wood has described⁵ under the same title as having occurred as an “abnormality” in Man. The same author found a like muscle in the Rabbit, which resembles that described by Krause, in his monograph upon the same animal⁶, as the “*levator scapulæ minor*,” except that the latter is inserted as low down as the inferior angle of the scapula. A similar muscle has been found by Mr. Mivart and Dr. Murie in the Hare and Guinea-pig, as well as in the Rabbit, and is termed by them “*rhomboides capitis*”⁷.

Levator scapulæ.—This appears to be a muscle distinct from the preceding. It is very fleshy, and takes origin from certain of the lower cervical vertebræ; it is inserted into the inner face of the superior angle of the scapula, and also along the posterior half of the superior costa of the bone. Cuvier notices this latter mode of insertion⁸, and remarks that in mammals the muscle is rarely distinct from the *serratus magnus*, of which it is, properly speaking, but an anterior offset. Meckel⁹ describes this muscle as entirely distinct from the *serratus magnus*, of which, however, it appears at first sight to be a factor.

Turner, London, 1863, p. 91. Herbert Spencer, ‘Principles of Biology,’ vol. i. p. 387, London, 1864; vol. ii. p. 359, London, 1867.

¹ Natural History Review, no. iv. Oct. 1861, p. 511.

² Syst. der vergleich. Anat. (Halle, 1828), dritt. Theil, p. 483.

³ Muskellehre, p. 27: Braunschweig, 1858.

⁴ *Op. cit.* pl. 259. fig. 2.

⁵ Proc. Roy. Soc. May, 1867, p. 520.

⁶ Anatomie des Kaninchens (Leipzig, 1865), p. 104.

⁷ “Anatomy of the Crested Agouti,” Proc. Zool. Soc. June 1866, p. 393.

⁸ Leçons d'Anatomie Comparée, 2^{me} éd. Paris, 1835, tom. 1. p. 370.

⁹ *Op. cit.* p. 478.

The *serratus magnus* appeared to be in two distinct divisions, with which the preceding muscle seemed at first sight to be incorporated as a third factor. Both are thin and fan-shaped, and both are inserted into the sabre-like inferior angle of the scapula, the upper overlapping the lower at insertion. The latter factor arose from the third to the sixth ribs inclusive, posterior to their cartilages, while the origin of the former was confined to the first and second ribs.

Though not strictly under the same category as the muscles of the shoulder, the *omo-hyoid* may, I think, be noticed here, since one of its normal attachments is at the superior costa of the scapula. I did not succeed in finding this muscle in the Armadillo, and therefore conclude that it is absent. Both Meckel and Cuvier are silent with respect to its presence or absence in this animal; but both say positively that in the Sloths it is entirely absent—"manque tout-à-fait."

The latter author describes this muscle in the Anteater¹ (species not given); but Professor Owen makes no mention of it in his description of the muscles of the tongue of *Myrmecophaga jubata*².

Trapezius.—This muscle is well seen on reflecting forward over the head the scapular shield. Its fibres are coarse, and it appears to be made up of two distinct factors.

The upper, corresponding to the "portion occipitale" of Cuvier³, arose from the cellular tissue in the middle line of the cervical region, for about five inches below the occiput, and was inserted along the principal spine of the scapula as far as the end of the acromion—the whole extent of its acromially inserted portion being overlapped by an offset from the upper part of this factor of the muscle, which passed under the terminal portion of the *acromio-basilar* to become finally lost in the strong fascia which invests the shoulder and arm.

The lower, which answers to the portion termed "dorsale" by Cuvier, took origin from the neural spines of the third and succeeding dorsal vertebræ, and from a strong fibrous aponeurosis stretching between the spines and metapophyses of the lumbar vertebræ. It then passed upwards and outwards to be inserted by a broad triangular tendon along the posterior half of the principal spine of the scapula, being slightly overlapped here by the occipital portion of the muscle. In the specimen from which I took these notes, the fibres of the first-described portion of the muscle were pale in colour, while those of the dorsal factor were of a deep rich reddish-brown tint. This contrast may only be due to a difference in the stages of decomposition undergone by the two divisions of the muscle; but it, nevertheless, seems to point to some slight want of completeness in the harmony of their relationship.

No fibres of this muscle are inserted into the clavicle. According to Meckel⁴ the *trapezius* has an insertion into the posterior half of this bone in the Anteater, and into its rudiment in the *Ai*.

¹ *Op. cit.* tome iv. 1^e partie, p. 490.

² "On the Anatomy of the Great Anteater," *Trans. Zool. Soc.* July 1854.

³ *Anat. Comp.* pl. 259. fig. 2.

⁴ *Op. cit.* p. 468.

The clavicular portion of the muscle is, moreover, wanting, according to Pfeiffer¹, in many Apes and Lemurs, in Bats, in the Hedgehog, Hystrix, and Arctomys.

The *acromio-basilar* is very distinct, and is fairly developed. It takes origin from the lateral ridge of the supraoccipital bone, and passes thence obliquely downwards and outwards to be inserted tendinously into the strong downwardly directed tubercle at the base of the acromion—"metacromial process" of Parker².

Not far from its termination it passes over that part of the occipital division of the *trapezius* which is detached to join the fascia of the arm.

Cuvier evidently considered this muscle to be a factor of the *trapezius*, seeing that it is lettered by him in his plates³ as its "portion cervicale."

According to Meckel⁴ the *acromio-basilar*, to which he has given no distinct designation, is to be regarded, either as a portion of the *trapezius*, or as a muscle *sui generis*. The first of these views, he holds, receives support from the arrangement of the muscle in the Otter, in which animal it springs from the internal face of the *trapezius*—this latter being consequently differentiable into an external and internal layer. He does not agree with Cuvier that it is a *levator scapulae* carried far forward, because, 1, of its coexistence with that muscle in all animals where it is present; 2, of its superficial position in the Makis and certain Apes.

Church⁵ found a representative of this muscle in the Orang; and Wagner, according to Henle⁶, discovered in the human subject an accessory portion of the *trapezius* which passed to the acromion from the mastoid process.

Levator claviculae.—A fairly developed muscle, which takes origin from the strong fibrous aponeurosis covering the occipito-parietal region of the skull, immediately to the outside of the origin of the preceding muscle. It then runs along close to the outer edge of the *cleido-mastoid*, and parallel with it, and is inserted into the clavicle, just external to the terminal portion of the muscle.

Cuvier gives a very fair representation of it on the right side of his figure (pl. 260, Anat. Comp.), but attaches to it neither letter nor sign.

Cleido-mastoid.—Is a comparatively broad and flat muscle, arising from the mastoidal portion of the temporal bone, posterior to, and overlapped by, the origin of the *sterno-mastoid*. It passes down, slightly and gradually diverging from this muscle, to be inserted into the sternal third of the clavicle, a slight interval being left between the inner limit of its insertion and the sterno-clavicular articulation.

Sterno-mastoid.—Arises from the mastoid process of the temporal bone, in close contiguity to, but covering, the preceding muscles at origin. Though running in company with the above at first, it gradually parts company, and is finally inserted along the upper edge of the manubrium. Certain fibres, however, which are derived from the anterior free edge of the muscle, are continued over the *pectoralis major*, to meet a similar prolongation from the *sterno-mastoid* of the opposite side, and to be finally

¹ Zur vergleichenden Anatomie der Schultergerüsts und Schultermuskeln. Hermann Pfeiffer. Giessen, 1854: p. 13.

² Vide A Monograph on the Structure and Development of the Shoulder-girdle and Sternum in the Vertebrata. Ray Soc. 1868: p. 203.

³ Anat. Comp. pl. 259. fig. 2.

⁴ Op. cit. p. 481.

⁵ Loc. cit. p. 512.

⁶ Loc. cit. p. 24.

inserted, in company with the above prolongation, along the whole length of the manubrium in the middle line. This last-described element of the muscle, by overlapping that portion of the *pectoralis* which takes origin from the manubrium, and those fibres of the *sterno-mastoid* which terminate along the upper edge of this sternal factor, aids in the formation of a kind of muscular sac, having the concavity looking outwards.

Meckel describes the *sterno-* as distinct from *cleido-mastoid* in *Dasypus*; and states that both these factors of the compound muscle, especially the first, are of great thickness. The *sterno-mastoid*, according to him, is attached along the whole of the first third of the sternum. This muscle is also double in the Anteater; but the *sterno-mastoid* in the Aï has this peculiarity, that at its upper part it splits into two pointed heads (Zipfel), between which lies the styliform process¹.

The *sterno-cleido-mastoid* is clearly represented by Cuvier in one of his plates².

This muscle, in *Dasypus sexcinctus*, has no relation whatever, either of contiguity or continuity, with the terminal portion of the *rectus abdominis*³.

Subclavius.—A very stout fleshy muscle. It arises from the irregularly oval and roughish depression seen at the expanded anterior termination of the first rib, also from its superior edge, for a short distance. It then passes obliquely outwards over the axillary vessels and nerves, and, dipping beneath the clavicular portion of the *deltoid*, with which it makes exactly a right angle at the point of crossing, passes to its insertion. It is inserted by a flat tendon along the whole extent of the upper ridge of the long acromion process of the scapula, and becomes, moreover, continuous with the strong fascia which covers the head of the humerus, and which is also lost over the *supraspinatus*. The strong coraco-clavicular ligament passes across through the substance of the muscle, close to the insertion of the latter, splitting it into two unequal portions, the smaller and anterior of which dips under the ligament to join its tendon, while the largest portion, comprising about two-thirds of the muscle in this part of its course, passes over the ligament.

Meckel makes no mention of the presence or absence of this muscle in *Dasypus*.

The smaller factor of a muscle in *Dasyprocta cristata*, termed by Mr. Mivart and Dr. Murie, in their paper on this Rodent⁴, *sterno-scapular*, has great resemblance to the muscle in *Dasypus* which I have called *subclavius*. This factor of the *sterno-scapular*, which may be the *subclavius*, as the above authors, following Meckel⁵, suggest, arose "from the outer side of the base of the manubrium and from the cartilage of the first rib," and, at about an inch beyond the distal end of the clavicle, united with the larger portion of the muscle, with which it was inserted "close to the anterior vertebral angle of the scapula. Some fibres pass over the supraspinatus, and are attached by fascia to the spine of the scapula."

The *subclavius* was absent in a specimen of *Myrmecophaga tamandua* (non-clavicate)

¹ *Op. cit.* p. 422.

² *Op. cit.* pl. 260.

³ For the bearings of this point see Prof. Turner's paper "On the Musculus Sternalis," Journ. of Anat. and Phys. vol. i. p. 250, 1st series. Cambridge 1867.

⁴ "On the Anatomy of the Crested Agouti," Proc. Zool. Soc. June 1866, p. 398.

⁵ *Op. cit.* p. 444.

which I examined at the University Museum at Oxford. Rapp, moreover, in his monograph on this species of Anteater, makes no mention of this muscle; nor does Cuvier figure it in his plates of the myology of this animal.

The *subclavius* is not mentioned in M. Pouchet's monograph upon the (also non-clavicate) *M. jubata*¹.

With regard to the clavicate *M. didactyla*, Meckel, in his monograph on this species², makes no mention of the muscle in question; nor does Cuvier represent it in his drawings of this animal's anatomy.

In a specimen of the Two-toed Sloth (*Cholæpus didactylus*) which I examined at Oxford, I found the *subclavius* in the form of a long and slender fusiform slip, which passed from the first rib to be inserted into the scapular third of the clavicle, and into the acromial process of the scapula.

Cuvier, in his plates illustrating the myology of *Bradypus tridactylus*, gives a figure of a muscle which has a slight resemblance to the *subclavius*, but attaches to it the symbol of the *pectoralis minor*³.

In the Wombat (*Phascolomys wombata*) "the subclavius arose by two heads, one a very delicate one, arising from the lower ribs and passing vertically upwards to end in a fine tendon; the other, a thick fleshy one, arose from the first rib and was inserted into the outer end of the clavicle, and, by means of fascia covering the supra-spinatus, into the whole length of the spine of the scapula"⁴.

In the Porcupine this muscle is of great length, strap-shaped, of nearly uniform breadth. It arises from the costal portion of the first rib, has a slight attachment to the scapular extremity of the clavicle, and is finally inserted, by means of a thin tendon, along the spine of the scapula, becoming continuous, moreover, with fascia which covers the *supraspinatus* and which is also attached to the anterior edge of the scapular factor of the *deltoid*. Upon reaching the shoulder the muscle broadens, and continues of this increased breadth until it reaches its insertion over the *supraspinatus*.

The termination of this muscle in the above rodent is very fairly represented by Cuvier in one of his plates⁵.

In Gratiolet's monograph upon the Hippopotamus, there is a muscle described under the name "scapulo-sternal," which arises from an aponeurosis covering the muscles of the supraspinous fossa of the scapula, and attached to the border of the coracoid and acromion, and terminates at the manubrium of the sternum. The following footnote is appended to the description of this muscle:—"Ce muscle dont l'insertion s'étend sur le cartilage de la première côte, représente probablement le *sous-clavier*"⁶.

¹ Mémoires sur le Grand Fourmilier, par Georges Pouchet. 1^e livraison. Paris, 1867.

² J. F. Meckel, "Anatomie des zweizehigen Ameisenfresser," Archiv für die Physiologie, fünfter Band (Halle und Berlin, 1819).

³ *Op. cit.* pls. 252, 253.

⁴ The above extract is taken, by kind permission of Prof. Rolleston, from one of the volumes of the 'Student's Note Book,' which is kept in the biological department of the University Museum at Oxford, for the purpose of recording anatomical and physiological observations of importance.

⁵ *Op. cit.* pl. 229. fig. 2.

⁶ Gratiolet, 'Recherches sur l'Anatomie de l'Hippopotame,' publiées par les soins du Dr. Edmond Alix. Paris, 1867: p. 256.

Deltoid.—This muscle appears to consist of three factors, which are as follow :—

1. *Clavicular*, a flat muscular slip, arising from the acromial extremity of the clavicle. It has a rhomboidal (but almost approaching a triangular) shape, and narrows in breadth towards its insertion into a smooth oval facet situated on the outer aspect of the deltoid trochanter of the humerus. This portion of the muscle, before its insertion, fuses with the rounded superior portion of the *pectoralis major*, at the termination of this latter, and with the factor of the *deltoid*, next to be described.

2. *Acromial*, a stout, fleshy, subcylindrical muscle, arising, slightly tendinous at origin, from the posterior half of the long acromial offset of the scapula, immediately in front of the "metacromial process" of Parker. It passes obliquely forward, and, after fusing with the clavicular factor of the *deltoid*, shares with it its insertion.

3. *Scapular*. This, the largest factor of the muscle, is triangular in shape, and arises from the whole length of the outer side of the principal (superior) spine of the scapula, from its termination at the base of the bone to its origin at the spring of the acromion; being overlapped for the last inch and a half of its origin by the dorsal portion of the *trapezius*. It passes obliquely forwards, narrowing very rapidly from its broad base, to be inserted into the ridge bounding the facet which gave insertion to the two former factors of the muscle, but becomes, moreover, continuous with the fascia of the arm, to which the occipital portion of the *trapezius*, as already described, furnishes a contribution. This factor of the *deltoid* overlaps that portion of the acromion which affords origin to the factor which I have termed *acromial*.

Supraspinatus.—This muscle has no peculiarities worthy of record. It arises from the whole of the supraspinous fossa of the scapula, and has a very broad fleshy insertion into the upper edge of the external tuberosity of the humerus.

Infraspinatus.—In the small infraspinous, or rather *interspinous*, fossa which lies between the greater and lesser spines of the scapula, arises the above muscle, which is inserted into the outer tuberosity of the humerus, at a point a little above that of the termination of the muscle next to be described.

Teres minor.—A muscle of no great breadth, arising from the whole length of the lesser (inferior) spine of the scapula, above the origin of the "long" head of the *triceps*. Passing forwards, parallel with the ridge from which it takes origin, it is inserted into a spinous projection below the outer tuberosity of the humerus, developed upon a ridge which runs upwards from the outer edge of the deltoid trochanter. Overlapping the origin of the "long" head of the *triceps*, and, close to its insertion, the origin of the external factor of the same muscle, it is overlapped in turn by the most posterior (*scapular*) portion of the *deltoid*.

Subscapularis.—This muscle takes its ordinary origin from the inner aspect of the scapula, and is inserted by a broad tendon into the inner tuberosity of the humerus.

Teres major.—Arises from the posterior triangular space lying between the lesser (or inferior) spine of the scapula and the inferior angle of the bone¹. At their origin,

¹ "L'angle postérieur des *tatous* est remarquable par sa courbure et sa saillie aiguë." (Cuvier's *Leçons*, 2nd ed. *loc. cit.* p. 352.)

its fibres fuse with that most posterior factor of the *triceps* which joins the *latissimus dorsi* as this latter gives off its *dorso-epitrochlear* contingent to the elbow, also with that portion of the *latissimus dorsi* which passes up to the usual insertion at the shaft of the humerus.

It is inserted tendinously into the humerus, immediately below the latter muscle.

Latissimus dorsi.—This muscle arises from the “metapophyses” (Owen) of the lumbar vertebræ, and from the lumbar aponeurosis, between those posterior fibres of the dorsal portion of the *trapezius* which terminate in this aponeurosis and the anterior fibres of origin of the *gluteus maximus*—also from fascia which lies beneath the factor of the *trapezius* mentioned above, and which covers one of the longitudinal dorsal muscles. Its upper fibres of origin are scarcely, if at all, to be differentiated from the lowermost portion of the *rhomboidei* muscles, or muscle.

Certain fibres, moreover, take origin from the bony elements of all the true ribs from the fifth downward, those which arise from the fifth to the ninth inclusive passing straight upwards towards the tendon of insertion of the muscle.

The whole of the outer aspect of the thorax is, in short, completely covered by the fibres of this muscle.

Those costal elements which derive their origin from the ribs posterior to the ninth, and that portion of the muscle which arises from the dorsal region of the trunk, pass together obliquely upwards and onwards, and contribute mainly to the formation of the well-developed *dorso-epitrochlien*. This cubital offset from the *latissimus dorsi*, after dropping a few fibres in the fascia covering the elbow, is continued over this process, and proceeds for some distance along the inner aspect of the forearm, to be finally lost in the fascia of this region.

Those costal fibres mentioned above as taking origin from the ribs between the fifth and ninth inclusive, after fusing with the proximal portion of the *dorso-epitrochlear* branch, and also very slightly with the *teres major*, at its origin, pass gradually into the terminal tendon of the *latissimus dorsi*—which, after passing under the axillary vessels and nerves, is inserted into the shaft of the humerus, on its inner aspect, a little below, and to the outer side of, the insertion of the “short” variety of the *coraco-brachialis*, and above that of the *teres major*.

Certain muscular fibres take origin from the ribs between the fifth and ninth inclusive, anterior, but close, to those costal elements of the *latissimus dorsi* already described as arising from the same ribs, and pass straight upward to that portion of the broad terminal tendon of the *pectoralis major* which has the highest insertion into the humerus.

Cuvier's representations of this muscle are clear, and agree very fairly with my observations¹. The costal slip, last described, is figured very distinctly as passing, outside the *external oblique*, upwards, and slightly outwards, over the axilla, over the *coraco-brachialis* and *biceps*, to be inserted into the humerus above, but in company with, the upper part of the tendon of insertion of the *pectoralis major*, of which muscle, moreover, if his appended symbols do not belie his meaning, Cuvier apparently considered it to be a factor.

¹ Anat. Comp. pl. 259. fig. 2, and pl. 260.

Now Meckel, in his description of the *pectoralis major* in the "Tatu," says expressly that this muscle has no origin from the ribs¹; besides this, the costal slip above mentioned bears very great resemblance to one of those offsets from the *latissimus dorsi*, (the "Achselbogen" of German anatomists) which are by no means uncommon in the human subject as slips which pass from this muscle over the axillary vessels and nerves to join the tendon of the *pectoralis major* at its insertion. Mr. John Wood has described several such in papers read before the Royal Society, and has, moreover, suggested² that these are "imperfect developments of the so-called *dorso-epitrochlear* muscle of the lower animals." The coexistence, however, with this muscle of the costal slip which I have described above, could hardly be cited in support of such a conclusion.

Cuvier's figure of the prolongation of the *dorso-épitrochlien* into the forearm, and of its fascial termination in this region, is most distinct³.

Meckel describes the *latissimus dorsi* in *Dasypus* as coming from the vertebral column, from the second thoracic vertebra, and from the third to the last rib. It then splits itself into two fascicles, one for the humerus, the other for the whole anterior half of the ulna and the antebrachial aponeurosis, which last is very broad⁴.

I have examined the *dorso-épitrochlien* in the Tamandua, "Unau" (or Two-toed Sloth), and Wombat. In the former animal, as in *Dasypus*, this muscle became continuous with the fascia of the forearm. Rapp describes it, in the same species, as taking origin, in company with the *teres major*, from the scapula, and being inserted at the olecranon. He proceeds to state that "ein Theil seiner Sehne geht in die *Fascia* des Vorderarms über, die er spannen kann"⁵. The same muscle is represented by Cuvier, in his figures of the Two-toed Anteater, as being continued a long distance into the forearm⁶.

In *Choloepus didactylus* this muscle consists of a thin somewhat cylindrical slip, being rolled on itself, and is inserted principally into the anterior ridge bounding the supracondyloid foramen, and partly into the humerus, above the foramen, a little below the insertion of the *coraco-brachialis*, between which terminal portions of the muscle the median and ulnar vessels and nerves pass. This muscle has no prolongation into the forearm. A similar supracondyloid termination is figured in one of Cuvier's plates of the myology of *Bradypus tridactylus*⁷.

In the Wombat the *dorso-épitrochlien* terminates at the olecranon, previously blending with the tendon of insertion of the most posterior division of the *triceps*. A slip is, moreover, sent from the most anterior portion of the *latissimus dorsi*, over the axillary vessels and nerves, to join the highest part of the tendon of the *pectoralis major*. This may belong, however, to the *panniculus carnosus*; but this latter is so closely blent with the anterior edge of the *latissimus dorsi*, that it is difficult to determine satisfactorily the nature of the muscle in question.

Henle figures, in his work upon human anatomy, a tendinous offset passing from the beginning of the tendon of the *latissimus dorsi* to that of the "long" head of the *triceps*

¹ "Von den Rippen kommt er dagegen nicht." Vergleich. Anat. loc. cit. p. 508.

² Proc. Royal Soc. June 1866, p. 231.

³ Op. cit. p. 48.

⁴ Op. cit. pl. 260.

⁵ Op. cit. pl. 258. fig. 1.

⁶ Op. cit. p. 502.

⁷ Op. cit. pl. 253.

(*m. anconeus longus*), which is probably a representative of the *dorso-épitrochlien* of lower animals¹.

Pectoralis major.—This muscle takes origin from the whole length of the sternum, manubrium included, in the middle line, from the ensiform process, and from the upper half of the abdominal aponeurosis which forms the anterior wall of the sheath of the *rectus*.

There is no clavicular origin.

A few delicate riband-like fibres appear to be derived from the outer side of the muscle, which run down in an almost straight direction on either side along the abdomen, to be eventually lost in the fascia of the inguinal region. These may, however, more properly belong to some deep-lying element of the *panniculus carnosus*.

The *external oblique* joins the aponeurosis at the point where the lowest fibres of the *pectoralis* terminate.

The *pectoralis* is thickest in the region of the manubrium sterni, and gradually thins as it nears the lower region of the thorax and the abdominal aponeurosis.

The muscle is inserted into the humerus by a broad, thin tendon, along the sharp inner edge and hamular projection of the deltoid trochanter, being, as in man, folded upon itself; so that its thin lower margin has the highest attachment, while the thick, rounded, upper border is inserted much lower down, so as to fuse with the *deltoid* muscle at its termination. The tendon, at its highest part, becomes continuous with a shining aponeurosis which covers the head of the humerus.

Meckel, in his description of this muscle in the "Tatu,"² attaches some importance to the fascicle which arises from the ensiform process—"den er kraftvoll emporhebt, was, wenn das Thier zusammengekugelt ist, für das Athmen wichtig ist." This is applicable, however, to *Tolypeutes* alone, no other Armadillo being known to possess, or rather to exercise, the faculty of rolling itself together into a ball³.

In a representation of each of the two genera of Monotremata, namely, a specimen of *Ornithorhynchus paradoxus*, and of *Echidna setosa*⁴, which I was enabled through the kindness of Prof. Rolleston to examine at Oxford, I have found the downward prolongation of the muscle into the abdominal aponeurosis. In both cases, however, this portion was naturally differentiated from the pectoral factor of the muscle—so much so

¹ Muskellehre, p. 182, and fig. 88.

² *Op. cit.* p. 508.

³ "Die Schuppenthier (the *Manis*) und *Dasypus tricinctus* können sich zusammenrollen, wie ein Igel."—*Rapp. op. cit.* p. 64.

Darwin says of this species (under the name of "*Apar*"), "It has the power of rolling itself into a perfect sphere, like one kind of English Woodlouse."—*The Voyage of a Naturalist round the World*, p. 96, 2nd ed. London, 1845.

"One species only" according to the 'Cyclopædia of Natural History,' *loc. cit.*, article "Armadillo," "has the faculty of rolling itself up into a round ball like a hedgehog." This is, further on, stated to be the Three-banded Armadillo. Azara, *loc. cit.* p. 197, says of this, his eighth species, "Beaucoup de personnes l'appellent *bolita* (petite boule) parce que c'est l'unique Tatou, qui lorsqu'il craint, ou lors qu'on veut le prendre, cache sa tête, sa queue et ses quatre pieds, formant de tout son corps, une boule," &c.

He says further on (p. 199), "Il y a trois bandes mobiles."

⁴ For descriptions of the above species (?) see Gould's 'Mammals of Australia,' vol. i.; Waterhouse's 'Nat. Hist. of the Mammalia,' vol. i. p. 47; List of Mammalia in British Museum (Lond. 1843), p. 192.

that Prof. Rolleston proposed for it the distinctive term "pyramidal" portion—a name derived from the muscle subjacent to the aponeurosis with which it was continuous.

Reptiles and Batrachians, as well as Mammals, are able to furnish instances of the modification of the *pectoralis major* mentioned above.

I have found a like downward continuation of the *pectoralis* into the aponeurosis covering the *rectus abdominis* in a young Crocodile; and Ecker, in his Monograph upon the Frog, describes and figures under the name "portio abdominalis" (*abdomino-huméral*, Dugès) a similar prolongation of this muscle, "welche mit der Aponeurose des *M. obliquus abdominis externus* in Verbindung steht"¹.

Pectoralis minor.—I did not succeed in finding any representative of this muscle.

According to Meckel, this muscle is absent in *Myrmecophaga* and *Bradypus* among Edentata, among Marsupials, in the Opossum and Kangaroo, and in most Rodents. Further on, he describes in *Dasypus* a muscle which passes from the first rib, under the *pectoralis major*, to the humerus, where it finds insertion above this latter muscle. A similar muscle is present in *Arctomys*, but arises from the middle region of the sternum. Meckel suggests that this muscle may not be the *pectoralis minor* after all, but a differentiated portion of the great *pectoral*². May it not be, however, the *subclavius*?

Coraco-brachialis.—This muscle arises from the coracoid process of the scapula by a strong and fair-sized tendon. About the distance of half an inch from its origin, where muscular fibres begin to blend with the tendon, a delicate slip is given off from the inner side of the muscle, which winds round beneath the inner tuberosity of the humerus, to be inserted into the neck of the bone, or capsule of the joint, at a point between the articular head and the above tuberosity. This muscular offset evidently represents the "short" variety, as it has been termed by Mr. John Wood. At the distance of an inch after giving off the above muscular slip, the *coraco-brachialis* joins the *biceps*, and is partly continued with this muscle into the forearm, partly is prolonged, as a considerable slip, to the ridge which runs upward from the inner condyle to form the anterior boundary of the supracondyloid foramen. This, the "long" variety of the muscle, is the only form recorded by Mr. Wood³ as being present in the Armadillo, of which, however, the species examined is not mentioned. The "short" variety of the muscle was present, in a condition of equal development, on both sides in the Oxford specimen of *Dasypus sexcinctus* which I examined, and on the left side (the only side available for dissection) of the specimen belonging to the Royal College of Surgeons.

I have omitted to state that a few fibres of the terminal portion of the "long" variety were inserted into the posterior boundary of the condyloid foramen, and at a higher level than those which terminate at the anterior ridge, and are separated, moreover, from these latter by the median vessels and nerve.

¹ Die Anatomie des Frosches. Von Dr. Alexander Ecker (Braunschweig, 1864). 1ste Abtheil. p. 95, fig. 73.

² *Op. cit.* pp. 490–91.

³ "In the Armadillo it (the *coraco-brachialis*) is also single, and is implanted upon the supracondyloid arch or foramen just above the inner condyle, thus presenting the long variety of the muscle."—On Human Muscular Variations and their Relation to Comparative Anatomy. By John Wood, F.R.C.S.—Journ. of Anat. and Phys. 1st ser. (Cambridge, 1867) vol. i. p. 51.

The *coraco-brachialis* in *Cholæpus didactylus* is a thin, cord-like muscle of uniform size, and, like its homologue in *Bradypus*, as described by Mr. Wood in the paper to which I have already made reference, represents the ordinary or *middle* variety only of the muscle.

Among other animals in which, through the kindness of Prof. Rolleston, I have been enabled to examine and make sketches of this muscle are *Macropus tamandua*, *M. ruficollis* (var. *Bennetti*¹), *Phascolomys wombata*, and a specimen of *Hystrix (crinata)*, I think).

In the *Tamandua* this muscle arises from that portion of the superior edge of the scapula which is anterior to the omohyoidean notch (or foramen), and which may represent a rudimentary coracoid, in company with the *biceps*. It then passes over the inner tuberosity, completely covered by the fibres of insertion of the *subscapularis*. Upon a level with the superior edge of the *latissimus dorsi* the muscle divides, the inner portion passing down straight, but gradually widening to its insertion above the inner condyle, while the outer branch joins the *biceps* at about the level of the condyloid foramen. Upon reflecting those fibres of the *subscapularis* which cover the *coraco-brachialis* as it passes over the inner tuberosity, there may be seen a delicate band of muscular fibres, which arises in the acute angle made by the tendons of origin of the *biceps* and the preceding muscle and appears to take rise from the common aponeurosis of origin of these two muscles, and which is inserted into the outer portion of the inner tuberosity of the humerus². Its fibres are as nearly parallel to those of the *subscapularis* as those of any broad muscle can be which converge towards their termination. Is this slip to be regarded as an outlying element of the *subscapularis*, or as the representation of the *short* variety of the *coraco-brachialis* which has dropped short of its ordinary insertion?

In *Macropus ruficollis* this muscle appears to be represented by the "short" variety of Wood only, but presented some note-worthy peculiarities, a description of which I subjoin in a footnote³. This variety only is, moreover, present in the Wombat, being

¹ Waterhouse, *op. cit.* p. 130.

² M. Pouchet, in his Monograph upon *Myrmecophaga jubata*, already cited, figures (pl. ii. fig. 4) and describes (p. 7) an arrangement in this species, of the fibres of the *subscapularis*, precisely similar to that just described as existing in the Tamandua. M. Pouchet says, *loc. cit.*, of the termination of the *subscapularis*, "cette insertion se fait par un puissant tendon perforé, ou plutôt divisé en deux parties, entre lesquelles glisse le tendon de la courte portion du biceps."

³ This description is taken, with Prof. Rolleston's permission, from one of the volumes of the afore-mentioned 'Student's Note-Book': "From the coracoid in this animal a muscle arises, in close relation to, but not connected with, the upper fibres of the *subscapularis*; it receives an accessory head from the tendon of the *biceps*, and is itself divisible into two fascicles—of which the smaller and deeper in position is inserted immediately below the insertion of the *subscapularis*, and at right angles to it, while the larger occupies the space left vacant on the humerus between the insertion of the *subscapularis* and that of the conjoined *teres major* and *latissimus dorsi*."

From the same source I borrow the following description of the *coraco-brachialis* in *Macropus giganteus*:—"A thin muscular slip arises from the superior border of the scapula near the origin of the *omo-hyoid*. It is separable for an inch and a half from the *subscapularis*, over the tendon of which it passes; it is attached for half an inch to the tendon of the *biceps*, where it glides over the inner tuberosity of the humerus. From this point it passes downwards to be inserted on the inner side of the humerus, above, but in close proximity to, the insertion of the *teres major*, overlying and giving fibres to the inner head of the *triceps*."

inserted immediately beneath the inner tuberosity of the humerus, and above the terminal portion of the *latissimus dorsi*, and is also fused at origin with the tendon of the single (*coracoid*) head of the biceps. In *Hystrix* the *coraco-brachialis* has no communication whatever with the *biceps*, which is single-headed in this rodent. It is represented by the *middle* and *long* varieties of Wood. At about the level of the middle of the tendon of the *latissimus dorsi*, the muscle is pierced by a nerve ("perforans Casserii"?) which bores through the fleshy portion on the inner side of the median tendon of the muscle, passes behind this latter, and emerges at its outer side, through the muscular substance, to run across to the posterior part of the biceps. From immediately below the lower edge of the tendon of the *latissimus dorsi* the muscle takes insertion into the humerus, its inserted part being prolonged as far as the inner condyle, just above the origin of the *epitrochleo-anconeus*. That portion of this muscle which is cut off by the nerve at its emergence, and which is inserted immediately below the tendon of the *latissimus dorsi*, may be regarded, I think, as the representative of the *middle* or ordinary variety, the rest of the muscle, from this point downwards, representing the *long* variety.

Professor Rolleston has pointed out to me this muscle in the Tenrec (*Centetes ecaudatus*). It was represented by both *short* and *long* varieties, and was, moreover, quite distinct from the *biceps* for its whole length.

Meckel, I find, describes only the *long* variety of the *coraco-brachialis* as present in the "Tatu."¹ Cuvier, too, represents this variety alone in his figures of the myology of *Dasypus sexcinctus*.²

Biceps.—A single-headed muscle, arising by a strong flat tendon from the superior edge of the glenoid cavity of the humerus, immediately external to the root of the coracoid process of the scapula, being completely covered by the terminal portion of the *supraspinatus*. It then passes through a deep groove, excavated in the anterior face of the humerus, between the two tuberosities, which is converted into a complete foramen by the bridging over of its channel by a strong broad ligament stretched between the tuberosity piers on either side.

Soon after its emergence from the above groove, the biceps gradually loses its tendinous character, gradually, too, swells out laterally, and at the middle of the arm attains its greatest size, becoming somewhat ampulliform in shape. From this point it, by degrees, diminishes, and receives, immediately below the same, on its inner side and posterior aspect, those fibres of the *coraco-brachialis* which are not continued to the supracondyloid ridge. At a short distance from its termination, it divides into two tendons, or rather its very short single tendon splits into two branches, the outer of which is inserted into the palmar aspect of the neck of the radius, and the inner into the fossa scooped out of the radial edge of the ulna, and overhung by the coronoid pro-

In *Martes abietum*, among Carnivora, according to the same authority, "The *coraco-brachialis* has an accessory muscle inserted next between the *subscapularis* and *teres major*."

According to Meckel, however, this muscle is entirely wanting in the Kangaroo; but in the Opossum it is very short, and is attached to the upper sixth of the humerus.—*Op. cit.* p. 515.

¹ *Op. cit.* p. 514.

² *Op. cit.* pl. 260.

cess, in company with the tendon of insertion of the *brachialis anticus*, which is fixed slightly anterior to it and to its outer side.

Meckel makes no mention of the termination of this muscle in *Dasypus*, but remarks that its ordinary head, which is very short, receives on its inferior aspect a much slighter offset from the *coraco-brachialis*. In the Anteater, according the same anatomist, the long head soon divides into two branches, the anterior of which is inserted into the radius, while the posterior terminates at the ulna, after fusing with the *brachialis anticus*¹. In *Macropus ruficollis* (var. *Bennetti*) this muscle, which is single-headed, divides at the termination of the upper third of the arm into two equal-sized factors, the anterior of which arises from the inner (or superior, as it lies in the bicipital groove) edge of the tendon; while the inner branch, into which is continued a rounded moderately thick tendon, arises from the inferior or outer edge, of which this rounded tendon is a continuation. The anterior division, at the inferior third of the arm, takes an external position, and is finally inserted by a broad tendon into the neck of the radius; while the posterior, occupying the inner position, terminates at the ulna.

Meckel describes this muscle, in *Macropus giganteus* ("Riesenkänguruh"), as dividing—the superficial division passing to the radius, the deeper to the ulna, where is also inserted the *brachialis anticus*, quite distinct, however, from the former muscle. In the Opossum, according to the same anatomist, the reverse takes place, the muscle consisting of two heads above, which soon unite lower down into one thick belly².

Mr. Mivart describes, in *Echidna hystrix*, the existence of an ulnar as well as a radial termination to the *biceps*³. In the Ornithorhynchus, on the other hand, according to Meckel⁴, both heads of this muscle "setzen sich vereinigt sehr günstig Behufs des Schwimmens an die Mitte der Speiche." According to Mr. Mivart, the *biceps* of *Iguana tuberculata*, among Lacertilia, has an insertion into both radius and ulna⁵.

Dr. Macalister, in a recent paper, states that the *biceps* is single-headed in *Dasypus septemcinctus*, but also remarks, in a foot-note, that both he and Dr. Haughton have examined Armadillos (species not given) in which this muscle has two heads⁶.

Brachialis anticus.—This muscle, which is not figured by Cuvier in his plates of the myology of the Armadillo, is of considerable size and length, having a very high origin. It arises, by a completely fleshy origin, from the neck of the humerus, posteriorly and externally, in the space intervening between the roots of the two tuberosities of the bone, being completely covered at origin by the thin tendinous origin of the outer head of the *triceps*. It also arises from the whole external aspect of the humerus, included between its anatomical neck and the groove of the musculo-spiral nerve, besides implanting a few fibres in the outer and anterior overhanging edge of the large deltoid trochanter. It then passes, having close to its inferior edge the musculo-spiral nerve, also the extensive origin of the *extensor carpi radialis* on its outer side and the *biceps* on its inner, into

¹ *Op. cit.* p. 520.

² *Op. cit.* p. 522.

³ Trans. Linn. Soc. vol. xxv. p. 386.

⁴ *Op. cit.* p. 520.

⁵ Proc. Zool. Soc. June 1867.

⁶ "On the Homologies of the Flexor Muscles of the Vertebrate Limb," Journ. of Anat. and Phys. 2nd ser. (Cambridge, 1868) vol. i. pp. 285 and 289. The seven-banded specimen which I examined at Oxford had but a single-headed *biceps*.

the forearm, between the two prongs of the forked tendon of insertion of the latter muscle, to be inserted into a fossa in the ulna, overhung by the coronoid process of this bone, a little anterior to, and to the outer side of, the insertion of the ulnar division of the tendon of the *biceps*.

This muscle, according to Meckel, is, in the Anteater, fused with the olecranal division of the *biceps*. Its insertion is, in the *Platypus*, according to the same author, confined to the radius¹.

The *brachieus internus* is, according to Rapp, absent in *M. tamandua*².

Triceps.—A well-developed, and, apparently, very powerful muscle, made up of the following factors, which will be separately enumerated:—

1. *Scapular*.—This, the largest portion of the muscle, arises from the inferior, or lesser, spine of the scapula, along the whole of its extent; and after proceeding some distance on its course, joins the external *humeral* head of the muscle, and, in company with this, is inserted into the olecranon process, and becomes also continuous with the fascia on the outer side of the arm and forearm. Another element of this portion of the muscle, which is probably the representative of the “long” head of human-anatomy language, takes origin from the lower, or axillary, border of the scapula, from a projecting ridge situated just posterior to the neck of the bone, by a thick tendon, invested externally with muscular tissue. It has a uniform breadth, and runs in close company with the preceding element of the *scapular* factor, to share the same insertion, fusing with it near its termination.

This factor is inserted in the posterior edge of the olecranon, overlapping the insertion of the internal *humeral* head. This part of the muscle is, moreover, continuous with the fascia covering the elbow.

2. *External humeral* factor.—A strong fleshy slip, which arises by a thin tendon, encircling about half the circumference of the neck of the humerus—namely, that space which intervenes between the two tuberosities on the posterior and outer aspect of the bone. This tendon completely covers the fleshy fibres of the origin of the *brachialis anticus*, and is, moreover, overlapped on its outer aspect by those fibres of the *teres minor* which pass across to their insertion below the external tuberosity of the humerus. This factor takes origin also from nearly the whole length of the posterior edge of the ridge running from the above tuberosity to the deltoid trochanter. About one-third of the distance between its origin and insertion, it fuses with the two most posterior divisions of the *deltoid* at their point of insertion into the great trochanter of the humerus, and arches over that portion of the *brachialis anticus* which lies in the channel between the above process and the origin of the *extensor carpi radialis*. After this point it becomes continuous by its outer edge with the fascia of the arm. Its inner edge, after proceeding about two-thirds of the distance between origin and insertion, fuses with the *scapular* factor of the muscle.

3. *Internal humeral*.—A somewhat slender slip arising along the inner aspect of the humerus from immediately below the insertion of the *subscapularis* to almost the lower extremity of the posterior boundary of the supracondyloid foramen. It is inserted into

¹ *Op. cit.* p. 525.

² *Op. cit.* p. 48.

the posterior rounded and smooth edge of the olecranon, overlapping the insertion of the *epitrochleo-anconeus*.

4. *Anconeus*.—A very large, strong, fleshy muscle, of a triangular form, the apex uppermost. It arises from the whole of the extensive space (which may conveniently be termed “olecranon fossa”) bounded at the base by the trochlea of the humerus, at the sides by the strong ridges which run from the middle of the posterior aspect of the bone to either condyle. It is inserted into the smooth triangular surface which intervenes between the posterior extremity of the olecranon and the humeral articular surface of the ulna. Some fibres, however, are prolonged along the outer aspect of the arm to blend with the origin of the *extensor carpi ulnaris*.

The last-named element of the muscle is very well represented by Cuvier in one of his plates¹.

It has been already stated, in the description of the *latissimus dorsi*, that the *dorso-epitrochlear* offset of this muscle is reinforced by some fibres which arise from the lower part of the axillary costa of the scapula, near the inferior angle of this bone. Prof. Rolleston has suggested to me that these fibres probably answer to an element of the *triceps* figured in one of Cuvier's plates of the myology of the Badger (*Ursus meles*) as a *fifth* extensor of the elbow², and which is formed by a differentiation of the scapular portion of the latter muscle into two fascicles, of which the most posterior is fixed at the inferior angle of the scapula. On the other hand, the *fourth* extensor, the *dorso-épitrôchlien*—seeing that, in Cuvier's figure, it arises from the *latissimus dorsi*—is but feeble in this animal. The following remark occurs in the letterpress appended to the plates:—“Le Blaireau est, comme on sait, un animal fouisseur, et la disposition de ce cinquième extenseur doit augmenter considérablement la force d'extension de l'avant-bras. Dans l'Ours, cette particularité n'existe pas; mais l'extenseur scapulaire est très-puissant et s'attache à presque tout le bord inférieur de l'omoplate”³.

In the Otter (a swimmer) the portion of the *triceps* mentioned as arising from the angle of the scapula and passing to the elbow, in the Badger, is present; but there seems to be no true *dorso-epitrochlear* offset from the *latissimus dorsi* present in this animal⁴.

It has been further suggested to me by Professor Rolleston that the above-described muscular element, which arises at the inferior angle of the scapula and terminates at the olecranon, may be the *serial* homologue of a certain muscle which is present in the lower limb of some animals (the “*ilio-peroneal*,” described by Mr. Mivart in a paper upon the “Myology of *Iguana tuberculata*”)⁵.

Epitrochleo-anconeus.—A fleshy, stout, lozenge-shaped muscle, arising from the inner condyle of the humerus, immediately behind the combined origins of the *pronator teres* and *flexor carpi radialis*, and passing obliquely backwards to be inserted into the hamular extremity of the olecranon, fusing also with the inserted portion of the *triceps*.

This muscle is figured by Cuvier, in one of his plates of *Dasypus sexcinctus*, under the name of *anconé interne*⁶.

¹ *Op. cit.* pl. 259. fig. 2.

² *Op. cit.* pl. 100. fig. 2.

³ *Op. cit.* pls. 81 and 82.

⁴ *Op. cit.* pl. 109. fig. 1.

⁵ Proc. Zool. Soc. June 1867, p. 789.

⁶ *Op. cit.* pl. 260.

This muscle, the *epitrochleo-anconeus*, has had a monograph, consisting of several pages, and illustrated by three plates, devoted to it by Professor Wenzel Gruber¹. The first plate, consisting of five figures, is devoted to the varieties of this muscle as seen in the human subject, in which it is by no means uncommon². In one of these figures (fig. 5) it is represented as being made up of two distinct delicate slips, each constricted in the middle and bellying out towards origin and insertion. This differentiation of the muscle is not figured as occurring in any of the animals whose elbow-regions form the subjects of Prof. Gruber's plates; nor have I succeeded in finding such in the beasts which I have had the opportunity of examining.

Prof. Gruber describes the *epitrochleo-anconeus* among the Bruta, in the following members of the order:—*Bradypus tridactylus*, *Dasypus tricinctus*, *Myrmecophaga didactyla*, and a *Manis*, species unknown³; but figures that muscle only which belongs to the three-banded Armadillo⁴.

To Prof. Gruber's already copious list I am able to add the names of the following animals, in which I have dissected out and made drawings of this muscle:—*M. tamandua* and *Choloepus didactylus* among Bruta⁵, *Echidna setosa* among Monotremata⁶, *Phascoglossus wombata* among Marsupials, and *Hystrix (crinata?)* among Rodents. In all cases the muscle had the relation to the ulnar nerve described by Prof. Gruber.

Pronator teres.—Is a triangular, very well developed muscle, fleshy and subcylindrical at its origin, from which it gradually flattens out into a ribband-like expansion, and is inserted by a broad tendon into the distal half of the radius. This muscle arises from the inner condyle of the humerus, and has an origin common with, but superior to, that of the *flexor carpi radialis*.

No portion of the muscle arose from the coronoid process of the ulna⁷.

Supinator longus.—Appears to be absent.

Supinator brevis.—From a smooth surface outside a sharply prominent tubercle, external to the outer condyle of the humerus, arises a delicate fusiform muscular slip, barely three-quarters of an inch in length, which is inserted into the longitudinal ridge

¹ "Ueber den Musculus epitrochleo-anconeus der Menschen und der Säugethiere" (mit 3 Tafeln), Mém. de l'Acad. Imp. des Sciences de St. Pétersbourg, 7th ser. tome x. no. 5.

² In the 'Proceedings of the Royal Society' for May 1867, Mr. John Wood describes (p. 521) and figures (fig. 2) this muscle as occurring in a human male subject, and proposes for it the name "*Anconeus epitrochlearis*." Mr. Wood mentions, moreover, that he found in the tame Rabbit "a somewhat fan-shaped muscle, connecting the *epitrochlea* and the *olecranon*." Prof. Gruber figures such a muscle in the Hare (*Lepus timidus*), *op. cit.* tab. iii. fig. 2.

³ *Op. cit.* pp. 10 and 20.

⁴ *Op. cit.* tab. iii. fig. 3.

⁵ It may not be amiss here to state that I have seen this muscle very well developed proportionally in a young specimen of *Tatusia novem-cinctus* (*D. peba*), which measured but five inches and a half from the tip of the snout to the root of the tail, and which had the umbilical cord still adherent.

⁶ Mr. Mivart describes, but by no distinct name, this muscle as present in *Echidna hystrix*. At the conclusion of his description of the muscle, he observes—"Of course it arches over the ulnar nerve," *loc. cit.* p. 388.

⁷ "Regarding the comparative anatomy of the coronoid slip, it will be found very rarely, if ever, developed in the lower animals; * * * * it is not present in any of the Rodents which I have examined; but I have not had any opportunity of looking for its existence in any of the Edentata. It seems thus to be a muscle peculiarly human in its nature."—Dr. Macalister "On the Nature of the Coronoid Portion of the Pronator Radii teres," Journ. of Anat. and Phys. 2nd ser. (Cambr. 1867) vol. i. p. 9.

of the radius, at the junction of the proximal with the middle third of this bone, and immediately posterior and external to the insertion of the broad tendon of the *pronator teres*, widening out and becoming flatter at its termination.

This muscle is not represented by Cuvier in his plates of the myology of *Dasypus*.

Both short and long *supinatores* appear, according to Meckel, to be fused together ("verschmolzen zu seyn"). He remarks further that no muscle is given off from the humerus above the *extensores* of the hand. Under these, on the other hand, lies a much stronger muscle, which passes to the upper half of the radius, "und bloss Beuger ist." In all probability the long *supinator* is absent in this animal (*Dasypus*); and the above muscle may be, after all ("nur"), the short *supinator*¹.

Mr. Mivart and Dr. Murie, in their paper on the "Myology of *Hyrax capensis*"², describe as *supinator longus* a muscle which much resembles that which I have termed *s. brevis* in *Dasypus*. It is "exceedingly diminutive, and arises from the outer shaft of the humerus, just above the common origin of the next two muscles (*extensor carpi radialis* and *e. communis*), and is inserted into the radius near its neck."

Soemmering³, in his description of this muscle in man, says, "Nonnumquam superior pars [humeral origin] a reliquo musculo distincta est."

Theile, moreover, states that when the two layers of which the muscle is composed are distinct, the superior head takes origin from the outer condyle of the humerus⁴.

Extensor carpi radialis.—From the strong outer ridge ("supinator ridge") of the humerus arises, for the extent of nearly three quarters of an inch along its superior portion, a muscle which, after completing about half of its course, crosses over the radius, and, becoming suddenly tendinous at the distance of an inch from its insertion, passes under a ligamentous and muscular bridge into the palm. The ligamentous bridge stretches from the abrupt spinous termination of the dorsal ridge of the radius to a sesamoid lying midway between this point and the styloid process of the bone. The *extensor ossis metacarpi pollicis* forms the muscular bridge.

Two cord-like tendons are given off simultaneously by this muscle, which, before becoming tendinous, narrows more or less suddenly to a conical apex; one of these is inserted into the dorsal surface of the metacarpal of the index, while the other terminates at the same aspect of the like segment of the middle digit.

These answer respectively to the tendons of the *extensores carpi radiales, longior et brevior*, of human-anatomy language.

It is stated in Cuvier's 'Leçons'⁵ that in some animals, such as the Dog, Hyæna, Hare, and the Edentata, the above muscles are fused together at their condyloid extremity, their tendons alone being distinct.

Meckel observes that the *extensor radialis brevior* is occasionally absent in man, as is the case in many mammals, in which never more than one radial *extensor* is met with. "Conformation," he continues, "dont le premier degré est la fusion complète des deux radiaux externes en un seul, dont on connaît divers exemples"⁶.

¹ *Op. cit.* p. 534.

² *Proc. Zool. Soc.* April 1865, p. 340.

³ *De Corp. Humani Fabr.* tom. iii. p. 267.

⁴ *Encyclopédie Anatomique*, tom. iii. (Paris, 1843) p. 231.

⁵ *Loc. cit.* p. 443.

⁶ *Manuel d'Anatomie Générale*, tom. ii. p. 163.

Henle, moreover, says, concerning these muscles in man, that the *e. r. brevior* is occasionally absent, or has so grown together with the *e. r. longior* that this latter appears to give off two tendons¹.

Extensor ossis metacarpi pollicis.—This is a muscle of great length. It arises from the fossa included between the ridge which forms the inner boundary of the ulna and another ridge which runs down from the humeral articular surface of the bone to join the former, at the distance of about three quarters of an inch from the tip of the olecranon—also from the adjoining portion of the capsule of the joint, and from the strong interosseous septum between radius and ulna.

It then runs along the radial side of the *extensor indicis* for some distance, taking a direction obliquely towards the radial side of the carpus, and passes, also obliquely, over the radius, immediately behind the “crista-galli”-like termination of the median dorsal ridge of this bone, being bridged over by a thin ligamentous arch, which stretches from the above-mentioned terminal crest longitudinally to the median ridge, which runs from it backward. The muscle appears to derive a few accessory fibres from the radial crest, and becomes tendinous immediately upon leaving the radius for the carpus. The short tendon then passes under a fragile ligamentous bridge, stretching from a tubercle projecting from the dorsum of the scaphoid bone (?) across to the styloid process of the radius, or a sesamoid in its immediate vicinity, and is finally inserted into the base of the metacarpal of the pollex, on its radial side. Under that portion of the muscle which lies between the terminal crest of the median radial ridge and the beginning of its proper tendon, pass the two tendons of the *extensor carpi radialis* into the palm. Meckel expressly states that this muscle is absent in the “Tatu”².

Extensor indicis.—A narrow, flat, strap-shaped muscle, of uniform breadth, arising from the strong ridge which runs along the inner edge of the ulna, at the beginning of the distal half of the bone. It then turns suddenly inwards towards the middle line of the forearm, and, running on the radial side of the mesial ridge, which is developed upon the distal third of the dorsum of the ulna, close to the ulnar edge of the *extensor ossis metacarpi pollicis*, passes under the ligamentous bridge which crosses over the *extensor communis*, on to the dorsum of the carpus. It soon becomes tendinous; and the tendon almost at once divides into two unequal portions, the larger of which, broad and flat, passes to the base of the proximal phalanx of the index; while the smaller, slight and cord-like, terminates at the base of the ungual phalanx of the pollex.

This muscle is, for the greater part of its course in the forearm, overlapped by the *extensor communis*.

According to Meckel, the index alone in the “Tatu” receives a tendon from this muscle³. The same anatomist states that this *extensor* sometimes sends, but not always, a small offset to the pollex in the Beaver. Its tendon, moreover, in the Bear and Coati, among Carnivora, passes to the pollex as well as to the index.

Extensor communis digitorum.—A moderate-sized fusiform muscle, which arises from the strong ridge above the external condyle of the humerus, immediately below the origin of the *extensor carpi radialis*, with the lowermost fibres of which muscle its own

¹ Muskellehre, p. 203.

² *Op. cit.* p. 553.

³ *Op. cit.* p. 551.

fibres are fused. It then passes obliquely, but gradually, towards the middle line of the forearm, and, upon passing on to the dorsum of the fore foot, is bridged over by a strong ligament, which crosses from the terminal crest of the median dorsal ridge of the radius to the cuneiform bone. Next, it becomes tendinous, dividing into two broad tendons, which divide dichotomously at the metacarpo-phalangeal articulation, and proceed as follows:—The outer division of the radial tendon passes to the index; the ulnar division of the same tendon, after being joined by the radial division of the ulnar tendon, to the middle digit; while the ulnar division of the latter tendon passes to the fourth (annularis) digit. Each of the divisions of these tendons passes to the root of the ungual phalanx of the digit to which it belongs.

This muscle, according to Meckel¹, passes in *Dasypus* only to the second, third, and fourth fingers—the arrangement, in fact, with the exception of the intercommunication of the three tendons, which I have just described.

Extensor annularis.—Immediately below the former muscle arises, from the strong supracondyloid ridge of the humerus, and from a strong tendinous septum which is attached to the median dorsal ridge of the ulna, a small, fusiform muscle, which does not become tendinous till when a little in advance of the *extensor communis*, after running parallel with it in the forearm.

Its tendon divides, almost immediately, into two slips, the radial of which passes to the base of the proximal phalanx of the fourth finger, while the ulnar slip is inserted into the base of the ungual phalanx of the little finger.

Extensor minimi digiti.—Having an origin similar to, but lower than, that of the last-described muscle, and fusing with the same for some little distance, passes a shorter and flatter muscle, parallel with the above, to be inserted into the dorsal aspect of the metacarpal bone or proximal phalanx of the little digit, by a tendon which has a comparatively wide expansion at its termination, and a greater length than that of the preceding muscle.

Cuvier, in one of his plates of the myology of *Dasypus*, represents the last two muscles as I have described and figured them; but the *extensor communis* has, according to his representation, but a single primary tendon, which splits, however, into three secondary divisions, passing to the index, middle, and fourth fingers. The delicate offset from the *extensor indicis*, destined for the pollex, is, moreover, not represented². Meckel states that the *extensor minimi digiti* passes only to the fourth digit in the “Tatu”³.

Extensor carpi ulnaris.—This muscle arises from the inferior termination of the strong “supinator ridge” of the humerus, immediately below, and fusing at its origin with, the lowermost fibres of the preceding muscle, also from the strong ligamentous septum which is stretched from the spinous termination of the median dorsal ridge of the ulna across to the lower extremity of the supinator ridge—and from the strong ridge which runs along the inner (or ulnar) edge of the above bone; the muscle, which is at origin of a more or less triangular shape, narrows gradually up to its tendon, which appears to

¹ *Op. cit.* p. 548.

² *Op. cit.* pl. 259. fig. 2.

³ *Op. cit.* p. 549.

be inserted into the ulnar side of the base of the metacarpal of the fifth digit, a small round sesamoid being developed in the tendon at the point of insertion.

Flexor carpi ulnaris.—Is a strong fleshy muscle which arises from the internal face of the olecranon process of the ulna, immediately below the insertion of the *epitrochleo-anconeus*. Its fibres blend at first with those of the *flexor profundus* which take origin from the inner edge of the ulna, then pass straight forward to be inserted by a broad short tendon into the free extremity of the sickle-shaped pisiform bone.

Flexor carpi radialis.—This muscle arises from the inner condyle of the humerus, having a common origin with the *pronator teres*, but being placed lowermost. On leaving the forearm, through which it has passed as a slender fusiform slip, it runs through a smooth groove channelled out in the palmar aspect of the scaphoid bone and having an oblique direction towards the middle line of the hand, being arched over in this groove by a strong ligament which spans its channel, to be finally inserted into the rounded, nodular, palmar projection of a carpal bone which I may term, for convenience and distinctness' sake, *trapezio-trapezoid*¹, and becomes, also, continuous with a strong

¹ The following digression on the subject of the bones of the carpus in *Dasypus* will not, I think, be deemed irrelevant, when it is borne in mind that accuracy in description of the attachment of muscles demands and is dependent upon a previous knowledge of the nature, at all events, of those osseous structures which may either serve these as a starting-point when they enter upon their journey, or be to them a goal or "meta" on the completion of their course.

"Sieben Knochen," says Rapp, "finden sich auch bei den Schuppenthieren" (*op. cit.* p. 42); but no further description is given of these. Since, then, the number of bones falls short of the usual carpal complement by one, there must either be a complete loss, or a fusion with some other element, of the eighth unit. Careful inspection, supported by the testimony of Cuvier and Owen, shows that the latter has taken place. The former anatomist remarks, in his already quoted 'Ossements Fossiles' (*loc. cit.* p. 127) that in *D. sexcinctus* ("l'Encoubert"), "Un seul os tient la place du trapèze et du trapézoïde;" while the following passage occurs in the monograph upon *Myiodon robustus* of the latter (Lond. 1842, p. 97 *et seq.*):—"In the only species of Armadillo (*Das. sexcinctus*) in which two of the normal carpal bones are blended into one, it is the trapezium and trapezoides which so coalesce, not the trapezium and scaphoides."

I append a description of the carpal bones of a species of *Dasypus* (*sexcinctus*?), which I drew up for my own use when dissecting the Armadillo which is the subject of the present paper.

Dorsal aspect.—

First row (beginning from radial side):—

1. *Scaphoid*: carries in front *trapezio-trapezoid* bone; articulates on ulnar side with *os lunare*.
2. *Lunar*: articulates with preceding bone on radial side, on ulnar side with *cuneiform*, in front with *os magnum*.
3. *Cuneiform*: a bone of great lateral extent articulates radially with *lunar*, on ulnar side with a small sesamoid, posteriorly with *ulna* and elongated *pisiform*, anteriorly with *unciform*. It carries, moreover, the metacarpal of the fifth digit.
4. *Pisiform*: is wedged in, palmar, between *ulna* and *cuneiform*. The first two bones of the above row of the carpus articulate posteriorly with the *radius* in the usual manner.

Second row (beginning radially):—

5. *Trapezium* and *trapezoid*: fused into one laterally elongated bone, which carries the metacarpals of the pollex and index, and articulates posteriorly with the *scaphoid*, and on the ulnar side with the *os magnum*.
6. *Os magnum*: carries metacarpal of middle digit only. It articulates posteriorly with the *lunar* principally, slightly with the *scaphoid*, with *unciform* on ulnar side, radially with *trapezio-trapezoid*.
7. *Unciform*: carries fourth digit only; articulates posteriorly with *cuneiform*, radially with *os magnum*, on ulnar side partly with *cuneiform*, partly, but slightly, with fifth digit, which is supported mainly by *cuneiform* bone.

ligament passing from the above projection to the palmar boss of the os lunare and the ulnar margin of the scaphoid groove.

Flexor sublimis digitorum.—This muscle, which appears to be combined with the *palmaris longus* both homologically and functionally, arises from the lowest part of the inner condyle of the humerus, in company with two heads of the *flexor profundus*, and passes forwards, muscular for some distance, to blend finally with the palmar fascia, which is attached on one side to the pisiform bone, on the other to a small sesamoid which lies alongside of the scaphoid.

Two digits only are supplied with a tendon from this muscle, namely, the index and middle digit, as Cuvier has figured, but somewhat indistinctly, in one of his plates of *Dasypus*¹.

According to Meckel, however, the superficial *flexor* in the "Tatu" divides into three muscles—one for the pollex and index (the tendon of which previously splits deeply), one for the third, and the remaining factor for the fourth digit².

Theile, in noticing varieties of the *palmaris longus* in the human subject, observes that its absence is sometimes supplied by a tendon of the *flexor sublimis*³.

Flexor profundus digitorum.—An enormously powerful and complex muscle, made up of several elements—which may, however, be considered under two divisions, which are as follows:—

1. A large muscular mass which arises from the whole of the internal face (or palmar aspect) of the ulna, from the olecranon to within a short distance of the carpal extremity of the bone.

After proceeding a little more than halfway on its course, it is joined, having already become tendinous, by a smaller, but still considerable muscular slip, which takes rise from the inferior surface of the inner condyle of the humerus, in company with the origin of the *flexor sublimis* and another slip of the deep *flexor* presently to be described. The slip proceeding from the inner condyle is, soon after its origin, joined by another muscular mass, which arises from the coronoid process of the ulna, from the interosseous septum (between these two heads the ulnar tendon of the *biceps* and the tendon of the *brachialis anticus* dip down towards their insertion), and from the radial edge of the ulna. All these elements of the first muscular mass are continuous with an enormous tendon, in which, at the beginning of the palm, a large horseshoe-shaped sesamoid bone is developed.

2. Where the tendon joins the sesamoid, the latter is joined, but without the intervention of a tendon, by two muscular slips, the smaller of which arises from the inferior surface of the inner condyle of the humerus, in company with the superficial *flexor*, whose fibres of origin separate it from a slip which has the same origin but has been already described. On the radial side of the insertion of this slip the sesamoid is joined by a larger muscular element, which arises from the whole palmar surface of the radius, beginning at the neck of the bone, and bounded externally (that is, on its radial margin) by the insertions of the *pronator teres* and *supinator brevis*.

Between the insertions of the two above-described masses into the sesamoid there

¹ *Op. cit.* pl. 260.

² *Op. cit.* p. 559.

³ *Op. cit.* p. 237.

terminates at this latter the tendon of a slightly flattened fusiform muscular slip, which arises from the bottom of the coronoid fossa of the humerus, and proceeds straight towards its insertion.

From the anterior extremity of the sesamoid proceed four very stout tendons to each of the four inner digits; while from its radial side, a little posterior to the origin of the above tendons, a tendon, having a much smaller diameter than these, is given off for the pollex, and is finally inserted into the base of its ungual phalanx.

Each tendon, before being inserted into a strong spinous projection at the base of the palmar aspect of the ungual phalanx of its proper digit, passes over an oval, flattened sesamoid, which lies at the junction between the ungual and preceding phalanx.

Posterior to the large sesamoid bone, a strong *retinaculum* springs up from the bottom of the sheath (regarding it from its palmar aspect) to join the deep *flexor* tendon.

Meckel states that the *flexor profundus* goes to the three outer digits; and mentions also that its tendon contains a sesamoid bone¹.

"In the *Echidna*, as in the *Ornithorhynchus*," says Mr. Mivart, "there are one or two ossicles in the palmar portion of the flexor tendon"².

Meckel, in his monograph upon the latter Monotreme³, says, in the course of the description of the deep *flexor* of the fore foot, "*tendine crassissimo, cujus fini inferiori duo ossicula, ad Sauriorum Dasypodumque modum, insunt.*"

The *Chlamyphorus* has a palmar sesamoid very much resembling in shape that of *Dasypus sexcinctus*⁴; while in *Priodontes* (*Dasypus*) *gigas* this bone is very large, and of an irregularly conical shape, the apex being directed forwards⁵.

Pronator quadratus.—This muscle appears to be completely absent. It is not figured by Cuvier in his plates of the myology of *Dasypus*. Meckel notices the absence of this muscle in the "Tatu," but remarks that the *pronator teres* is well developed in compensation. He states, too, that in the *Aï* it is very small, perhaps smaller than in any

¹ "Ein stärker, später unstreitig verknöchert Faserknorpel."—*Op. cit.* p. 560.

² "On the Anatomy of *Echidna Hystrix*," Trans. Linn. Soc. vol. xxv. p. 389. Mr. Mivart adds the following in a footnote:—"As Meckel remarks, this palmar ossicle also exists in the *Armadillos*; and Professor Huxley, in his last Hunterian course (for 1865), mentioned its existence in *Dasypus sexcinctus*, as also the absence in that animal of any perforated flexor, and the union of the *flexor profundus* and *longus pollicis* to form one tendon. This point of similarity between the Monotremes and Edentates is the more interesting, as my friend Mr. W. K. Parker informs me that he has discovered singular points of resemblance in the sternal structure of those two groups."

³ *Ornithorhynchi paradoxi* Descriptio Anatomica. Fol. Lipsiæ, 1826: p. 28.

⁴ This sesamoid can be seen very well, *in situ*, in the left fore foot of the skeleton of this somewhat rare *Armadillo* which is preserved in the British Museum. In the specimens of the same animal belonging to the Museum of the Royal College of Surgeons a similar bone is present, but has been detached and placed in front of the skeleton.

⁵ This bone is described in the 'Ossemens Fossiles' (*loc. cit.* p. 128) as "*très-grand, renflé en arrière en une grosse tête très-inégale, * * * et se terminant vers la main par un corps comprimé et moins large que la tête.*" The sesamoid is represented by itself in figs. 12 and 13 of pl. xi. in the same work.

Rapp, in his already quoted monograph upon the Edentata, describes this bone as "*besonders gross bei Dasypus gigas, und ist hier hinten am dicksten und hat an seiner obern Seite zwei Gelenksflächen zur Artikulation mit dem halbmondförmigen Knochen und dem Os pisiforme,*" p. 43. In pl. iv. of this monograph the bone is figured *in situ*.

This sesamoid can also be well seen in the fine skeleton of *Priodontes gigas* lately added to the valuable collection of Bruta contained in the Museum of the Royal College of Surgeons.

other beast. It has, moreover, considerably more breadth than length; and, as a slender transverse muscle, answers at most ("höchstens") to the distal eighth of the forearm¹.

Lumbricales.—These muscles, five in number, are of considerable size and length. They are slightly ampulliform at origin, and arise from the posterior part of the sesamoid bone of the *flexor profundus*, apparently from three muscular masses, one median and two lateral. The median portion arises immediately in front of the terminal tendon of that factor of the deep *flexor* which takes origin from the coronoid fossa. Only one *lumbricalis* is continuous with this, and is inserted into the ulnar side of the index finger.

The ulnar portion arises just in front of the termination at the common tendon of that portion of the *flexor profundus* which takes origin from the inner condyle, and with a few fibres of which it is continuous on the radial side of its origin. Two *lumbrical* muscles are derived from this, which pass respectively to the radial sides of the fourth and fifth digits.

From the radial portion arises a *lumbrical* muscle which passes on straight to its termination at the radial side of the index. Soon, however, after it leaves the sesamoid, it gives off a more slender slip, which passes to the underside of the pollex. Some of the fibres of this portion seem to be continuous at origin with the terminal part of the radial factor of the *flexor profundus*, which arises from the internal condyle.

It will be seen, from the above description, that the middle digit has no *lumbricales*, that the index possesses two (one on each side), that the remaining digits have one each, the pollex on its ulnar side, the fourth and fifth digits on their radial aspects.

Cuvier gives a fair representation of these muscles in one of his plates, and figures the *lumbricalis* which passes to the pollex as an offset, as I have described above, from that which belongs to the index². Meckel states that the *lumbricales* in the "Tatu" are very strong and long³.

In animals as high in the scale as the *Quadrumana* there appears to be some indication of the arrangement of the *lumbricales* such as exists in *Dasypus*; for, according to Church, in the Orang, Magot, and *Cebus*, these muscles "formed a fleshy mass on the palmar surface of the fused tendons" of the *flexor profundus* and *pollicis*⁴.

Abductor minimi digiti.—A delicate, fusiform muscle, about half an inch in length, which arises from the pisiform bone, in advance of the insertion of the *flexor carpi ulnaris*, and is inserted into the ulnar side of either the metacarpal or first phalanx of the fifth digit.

Cuvier has given an indication, but somewhat indistinct, of this muscle, in one of his plates; but he has not attached to it any symbol⁵.

Flexor brevis (or *Opponens*?) *digiti quinti*.—A strong fleshy muscle, seemingly separable into two portions; one of which arises from the stout ligament which proceeds from the palmar boss of the os lunare to the rounded nodule upon the trapezio-trapezoid bone, and is inserted into the radial side of the fused proximal and middle phalanges of the

¹ *Op. cit.* p. 532.

² *Op. cit.* pl. 260.

³ *Op. cit.* p. 560.

⁴ "On the Myology of the Orang Utang," *Nat. Hist. Rev.* Jan. 1862, p. 82.

⁵ *Op. cit.* pl. 260.

fifth digit; while the other, which is inserted into the radial side of the base of the ungual phalanx, arises from the ligament stretched between the above nodule of the trapezio-trapezoid bone and the middle digit.

This muscle is described as the internal *interosseus* of the fifth digit, by Dr. Macalister¹.

Abductor pollicis.—A short, but well-developed fusiform muscle, which arises from the palmar fascia, close to its insertion at the small sesamoid which lies to the outer side of the scaphoid bone. It is inserted into the proximal phalanx of the pollex, on its external aspect.

Opponens pollicis.—Also well developed. It is a fusiform slip, which arises just posterior to a rounded projection from the palm, probably belonging to the trapezio-trapezoid bone, and is inserted, below the preceding muscle, into the radial side of the base of the proximal phalanx of the pollex.

Flexor brevis (or *Abductor*) *pollicis*.—A muscle similar, in size and shape, to the preceding; arises just anterior to the above-described process of the trapezio-trapezoid bone, also from a strong ligamentous raphe, which passes from the above nodular projection to the base of the proximal phalanges of the index and middle digits, and from which most of the other palmar *interossei* arise. It is inserted into the base of the proximal phalanx of the pollex, on its ulnar side.

Interossei.—A muscle, broad and fleshy, arises beneath the origin of the preceding muscle, and beneath the strong ligament which stretches from the proximal phalanges of the index and middle digits to the palmar nodule of the trapezio-trapezoid bone. It is inserted, by a round strong tendon, into the base of the proximal phalanx of the index, on its palmar aspect, and is also prolonged over the radial side of the root of this digit to join the *extensor* tendon, or its sheath, by a broad tendinous expansion over the dorsum of the proximal phalanx.

This muscle, which seems to be *functionally* an *abductor indicis*, is considered by Dr. Macalister² to be the displaced homologue of the deep head of the *flexor brevis pollicis*.

A flattened fusiform muscle arises between the origins of the preceding and the *flexor brevis minimi digiti*, crosses obliquely the metacarpal of the middle digit, and, becoming tendinous, runs along the radial side of the fourth digit, to be inserted into the base of its ungual phalanx, on the same side. As it crosses the middle digit, it is crossed in turn by a muscle next to be described.

A muscle similar to the preceding crosses over it at right angles, as it lies over the metacarpal of the middle digit, and is inserted into the proximal phalanx of the index, on the ulnar aspect of this digit. It appears to take origin from the palmar surface of the metacarpal of the fourth digit.

In the interspace between the metacarpal bones of the index and middle digits, from the point of origin of, but at a lower level than, the *interossei* which pass respectively to the radial sides of the index and fourth digits, arises a muscle which appears to be

¹ Annals and Mag. of Nat. Hist., l. c. p. 318.

² Loc. cit. p. 319.

inserted into the ulnar side of the base of the proximal phalanx of the index, and to join the sheath of its extensor tendon.

A muscle, fairly strong and fleshy, arises in the interspace between the metacarpals of the middle and fourth digits, and terminates by a broad tendon on the dorsum of the former digit, joining apparently the *extensor* tendon or its sheath. The middle digit has no other corresponding muscle on its radial side.

These two last-described muscles are the only *interossei* which, from their intermetacarpal origin, can be strictly termed, according to human-anatomy language, "*dorsal*."

Dr. Macalister, in his description of the arrangement of the *interossei* muscles in the manus of *Dasypus*¹, omits to notice the fact that the fourth digit has an *interosseus* of very appreciable size, attached, as I have described, to its radial side. This muscle, moreover, is rendered the more noticeable in that it is crossed almost exactly at a right angle by a muscle of similar size and shape, which takes origin from the ulnar portion of the palm, and passes to the ulnar side of the index. The arrangement of these two muscles may be well expressed by likening them to a capital X, the legs of which are rooted in the palm, while the arms are stretched out as though to embrace the index and fourth digits.

Dr. Macalister, moreover, has not noticed that the muscular fasciculus which he has correctly described as passing to the radial side of the middle digit, is peculiar in partaking rather of the character of a *dorsal interosseus*, seeing that it has an intermetacarpal origin, while its fellows would be ranked among the *palmar* series.

Meckel describes the *interossei* as being weak in the "*Tatu*"².

Lower Extremity.—The thigh was flexed upon the side of the abdomen, and the leg upon the thigh, in such manner that when the animal was placed upon its back it appeared to lie in an exaggerated, but humanly impossible, "*lithotomy position*." This posture was preserved by a disposition of fascia similar to that which existed in the upper extremity.

Tensor vaginæ femoris.—A flat, thin, almost triangular, but rather irregularly shaped muscle. It arises from a process which must be regarded as the homologue of the anterior superior spine of the ilium, from the lumbar aponeurosis, external to the transverse processes of the lumbar vertebræ; also from the last of the six dorsal bands, and from the first row of scales belonging to the pelvic armature.

It is gradually lost in thin fascia, which is partly inserted into the lower surface of the third trochanter of the femur, and partly blends with that portion of the *gluteus maximus* which is inserted into the ligament passing from the above trochanter to the extremity of the ridge which runs upwards from the outer condyle. It, moreover, partly terminates in the fascia covering the outer aspect of the thigh and leg, in the neighbourhood of the termination of a muscular slip given off by one of the divisions of the *biceps*. It is overlapped during the whole of its course by the anterior free edge of the *gluteus maximus*.

Gluteus maximus is a thin and flat muscle of great extent of origin. It arises from that part of the lumbar aponeurosis which is attached to the metapophysis of the last

¹ *Loc. cit.* p. 318.

² *Op. cit.* p. 569.

lumbar vertebra, from the free edge of the tuberosity of the ilium, from the sacral aponeurosis which covers the longitudinal caudal muscle and the *gluteus medius*, and from the free superior edge of the ischial tuberosity.

Its fibres converge towards the third (external) trochanter of the femur, into the external face of which process they are inserted, as well as into the ligament stretched between this trochanter and the extremity of the ridge continued upwards from the external condyle.

Gluteus medius.—A well-developed, but irregularly shaped muscle, arising from the external free ridge or "crest" of the ilium, and from its posterior (or superior) fossa, and from the metapophyses of the sacral vertebræ. The sacral and iliac element fuse at the external or anterior free edge of the muscle, but enclose between them a kind of cavity or sac, which is occupied by the *pyriformis*. That portion of the muscle which arises from the sacrum is inserted into the posterior part of the summit of the greater external trochanter of the femur, and partly into the posterior intertrochanteric ridge, just external to the insertions of the *gemelli* and *obturator externus*. The factor which takes origin from the ilium terminates through a strong tendon at the anterior part of the summit of the great trochanter, which tendon is joined, shortly before insertion, by that of the *pyriformis*.

Cuvier gives a good representation of the superficial portion of the muscle in two of his plates¹.

The *Gluteus minimus* appears to be absent, and is, moreover, not figured by Cuvier.

This muscle, according to Meckel², is not differentiable from the *gluteus medius* in the Sloth and Anteater. Rapp, on the other hand, found all these *glutei* in *Myrmecophaga tamandua*³.

Pyriformis.—A flat muscle, of nearly uniform breadth, arises from the anterior half of the posterior or superior margin of the oval foramen into which the great sciatic notch is converted by the articulation of the spine as well as the tuberosity of the ischium with the transverse processes of the last three sacral vertebræ, the above-mentioned margin being formed by the free edge of the processes of the middle vertebræ of the sacrum.

This muscle does not appear to have any origin from the concavity or inner face of the sacrum.

It is inserted into the summit of the great trochanter of the femur, being fused at its insertion with the strong terminal tendon of the inner layer of the *gluteus medius*.

Cuvier indicates the origin of the *pyriformis* ("pyramidal," or "sacro-trochantérien") in one of his plates⁴. The muscle appears to be separable into two portions, which, however, fuse again at its insertion.

According to Meckel⁵, it consists of two elements, and is of fair size in the *Platypus* and *Aï*.

Obturator externus.—Is a fan-shaped muscle, which takes origin from the whole of the superior edge of the thyroid foramen, and is inserted by a strong flat tendon into the posterior intertrochanteric ridge, just below the digital fossa of the femur, and immediately anterior or inferior to the insertion of the *gemelli*.

¹ Pl. 259. fig. 3, and pl. 260.

² *Op. cit.* p. 581.

³ *Op. cit.* p. 50.

⁴ Pl. 259. fig. 3.

⁵ *Op. cit.* p. 583.

The muscle has two heads of origin, the larger of which is the more anterior—the smaller, which is about one-third of the former in size, arising posterior to it, and immediately in front of the acetabulum. The sciatic nerve passes along the thigh to its outer side.

Henle¹ describes this muscle in Man as being made up of two portions at its origin.

Obturator internus.—Appears to be wanting, as might be expected, seeing that there is no lesser sciatic notch, the whole of that portion of the ischium which intervenes between its tuberosity and what must be regarded as the homologue of its spine being articulated with the sacrum.

Cuvier, moreover, gives no indication of this muscle in his plates, but states in his 'Leçons'² that in animals which have the ischium ankylosed with the sacrum (*e.g.* Tamandua) a muscle coming from the external face of the ischium takes the place of the *obturator internus* and the *gemelli*.

Rapp³ notices the existence in the Tamandua of the external obturator muscle, and of a muscle which "appears to answer to the *gemelli*," but makes no mention of an *obturator internus*, or of a substitute for it.

In the Aï, according to Meckel⁴, this muscle has left its position, and has become a second *obturator externus*, but smaller than the external obturator proper, under which it is situated. A like arrangement exists in the Anteater, which, moreover, possesses as does the Aï likewise, but one *gemellus*.

Gemelli.—Both these muscles are present, though the muscle with which they are in Man so intimately associated is absent. They are both delicate muscles, the anterior being the most slender, in that it is about one-third of its fellow in size. The former is, moreover, fusiform, while the latter is more or less fan-shaped, tapering from its origin towards its insertion.

Their origin is much further forward than in Man, owing to the great length of the ischium.

They arise immediately behind the posterior portion of the neck of the acetabulum, just above the superior border of the thyroid foramen, and are inserted into the digital fossa of the great trochanter, immediately posterior or superior to the strong tendon of insertion of the *obturator externus*.

Quadratus femoris.—Is an oblong muscle, of fair size, arising from the ramus of the ischium, immediately below the *adductor*. It passes across to be inserted obliquely into the posterior part of the rough ridge forming the anterior edge of the inner trochanter.

Cuvier figures it in profile in one of his plates⁵.

It is well developed, according to Meckel, in the Aï, but is absent in the Anteater⁶.

Ilio-psoas.—The two elements of this compound muscle appear to be early fused together, and are inserted along the whole edge of the inner trochanter. The iliac element takes origin from the whole inner face of the ilium.

Psoas parvus.—A long, slender muscle, which appears to arise from the outer side of the posterior edge of the last dorsal and two first lumbar vertebræ. It passes down

¹ *Loc. cit.* p. 252.

² *Loc. cit.* p. 502.

³ *Op. cit.* p. 49.

⁴ *Op. cit.* p. 584.

⁵ *Op. cit.* pl. 259. fig. 3.

⁶ *Op. cit.* p. 586.

straight, lying immediately on the inner side of the *psoas magnus*, to be inserted into a kind of tubercle ("ilio-pectineal") situated at the junction of the ilium with the pubes, immediately superior to the origin of the *pectineus*.

Pectineus.—Arises from the ilio-pectineal line of the os pubis, immediately posterior to the pubic origin of the *gracilis*. It is a thin, flat, fan-shaped muscle, and is twisted in such a manner between its origin and insertion that the surface which is superior at the former position becomes inferior at the latter—that edge, moreover, of the muscle which is anterior at origin becoming posterior at insertion, and *vice versâ*. When the thigh is completely abducted, the above appearance departs. The muscle is inserted by a flat tendon, which has a greater breadth than its cord-like representative figured in one of Cuvier's plates¹, into a roughish projection from the inner edge of the femur, situated immediately below, and slightly posterior to the spring of the "lesser" (internal) trochanter.

Its insertion lies between that of the *adductor* and the origin of the *vastus internus*.

In Cuvier's 'Leçons' it is stated that "le pectiné de la *taupe*, de l'*ours*, du *chien*, des *tatous*, des *fourmiliers* est ventru, et prolonge son tendon inférieur jusqu'au bas du fémur; cela n'est pas ainsi dans les autres mammifères." In some of these latter, together with the three-toed sloth, "ce muscle est séparé en deux portions; alors la deuxième portion prolonge également son tendon jusqu'au milieu ou même jusqu'au bas du fémur"².

Adductor.—This muscle, which is represented by Cuvier, in his plates³, as the *adductor brevis*, is large, almost uniformly broad, and flat, but fleshy. It arises, its origin being completely covered by that of the *gracilis*, from the triangular bony space, formed by the junction of the os pubis and the ischium, which lies between the thyroid foramen and the symphysis pubis, and also from the ascending ramus of the latter bone for the distance of about one inch. It passes across to the femur, broadening slightly towards its termination, and is inserted obliquely into this bone at the lower part of its middle third, filling up the interval between the inserted part of the *pectineus* and the edge of the third trochanter, and having its lowest fibres of insertion continued for a small distance in advance of the above muscle. Its highest fibres of insertion are immediately below that portion of the *vastus externus* which fills the fossa included between the "greater" and third trochanter.

Though the homologies of this muscle cannot be determined with great accuracy, it may nevertheless be regarded, I think, as the representative of either the *adductor longus* or *brevis*, or, possibly, of both these muscles combined.

Meckel, when describing the *adductors*⁴, makes no mention of *Dasypus*, but states that the single *adductor* in the Anteater, which coexists with a well-developed *pectineus*, is derived from three heads of origin. The *Aï*, moreover, although it has the latter muscle extremely well developed, has no less than four *adductors* in addition.

¹ *Op. cit.* pl. 260.

² Parenthetical remark by Editor, p. 505, vol. i. of 2nd edit.

³ *Op. cit.* pl. 259. figs. 2 & 3, and pl. 260.

⁴ *Op. cit.* p. 596.

*Quadriceps extensor*¹.—This compound muscle is made up of the following elements:—

a. Rectus.—A comparatively slender, fusiform slip, thickest in the middle, and tapering towards its origin and insertion. It arises from a smooth oval facet upon the ilium, situated immediately above, but slightly posterior to the cotyloid cavity. It takes a perfectly straight course to its insertion into the upper edge of the patella, above the points of insertion of the other components of the *extensor*.

β. Vastus externus.—A large fleshy mass, arising from the greater part of the external aspect of the femur. Its highest fibres of origin are derived from a portion of the inner face of the great trochanter, and from the outer and posterior aspect of the same tuberosity; the space, too, intervening between the third and the above-mentioned trochanter is filled up by fibres of origin of this muscle. The muscle arises, moreover, from the whole superior aspect of the third trochanter, also from the outer part of the anterior face of the rest of the femur as far as the root of the condyles. It is inserted into the superior edge of the patella, to the outer side of the insertion of the *rectus*.

γ. Vastus internus.—Is much smaller than the preceding factor; it arises from the superior and inner aspect of the femur, from the space intervening between the “greater” and “lesser” trochanters to the root of the condyles. It finds insertion at the upper edge of the patella, to the inner side of the termination of the *rectus*.

No distinct factor answering to the *crureus* appeared to be present.

Sartorius.—A very delicate muscle, which arises from the outer edge of the tendon of the *psoas parvus*, at the distance of about half an inch from the insertion of the latter. It passes downwards, diagonally, along the inner aspect of the thigh, as a thin, strap-like slip, and terminates in the aponeurotic fascia which covers the inner face of the knee and leg.

This muscle would appear to play the part, in the animal to which it belongs, of a kind of *tensor fasciæ femoris internus*.

I have not found any description of a similar origin of this muscle in any other animal.

According to Meckel², the *sartorius* in the Aï takes origin from the aponeurosis of the *external oblique*; but this statement is contradicted by the editor of the second edition of Cuvier's ‘Leçons,’ who declares that the muscle in question arises from the ilium³.

That, however, which Meckel has stated erroneously of the Sloth, takes place, if Krause's testimony be trustworthy, in the Rabbit, in which animal the *sartorius* is described as taking origin from the fascia of the *external oblique*, in the middle of *Poupart's ligament*⁴.

Gracilis.—A slender, broad, but thin, wafer-like muscle, having an extensive origin and insertion. Its origin, which is shaped thus > (right side), is derived from the adjacent portions of the os pubis and ischium, from the last inch anteriorly of the superior edge of the former bone, beginning where the origin of the *pectineus* terminates, and from the first inch anteriorly of the inferior edge of the latter bone.

¹ Cuvier, Anatomie Comparée, pl. 259. figs. 2 & 3, pl. 260.

² *Op. cit.* p. 614.

³ Vol. i. p. 519.

⁴ Die Anatomie des Kaninchens, Leipzig, 1868, p. 116.

It passes forwards, closely embracing for about the first half of its course the large subjacent *adductor* muscle, and joins the aponeurosis (common also to the *sartorius* above and the *semitendinosus* below) which is inserted obliquely into the tibia, between its anterior ridge and the strongly developed internal lateral ligament, and becomes, moreover, continuous with the fascia covering the front aspect of the leg.

The origin and insertion of this muscle is very clearly and truthfully represented by Cuvier in one of his illustrations of the myology of *Dasypus*¹.

Semimembranosus.—A strong, uniformly broad, strap-shaped muscle, which arises from the ischium, anterior to the tuberosity of the bone, immediately below the origins of the *adductor* and the *crus penis*. It passes along the inner aspect of the thigh, to be inserted, the lower half, obliquely into the tibia, immediately posterior to and covered by, at its insertion, the internal lateral ligament, the upper half into the facet and part of the ridge on the inner aspect of the internal condyle of the femur.

The inferior edge of the muscle, near its termination, is, moreover, connected with a strong aponeurosis, common also to the *semitendinosus* and *gracilis*.

Semitendinosus.—A narrow strap-shaped muscle, arising from the tuberosity of the ischium, in close company with, but immediately posterior to, the most posterior at origin of the two divisions of the *biceps*, and passing across to the inner side of the leg. After a somewhat long course, it terminates a little above the inner malleolus in a strong aponeurosis, common to the terminal portion of the *gracilis* and *semimembranosus*, and which is attached to the strongly developed "shin-ridge" of the tibia. By its lower edge the muscle is connected with strong fascia, continuous with the inner edge of the inner division of the *gastrocnemius*, close to its insertion.

Biceps.—This muscle arises from the posterior (superior) edge of the ischium, immediately anterior to its tuberosity. It is made up of two factors, which are distinct from each other throughout the whole of their course.

The most anterior at origin arises, partly fleshy, partly distinctly tendinous, from the ischium, and, after proceeding halfway on its course, sends off, nearly at a right angle, from its upper or outer edge, a slender muscular slip, which is finally lost in the fascia covering the outer aspect of the leg, not far below the lowest portion of the *tensor vaginæ femoris*. The main part of this factor of the *biceps* terminates in the strong fascia in the neighbourhood of the heel, at a little distance above the calcaneal process.

The second division of the muscle arises slightly posterior, but superior, to the former portion, taking origin from the tuberosity itself of the ischium, and being intimately connected with those fibres of the *gluteus maximus* which have their origin at this spot. Early in its course it crosses over and passes to the inner side of its fellow, on which side it remains, up to its termination in strong fascia which is in close relation with the tendon of the outermost division of the *gastrocnemius*, separating this muscle at this point from the terminal part of the first-described factor of the *biceps*.

Cuvier represents, somewhat vaguely, this muscle as a broad triangular sheet, covering the whole of the outer aspect of the calf, and seemingly blending with its fascia².

¹ Anat. Comp. pl. 260.

² Op. cit. pl. 259. fig. 2.

The same anatomist figures, in his plates illustrating the myology of the Otter¹, as arising from behind the *gluteus medius*, and covered by the *G. maximus*, a very thin accessory slip of the *biceps femoris*, which, "au lieu de s'épanouir sur l'aponévrose jambière, comme le biceps, se réunit au gastrocnémien externe, et contribue à former le tendon d'Achille." This seems to answer very fairly to the last factor of the *biceps*, which I have described.

A similar accessory factor of the above muscle is figured by the same author in his plates of the anatomy of the Hyæna, and is described as a "mince et long ruban musculaire qui descend tout le long de la cuisse et va se fixer vers le milieu de la jambe, sur le fléchisseur du pouce."²

Gastrocnemius.—This muscle arises by two distinct heads from tubercles situated posterior to the inner and outer condyles of the femur respectively, the outermost head having the widest extent of origin.

This latter takes origin from the ridge at which the strong ligament terminates, which is attached above to the third trochanter of the femur, and overlaps, moreover, the origin of the *plantaris*.

It becomes fused with its fellow at about the lower third of the calf, and is inserted into the calcaneum on either side, by a broad aponeurotic tendon, which crosses over the slender tendon of the *plantaris* as it passes into the sole.

Soleus.—This muscle, which appears to have no tibial origin, arises from a small cavity underneath an overhanging tubercle upon the posterior part of the head of the fibula. From this origin it passes straight down, gradually and slightly broadening, to its insertion at the calcaneum, in advance of that of the *gastrocnemii*. Besides its own proper insertion, some of its fibres blend on either side with the broad tendon of insertion of the above-mentioned muscle, but have in their midst a kind of foramen for the passage of the tendon of the *plantaris* into the sole of the foot.

Cuvier, in his 'Leçons'³, describes this muscle as of less considerable size in mammals than in man. According to him, it ordinarily attaches itself to the external face of the upper head of the fibula—but sometimes, however, descends to the middle part, as in the Aï and the Elephant.

Popliteus.—This is a muscle of considerable size, triangular or fan-like in shape. It arises, by two short heads, from the external condyle of the femur, immediately behind the posterior head of origin of the hindmost of the *peronei* muscles.

The lower of the two heads of origin of this muscle arises from a small depression in the external face of the articular portion of the condyle by a strong roundish tendon, which is, moreover, connected with the external semilunar cartilage. The upper and slighter of the two heads arises fleshy from a smooth facet on the condyle, situated immediately above the pit which affords origin to the first-described factor of the muscle, and is, moreover, in intimate relation with the capsular ligament of the joint. The body of the muscle spreads out, becoming flatter and thinner, to be inserted along nearly

¹ *Op. cit.* pl. 110. fig. 1.

² *Op. cit.* pl. 131.

³ 2nd ed. vol. i. p. 538

the whole extent of the posterior ridge or spine of the tibia, from the neck of the bone as far as a point about half an inch above the free lower extremity of its malleolus.

For the extent of the upper half-inch of its insertion, it is overlapped by the lower half of the terminal portion of the *semimembranosus*, which muscle is, in turn, itself overlapped by the strong internal lateral ligament.

The *popliteus* bears a striking resemblance in shape to its supposed *serial* homologue in the upper limb, namely, the *pronator teres*.

Plantaris.—This muscle arises partly fleshy, partly tendinous, in company and almost fused with the outer head of the *gastrocnemius*, and immediately internal to it (the above-mentioned portion of the latter muscle completely covering it on its external side), from a roughish projection from the inferior or posterior aspect of the shaft of the femur, just superior to the inner condyle. The muscle gradually swells out from this origin to attain its greatest breadth at about the termination of the upper third of the calf; after which point it gradually tapers towards a strong tendon, which passes into the sole through a vertical groove in the calcaneal process of the heel-bone, which is arched over by the broad tendon of insertion of the *gastrocnemius*.

The tendon of the *plantaris*, besides contributing to the plantar fascia, splits, at about the level of the tarso-metatarsal joint, into three divisions, which pass respectively to the hallux, second and third digits, and are inserted into the metacarpal extremities of their respective proximal phalanges, having a mode of termination similar to that of the tendons of the *flexor sublimis* in the upper limb, in that they form a tunnel for the passage of the tendons of the deep *flexor*.

The offset passing to the hallux is very delicate, and may have been overlooked by Cuvier, since it is omitted in his plate¹.

From the inferior aspect (the foot being viewed from its plantar surface) of the tendon, before its division, a branch is given off to the fourth digit, which has an insertion similar to that of the tendons which pass to the other toes.

The above-described contributions of the *plantaris* muscle to the digits of the foot are interesting, seeing that this vicarious assumption of the office of the *flexor brevis* is exactly paralleled in the upper extremity by the fusion of the *palmaris longus* and *flexor sublimis* into one muscle.

Mr. Mivart and Dr. Murie, in their paper on the Anatomy of *Dasyprocta cristata*², insert a quotation from one of Prof. Huxley's Hunterian Lectures (March 20th, 1865), which refers to the *plantaris* in the Rabbit. The passage concludes thus:—"It ends in a tendon which spreads on the pulley-like end of the calcaneum, and divides into four perforated tendons, thus replacing the flexor brevis, as in *Dasypus sexcinctus*."

The editor of the second edition of Cuvier's 'Leçons' remarks³ that in the Carnivora, in some Rodents, and some Edentates the short *flexor* exists, but its tendons are fused with that of the *plantaris*.

The following remark occurs in the same work (p. 539):—"Dans les *singes*, il (the *plantaris*) se continue manifestement avec l'aponévrose plantaire. Nous verrons plus loin que dans les autres mammifères, il tient lieu de fléchisseur perforé."

¹ Anat. Comp. pl. 260.

² Proc. Zool. Soc. June 1866, p. 414.

³ Vol. i. p. 557.

Henle says of the same muscle in man :—"Er ist ein Analogon des *M. palmaris* der oberen Extremität"¹.

The *plantaris* in the Hippopotamus appears to have an arrangement similar to that of its homologue in *Dasypus* and the Rabbit; for, according to Gratiolet, this muscle terminates in the sole by four digitations, which furnish to each of the four toes a superficial flexor of the first and second phalanx².

The three toes of the *Hyrax*, an animal *Ungulate* in its affinities, are supplied in like manner with offsets from the *plantaris*³.

Flexor longus digitorum.—A large fleshy muscle, which arises by two short heads, separated by the origin of the *soleus* from the whole posterior surface of the fibula, the most external head being highest and situated on the smooth external aspect of the head of the bone, just behind the origin of the most posterior of the *peronei*. It also takes origin from the interosseus membrane, and from the fibular aspect of the tibia, immediately external to the *tibialis posticus*.

At the posterior tibio-tarsal articulation it becomes suddenly tendinous, and its broad stout tendon passes immediately anterior to the insertion of the *soleus*, and close to the tibial face of the calcaneal process, into the sole; when at about the level of the tarso-metatarsal joint, it divides into five tendons of nearly equal size, each of which passes to a digit, the hallux included, those supplying the latter and the little toe being somewhat slighter than their fellows. Just before its division into the above branches, the tendon broadens, and in it is developed a flat, smooth, oval sesamoid, of less size than the corresponding ossicle in the palmar *flexor* tendon.

The following passage occurs in Cuvier's 'Ossemens Fossiles'⁴ :—"Dans le Cachicame⁵ il y a sous le tarse une partie ossifiée du tendon des fléchisseurs comme au pied de devant; mais je ne l'ai pas observée dans le Tatou géant ni dans les Cabassous⁶ et Encouberts"⁷.

Flexor brevis digitorum.—This muscle was absent; but its office appeared to be assumed, as I have already stated, by the modified *plantaris*.

Tibialis posticus.—Arises by two short heads, between which the anterior tibial vessels pass into the front of the leg. The inner of these heads is attached to the upper third of the posterior face of the tibia, while the other takes origin posteriorly from that portion of the head of the fibula which is ankylosed with the preceding bone.

The body of the muscle arises from the whole length of the interosseous membrane, and, at the inner malleolus, becomes tendinous; the tendon, passing through a groove in the posterior inferior aspect of this process, enters the sole of the foot, and finally terminates at the posterior part of the strong scaphoid tubercle which projects on the inner edge of the foot. Just before its insertion, the tendon runs through a strong

¹ Muskellehre, p. 289.

² Recherches sur l'Anatomie de l'Hippopotame, Gratiolet, publiées par les soins du Dr. Edmond Alix. Paris, 1867; p. 295.

³ Murie and Mivart, "On the Myology of *Hyrax capensis*," Proc. Zool. Soc. April 1865, p. 350.

⁴ Nouvelle édit., Paris, 1823, tom. v. p. 131.

⁵ *Dasypus novemcinctus*.

⁶ Tatou à 12 bandes (Buffon).

⁷ *D. sexcinctus*.

ligamentous sling or pulley, which passes from the anterior part of the free internal edge of the malleolus to the scaphoid bone, immediately posterior to the tubercle mentioned above.

Taking origin from the middle third of the posterior aspect of the tibia, immediately below the inner head of the *tibialis posticus*, and lying between the origin of its body and the *popliteus* at its insertion, is a smaller muscle, which, at the inner malleolus, becomes tendinous, the tendon lying in the malleolar groove in company with, and to the tibial side of, that of the *tibialis posticus*.

The tendon, after its emergence from the groove, passes on to the internal slope of the dorsum of the foot, and, running over the scaphoidal tubercle, is inserted into the posterior part of an ossicle which lies immediately in front of this tubercle, alongside of the free edge of the ento-cuneiform bone. From the anterior portion of the said ossicle passes a strong tendon or ligament, to be inserted into the tibial side of the base of the proximal phalanx of the hallux.

May not the latter of the two muscles described above be regarded as a *tibialis posticus secundus vel internus*¹?

Cuvier figures the last-described differentiated slip as the *tibialis posticus*, while this latter is represented by him as the *flexor longus pollicis*².

Meckel describes a division of the *tibialis posticus* into two parts as taking place in the Beaver and Marmot, but does not record the occurrence of a like differentiation in the Bruta³.

The same anatomist, in his monograph upon the *Platypus*⁴, records the existence of a sesamoid ossicle in the tendon of the *tibialis posticus* of this Monotreme.

According to Cuvier, the tendon of this muscle contains, in Apes, a sesamoid of considerable size, placed under the scaphoid⁵. Church, however, does not record the existence of any such ossicle in the Apes he examined.

Tibialis anticus.—A muscle of fair size, which arises from the upper third of the inner face of the tibia, from the hollow arch formed by the fusion of the upper part of this bone with the fibula, from the inner aspect of the anterior ridge of the latter bone, as far as the origin of the *extensor proprius hallucis*, and from the interosseous membrane.

Passing obliquely inwards from its origin at the tibio-tarsal articulation, it becomes tendinous; and its tendon then runs close to the tibial side of, and parallel to that of, the

¹ I am glad to find that the above hint coincides with a suggestion thrown out by Mr. John Wood in a paper on "Varieties in Human Myology" read before the Royal Society, and published in its 'Proceedings' for June 1865. The passage in which this occurs (p. 11 of reprint) runs as follows:—"In many of the same feet, and in others, a sesamoid bone was likewise found in the tendon of the *tibialis posticus*, placed to the inner side of, and playing over, the scaphoid bone. Its relation to the occurrence of an additional tarsal bone in this situation in the hinder limbs of the Armadilloes and other Edentata is suggestive. The special muscle found attached to it in these animals is produced apparently by a differentiation of fibres of the *tibialis posticus*, similar to that which frequently occurs in the *tibialis anticus* in the human subject, as shown in the author's last paper read before the Society."

² Anat. Comp. pl. 260.

³ Op. cit. pp. 636, 637.

⁴ Ornithorhynchi Paradoxi Descript. Anat. (Fol. Leipzig, 1826), p. 30:—"Reliquis longe minor tendine tenui, ossiculum sesamoideum satis magnum continente, hallucis phalangi primæ inseritur."

⁵ Leçons, loc. cit. p. 541.

muscle mentioned above—but, just before this passes into its tendinous pulley, parts company from it, and turns over the inner aspect of the ento-cuneiform bone, to be inserted into its inner or inferior edge.

Peroneus longus.—A muscle of considerable length, having but very slight connexion with the fibula. It has ~~two~~ heads of origin, both fleshy:—the smaller, and higher, from the outer edge of the patella, immediately above its ligament; the larger, from the arch-like ridge connecting the anchylosed upper extremities of the tibia and fibula, most of its inner fibres being intimately connected with those of the origin of the *extensor communis*; other fibres, too, arising from a strong fibrous intermuscular septum, which passes to the latter muscle from the anterior ridge of the fibula.

Upon reaching, after a straight course, the hamular projection from the outer malleolus, the muscle becomes tendinous, the tendon lying posterior in the concavity of the above process, being included, together with two other tendons, presently to be described, in a kind of synovial sheath, and being, moreover, arched over by strong fascia which passes from the malleolar process to the keel.

The tendon then dips down in front of a tubercle (the probable representative of the “peroneal tubercle” of human-anatomy language) developed upon the outer side of the anterior extremity of the calcaneum, being at this spot also arched over by strong fascia. It now, parting company from the two tendons mentioned above, passes into the sole of the foot, turning inwards sharply, almost at right angles to its previous course, and running along in the space between the cuboid and scaphoid bones posteriorly, and the bones in relation with these anteriorly, being covered by strong ligament which bridges over the intervening gap, reaches finally the outer or fibular side of the base of the metatarsal bone of the hallux.

The tendon, moreover, on reaching the sole of the foot, sends a flat offset to the tibial side of the base of the metatarsal of the fifth digit.

Peronei, brevis et tertius.—Since these muscles are, at their upper part, with difficulty to be differentiated from each other, they had best be included under one description.

The highest fibres of origin of the compound muscle proceed from the outer face of the external condyle of the femur, and from a strong flat ligamentous band which proceeds to this part of the condyle from the outer edge of the superior half of the patella. A few fibres, too, arise fleshy from the outer edge of the inferior half of the patella, immediately below the attachment to it of the above-mentioned band, being overlapped by the highest fibres of origin of the *peroneus longus*. The bulk of the muscle takes origin from the whole outer aspect of the fibula, and runs down parallel with, and close to, the preceding muscle, and shares with it the same synovial sheath, behind the outer malleolus, lying posterior and external to its tendon.

The main portion of the muscle does not become tendinous until it reaches the “peroneal tubercle” of the os calcis. Here its tendon passes under the same fibrous bridge as that which arches over the tendon of the *p. longus*, and is finally inserted into the outer face of the tubercle developed upon the inferior surface of the metatarsal of the fifth digit.

Such a termination appears to answer to that of the *peroneus brevis*.

Beginning in the muscle, about halfway down, and running for some distance in its

substance, there is present another tendon, which leaves the body of the muscle at about the level of the malleolus, and, lying first between the tendons of the *p. longus* and *brevis*, and then to the inner side of the former, but sharing the same synovial sheath, passes, superficial to, and to the inner side of these two tendons, under the fibrous bridge mentioned above, to be inserted into the outer side of the base of the proximal phalanx of the fifth digit.

This latter tendon may be regarded as a fair representative of that of the *peroneus tertius*.

Meckel notices the arrangement of the peronei in the Anteater and *Ai*¹. They are described as being only two in number, long and short. In the former animal the first is described as feeble, while the second divides into two factors which pass respectively to the metatarsal and first phalanx of the fifth digit—an arrangement resembling that which I have just described as existing in *Dasypus*. In the *Ai*, both *p. longus* and *p. brevis* are double, the longest factor of the former muscle coming from the femur. This muscle, moreover, is not continued into the sole, but stops short at the base of the external metatarsal. The same anatomist further on describes, as present in the Anteater, a small *extensor proprius* of the fifth digit—"der dritte Wadenbeinmuskel"—which springs from the fibula, between the long and short *extensor communis*, and terminates at the fourth tendon of the former *extensor*.

A similar short *extensor proprius*, or "third peroneal," is described as existing in *Dasypus* (species not given), which comes even from the external condyle of the femur. The termination of this muscle is, unfortunately, not mentioned².

The editor of the second edition of Cuvier's 'Leçons' remarks³ that in the *Ai* there is no *p. longus*. The *p. brevis* is a long muscle which arises from the whole length of the fibula, and above the tendon of origin of the *extensor communis*, which itself comes from the condyle of the femur. The "middle" *peroneus*, which comes but from the inferior part of the fibula, serves as the extensor of the two external digits.

Extensor communis digitorum.—Arises from nearly the whole length of the anterior ridge of the fibula, and from the outer half of the arch by which this ridge communicates with that on the front of the tibia, being in close relation at its origin with the anterior (or shorter) head of origin of the *peroneus longus*. A little above the tibio-tarsal joint it terminates in three roundish equal-sized tendons, which, after passing under a kind of annular ligament at the joint, are distributed as follows:—

The outer, or fibular, tendon divides, at the metatarso-phalangeal articulation of the fifth digit, into two branches; the outer of which passes to the terminal phalanx of this digit, while the inner joins the lateral expansion of the tendon next to be described, which this forms over the proximal phalanx of the fourth digit.

The middle tendon, a little before its division, receives, on its inferior surface and fibular side, the outer of the three divisions of the *extensor brevis*, and at the level of the tarso-metatarsal joint of the fourth digit divides into two branches, the outer of which passes to the distal phalanx of the fourth digit, receiving at its lateral expansion the

¹ Vergleich. Anat. loc. cit. p. 626.

² Op. cit. pp. 641, 642.

³ Loc. cit. p. 542.

inner of the two branches of its fibular fellow, while its inner branch is despatched to the middle toe, there to join the expansion of its tibial comrade over the proximal phalanx of this digit.

The last or tibial tendon divides at a much higher point than do the two preceding, this division taking place at about the end of the first half of the metatarsal of the middle digit; immediately, however, before doing this, it receives on its inferior surface the middle of the three divisions of the *extensor brevis*. It then divides into two branches, the outer of which reaches eventually the distal phalanx of the middle digit, receiving, however, at its lateral expansion over the proximal phalanx of this digit, the inner branch of the middle tendon of the *extensor communis*. The second, or innermost branch of the tibial tendon reaches at last the distal phalanx of the second digit; but, at its lateral expansion over the proximal phalanx, it receives a thin, but comparatively broad band given off from the middle of the convexity of its curved offset to the tendon of the *extensor proprius hallucis*. This offset leaves the last-described branch of the tibial tendon of the *extensor communis* at the point where it diverges from the outer branch of the same tendon, and may be regarded as a third branch of the tendon. It is joined at its origin by the innermost of the three divisions of the *extensor brevis*, and, after giving off the flat band mentioned above, is continued into the tendon of the *extensor proprius hallucis*.

The *extensor communis* in the Aï, according to Meckel¹, has an amphibian peculiarity, in that it does not reach as far as the toes, but is attached by a strong single tendon to the middle of the middle metatarsal.

It is stated in Cuvier's 'Leçons' that the common *extensor* of the toes, in most Rodents and Edentates, besides other animals, takes origin by a tendon from the external condyle of the femur².

Cuvier's representation of the termination of the tendons of this muscle, in one of his figures of the myology of *Dasypus*, is not distinct enough to allow of the determination of its correctness or the reverse³.

Extensor brevis digitorum.—An entirely fleshy muscle, which arises from the upper half of the whole length of the calcaneal process, on the external aspect of the bone, being bounded below by a line joining the peroneal tubercle and the free extremity of the process. It passes forwards, being arched over by a ligament which is extended between the outer malleolus and the tubercle mentioned above, and by the tendons of the *peronei* muscles, and, on gaining the dorsum of the foot, divides into three fusiform slips of equal size, which take an oblique direction from without inwards, and join two of the three tendons into which the common *extensor* divides, at a little beyond the first half of their course, and slightly posterior to their ramifications.

The outer of the three slips passes to the middle of the above tendons; the middle slip joins the inner or tibial one; while the inner slip passes to the curved transverse branch which the tibial tendon gives off to join the tendon of the *extensor proprius hallucis*.

¹ *Op. cit.* p. 641.

² *Loc. cit.* p. 535.

³ *Anat. Comp.* pl. 259. fig. 2.

Cuvier, in one of his figures, gives a good representation of the origin of the *extensor brevis*; but the termination is ill-defined¹.

In *M. tamandua*, according to Rapp², this muscle has attachments to all five digits. Such a distribution is borne out by one of Cuvier's figures of this species of Anteater³.

Extensor proprius hallucis.—Arises from the inner face of the fibula and from the inner edge of its anterior spine or ridge, a little above the level of the point where this bone begins to fuse inferiorly with the tibia, and below the lowest fibres of origin of the *tibialis anticus*. The muscle runs obliquely inwards, parallel with the inferior or outer edge of the *tibialis anticus*, and becomes tendinous at the level of the tibio-tarsal articulation.

The tendon, which runs parallel with that of the above muscle, courses along the inner aspect of the tarsus, passes through a tendinous loop or pulley which projects from the fibular side of the ossicle which lies immediately anterior to the prominent scaphoidal tubercle, takes a direction inclining obliquely outwards, and, broadening out, is inserted into the base of the proximal phalanx of the hallux. Just before this insertion, it sends a communicating branch to that broadened-out portion of the tibial tendon of the *extensor communis* which is inserted into the base of the proximal phalanx of the second digit. The tendon then contracts again, and, running along the dorsum of the hallux, terminates at the base of the ungual phalanx.

Plantar muscles of hallux.—From the posterior edge of the smooth oval tubercle on the fibular side of the plantar surface of the scaphoid bone arises a tendon which becomes continuous with two fusiform muscular slips; one of which passes to the sesamoid bone situated at the tibial side of the base of the proximal phalanx, while the other is continued to the distal phalanx of the hallux.

Though not strikingly homologous, these muscles may, I venture to think, be considered the representatives of the *abductor* and tibial head of the *flexor brevis* of the hallux.

They appear to be, with respect to function, opponents to the *peroneus longus*.

Plantar muscles of fifth digit.—These are three in number, and are as follows:—

a. A fusiform slip, which arises tendinous from the external, or fibular, tuberosity of the calcaneal process, and from strong fascia connected with the outer edge of this bone, and passes straight to its insertion into a strong tubercle developed upon the plantar aspect of the metatarsal of the fifth digit.

β. A muscle, somewhat broad at origin, which arises immediately to the inner side of the preceding, from the tibial, or inner, tuberosity of the calcaneal process. It gradually narrows into a long slender tendon, which is inserted into the outer (fibular) side of the ungual (middle?) phalanx of the fifth digit, on its palmar aspect.

These muscles are probably the representatives of the *abductor* and *flexor brevis minimi digiti*.

γ. A very small and delicate muscle, which appears to take origin from the deep

¹ *Op. cit.* pl. 259. fig. 2.

² *Op. cit.* p. 51.

³ *Op. cit.* pl. 261. fig. 1.

plantar fascia, at about the junction of the cuboid with the metatarsal bone of the fifth digit; and which is inserted into the outer side of the base of the proximal phalanx of this digit.

The true homologies of this muscle, which was so small that I nearly overlooked its presence, appear to be by no means easy of determination.

Interossei.—These somewhat delicate muscles are five in number, and radiate to their respective insertions from a common origin at the strong plantar ligament, where this crosses over the tendon of the *peroneus longus* as it passes along the sole to the hallux.

The first (innermost) of these muscles proceeds to the fibular side of the base of the proximal phalanx of the hallux.

The second and third pass one to either side of the same element of the second digit.

The fourth terminates at the tibial side of the base of the proximal phalanx of the fourth digit.

The fifth passes to the same side of the ungual phalanx of the fifth digit (*opponens digiti quinti*?). This muscle, like the *interosseus* despatched to the corresponding digit in the fore limb, is the most considerable in size of the plantar *interossei*.

It will be seen that the middle digit possesses no *interosseus*, unless it be (which is not improbably the case) that the third passes to its tibial side. In this case the *interossei* may be regarded as abductors towards an imaginary line drawn through the intermetacarpal space between the second digit and hallux.

Lumbricales.—These muscles are no less than seven in number. They take origin from four primary stocks or trunks, which are situated in the angles of the interspaces of the five branches of the deep *flexor* tendon, at the point of divergence of these latter from the sesamoid bone imbedded in this tendon, the two middle trunks arising slightly in advance of the two outer lumbrical stocks.

The outer or fibular stock divides into two thin muscular slips; one of which passes to the tibial side of the fifth digit, whilst the other terminates at the fibular side of the fourth digit.

The next lumbrical stock, which arises in the interspace between the deep *flexor* tendons of the third and fourth digits, passes, without division, to the tibial side of the fourth digit.

The inner of the two middle stocks divides into two branches; one of which proceeds to the tibial side of the third digit, the other to the fibular side of the second digit.

The inner or tibial stock also divides into two slips, of which one proceeds to the tibial side of the second digit, the other to the fibular side of the hallux.

Of these seven *lumbricales*, the hallux, third, and fifth digits possess but one, the former on its fibular, the two latter on their tibial sides; while the second and fourth digits have one on each side.

For the bibliography of the subject with which this paper deals, and for any general remarks which I may have occasion to make thereon, I refer to a forthcoming paper upon *Orycteropus Capensis*.

EXPLANATION OF THE PLATE.

PLATE XLIV.

Fig. 1. Muscles seen upon the anterior aspect of the left arm and forearm.

- S C. Subclavius.
- S S. Supraspinatus.
- D. Deltoid.
- L D. Latissimus dorsi.
- P. Pectoralis.
- C B. Coraco-brachialis.
- C B 3. Caraco-brachialis, "long" variety.
- B. Biceps.
- B A. Brachialis anticus.
- E C R. Extensor carpi radialis.
- E O M P. „ ossis metacarpi pollicis.
- E I. „ indicis.
- E C D. „ communis digitorum.
- E A. „ annularis.
- E M D. „ minimi digiti.
- E C U. „ carpi ulnaris.
- S B. Supinator brevis.
- P T. Pronator radii teres.
- F C R. Flexor carpi radialis.
- F P D. Flexor profundus digitorum.
- A B P. Abductor pollicis.
- O P. Opponens pollicis.
- A B I. Abductor indicis.

Fig. 2. Inner aspect of arm and forearm, left side. (Those muscles which have been already represented in the preceding figure retain the same lettering. This also applies to succeeding figures.)

- S. Subscapularis.
- C B 1. Coraco-brachialis, "short" variety.
- T M. Teres major.
- D E. Dorso-épitrochlien.
- T. Triceps.
- E A. Epitrochleo-anconeus.
- C A L. Coraco-acromial ligament.

Fig. 3. Outer aspect of left arm and forearm.

- A B. Acromio-basilar.
- D 1. Deltoid, "clavicular" portion.
- D 2. „ "acromial" portion.
- D 3. „ "scapular" portion.
- A. Anconeus.

Fig. 4. Dissection, showing deep-lying muscles on inner aspect of thigh. Left side.

G M D. Gluteus medius.

Q F. Quadratus femoris.

O E. Obturator externus.

V E. Vastus externus.

V I. Vastus internus.

R. Rectus.

A. Adductor.

P. Pectineus.

G. Gracilis.

S. Sartorius.

PP. Psoas parvus.

E P. Erector penis.

Fig. 5. Muscles seen upon anterior aspect of right leg.

T A. Tibialis anticus.

T P. Tibialis posticus.

E P H. Extensor proprius hallucis.

E C D. „ communis digitorum.

E B D. „ brevis digitorum.

P L. Peroneus longus.

P B. „ brevis.

P T. „ tertius.

* Patella.

Fig. 4. Illustration showing deep-flying animals on lower part of cliff. Left side.

G.M.P. *Glaucidium nuchale*

G.P. *Glaucidium fuscum*

G.E. *Glaucidium cristatum*

V.E. *Vireo castaneus*

V.A. *Vireo alpestris*

H. *Hirundo*

A. *Alcedo*

P. *Pernis*

G. *Glaucidium*

S. *Sturnia*

P.P. *Pernis ptilorhynchus*

E.P. *Euphonia*

Fig. 5. Illustration showing animals on upper part of cliff. Right side.

V.A. *Vireo alpestris*

P.P. *Pernis ptilorhynchus*

E.P. *Euphonia*

G.P. *Glaucidium fuscum*

E.P. *Euphonia*

P.P. *Pernis ptilorhynchus*

V.A. *Vireo alpestris*

P.P. *Pernis ptilorhynchus*

E.P. *Euphonia*

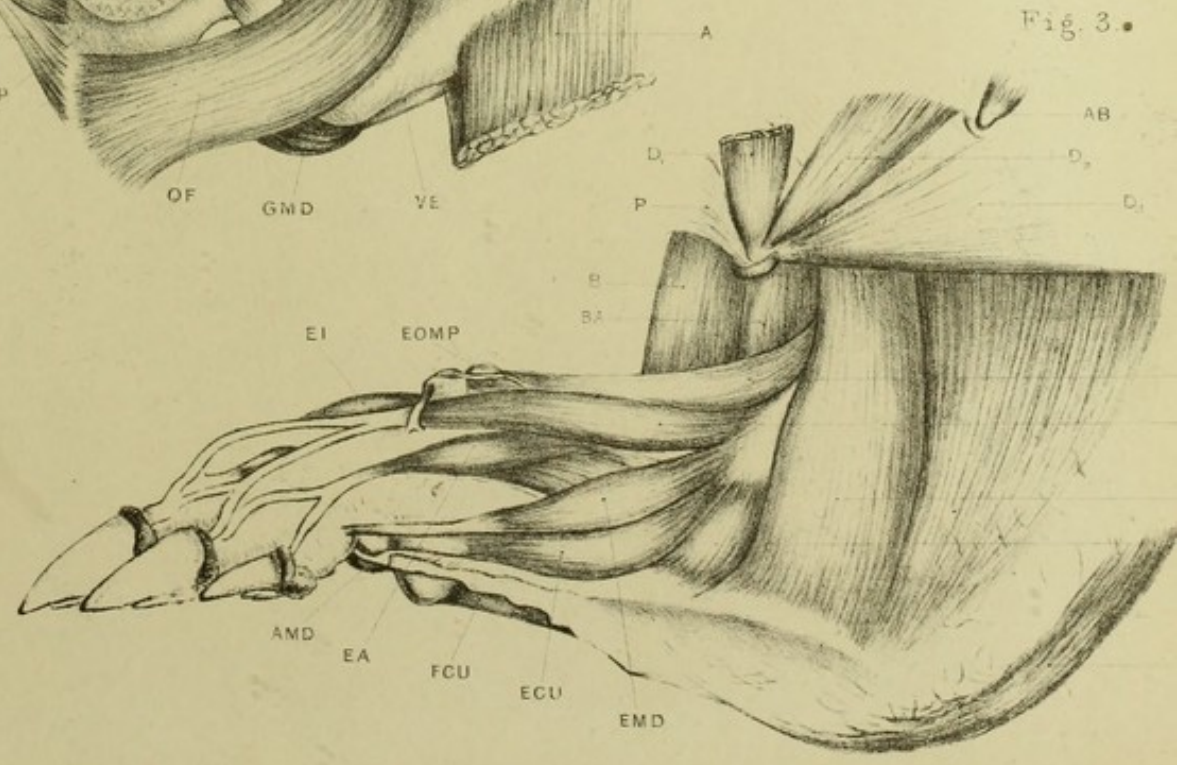
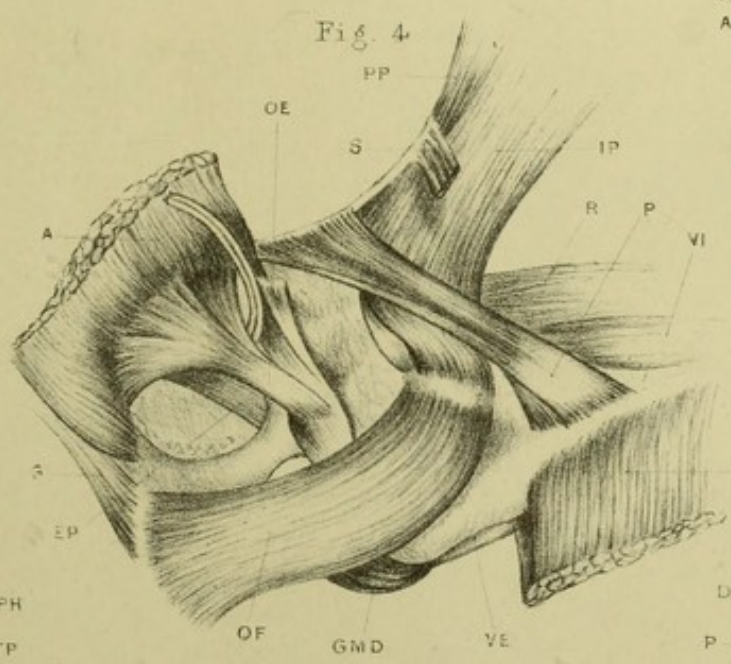
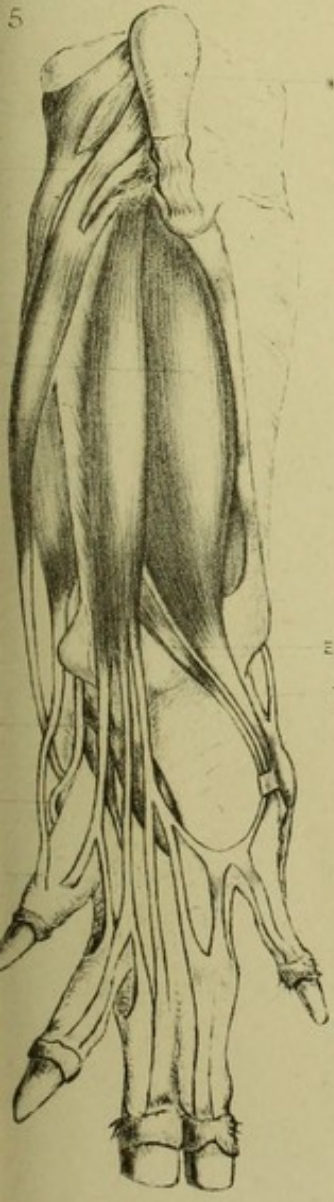
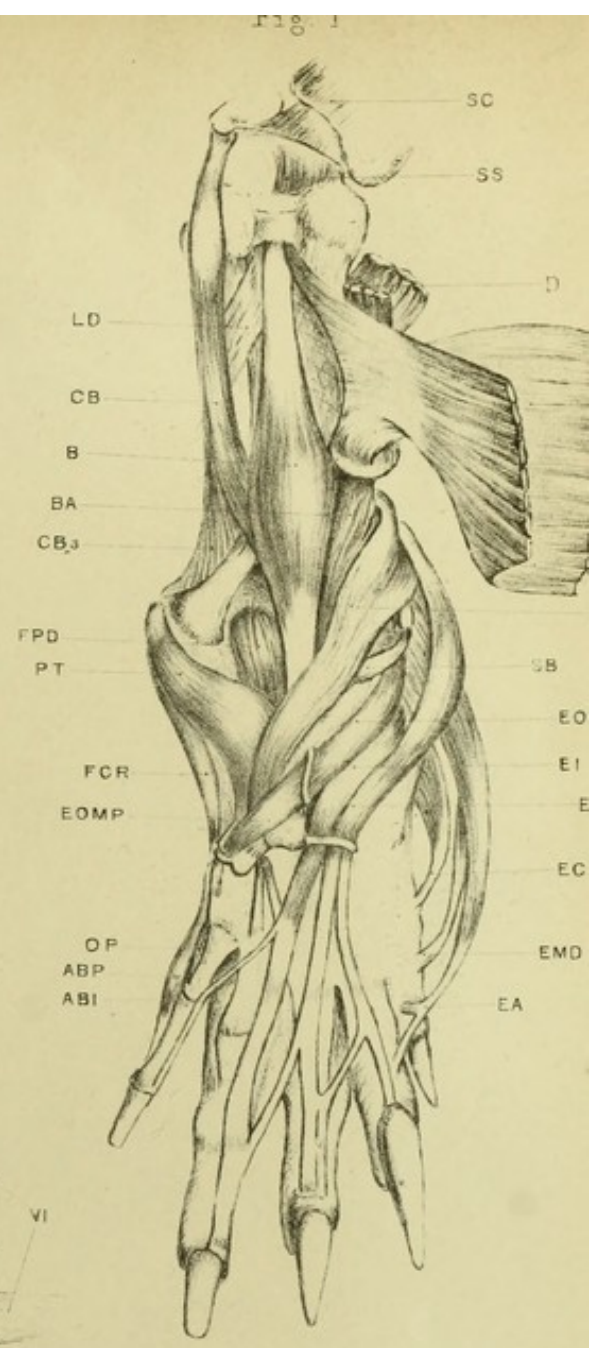
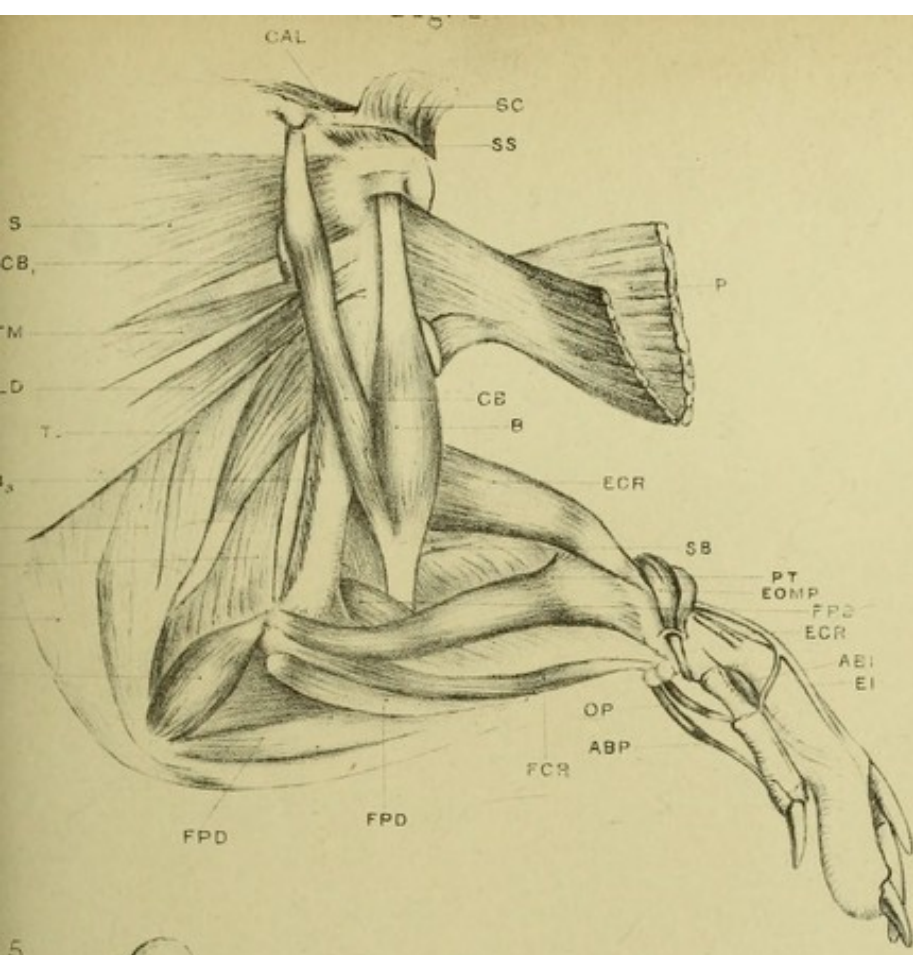


Fig. 4

Fig. 3

