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Professor W. Anders
With kind orga

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On the Myology of the Sciuromorphine and Hystricomorphine Rodents.

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In commencing this series of dissections nearly three years ago, I intended to work out the musculature of all the Rodents which I could collect. Before long, however, the size of my manuscript made it evident to me that I must be content to take up the subject in two parts, and I have accordingly devoted my first attention to the Hystricomorpha and Sciuromorpha because I was able to obtain a more representative series of animals in these groups.

The following is a list of the animals which I have dissected [1]:—

Aulacodus swindernianus.
Capromys pilorides.
Myopotamus coypus.
Octodon cumingii.
Hystrix cristata.
Sphingurus prehensilis.
Lagostomus trichodactylus.
Chinchilla lanigera.
Dasyprocta cristata.
Cœlogenys paca.

[1] For the opportunity of dissecting these animals I am indebted to the kindness of the Prosector to the Society, Mr. F. E. Beddard, F.R.S.

Cavia cobaya.
Ceredon rupestris.
Dipus ægyptius.
Dipus hirtipes.
Alectaga indica.
Sciurus prevosti.
Pteromys oral.
Xerus getulus.
Spermophilus mexicanus.
Arctomys marmotta.
Castor canadensis.

Full use has been made of the accounts of the myology of *Capromys fournieri* by Owen, of *Capromys melanurus* by Dobson, of *Erethizon dorsatus* by Mivart, and of *Erethizon epixanthus* by Windle. I have been also much indebted to the thorough account of the myology of the Crested Agouti by Mivart and Murie, to the writings of Dobson, and to the French translation of Meckel, as well as to work done by other authors.

In this manner six families of the Hystricomorpha have each been illustrated by types of two or more orders, and although more material would no doubt have added to the accuracy of the generalizations, it is hoped that a step has been taken in the road commenced by Mivart and Murie nearly thirty years ago. In the Sciuromorpha the supply of material has not been so plentiful, but this is less to be regretted because these animals do not seem to differ so much in their myology as the Hystricomorpha.

The Dipodidæ have been included among the Hystricomorpha, although, as will be pointed out in the general summary, they differ from the rest of the group in certain important particulars. Want of space has prevented the exact attachments of the muscles being chronicled in each animal, and I have contented myself with generalizations wherever possible.

Occasionally from various causes the whole of the muscles of some of the animals were not available for dissection or were overlooked; I have therefore, whenever it seemed necessary, placed in brackets the names of the animals on which the generalizations are founded.

Muscles of the Head and Neck.

Temporal.—The temporal muscle is always small, and rises from the side of the head above the external auditory meatus, the two muscles usually coming into contact in the middle line. It also derives some fibres from the inner side of the zygoma. The portion coming from the side of the head changes its course when it reaches the posterior root of the zygoma, which it uses as a pulley. The whole muscle is inserted into both surfaces and the anterior border of the coronoid process and part of the bone below. M. J. Kunstler, in his article "L'appareil masticateur des Rongeurs,"[1] describes the temporal of *Arctomys* as consisting of three parts—a superior from the parietal bone, a middle from the temporal, and

[1] Annales des Sciences naturelles, sér. 7, t. iv. p. 150.

an inferior from the zygomatic arch. I have verified this in *Arctomys*, and find the description applies to all the Sciuromorpha. In the Hystricomorpha it is difficult to satisfactorily separate the upper and middle portions.

In those animals, such as *Dipus*, *Chinchilla*, and *Xerus*, where the posterior part of the skull is broad, the two temporals do not meet in the mid line above.

Masseter.—For the purposes of description it is most convenient to divide this muscle into four parts—anterior and posterior superficial, and anterior and posterior deep. These parts do not always show a distinct line of demarcation.

The anterior superficial part rises by tendon from the side of the maxilla, and is inserted into the lower border and internal surface of the mandible, extending up to the insertion of the internal pterygoid. The posterior superficial rises from the whole length of the zygomatic arch, and is inserted into the lower part of the external surface as well as the lower border of the mandible. The anterior deep part differs in the Hystricomorpha and the Sciuromorpha. In the former, among which the Dipodidæ are included, this portion rises from a large area on the side of the maxilla, and then passes backwards and downwards through the enlarged infraorbital foramen to be inserted by a narrow flat tendon into the alveolar margin of the mandible, external to the molar teeth. In the Sciuromorpha this part of the muscle rises from the top of a vertical groove in front of the anterior portion of the zygomatic arch, the muscle runs down in the groove without passing through the infraorbital foramen and is inserted as in the Hystricomorpha.

The posterior deep part rises from the lower border and some of the internal surface of the zygoma, and is inserted into the greater part of the external surface of the ramus of the mandible. The arrangement used here is practically the same as that adopted by Meckel, the only difference being that he describes the whole superficial part under one name (*jugo maxillien*), although he states that the anterior border has a very strong superficial tendon; this anterior tendinous portion I have found to be easily separable from the rest in the Hystricomorpha, while in the Sciuromorpha it is separated by a distinct interval.

Buccinator.—This muscle is always well developed in Rodents, but in most cases shows no special points of interest. It rises from the maxilla and mandible opposite the molar and premolar teeth, and running forwards blends with the orbicularis oris.

In *Spermophilus* it is produced into the long cheek-pouch which, when empty, lies folded back on the cheek, having a muscular slip passing from the end of the pouch to the region of the shoulder.

Facial Muscles.—The orbicularis palpebrarum is not very strongly developed; from the anterior margin of it a muscle rises by a narrow origin, but spreads out to be inserted into the upper lip blending with the orbicularis oris, it probably represents the

levator labii superioris of human anatomy. The anterior belly of the occipito-frontalis may be made out as a thin layer of muscle running upwards from the upper border of the orbicularis palpebrarum; it is quite distinct in *Hystrix*. The other facial muscles, including those of the lower lip, are indistinguishable from the facial panniculus. (See fig. 10.)

Pterygoid Muscles.—The external pterygoid is small and rises from the very feebly marked external pterygoid plate or rather ridge; it is inserted into the inner side of the neck of the condyle and the bone just below. The internal pterygoid rises from the outer side of the internal pterygoid plate or pterygoid bone, and has the usual human insertion. In *Sphingurus* the internal muscle consists of two distinct layers; with this exception the above description applies to all the animals examined.

Digastric.—The digastric is attached posteriorly to the front of the paroccipital process, while anteriorly it is inserted into the inner surface of the mandible. There are two absolutely distinct types of the muscle. In the Hystricomorpha the two bellies are not separated by a real tendon as in Man, although there is a slight constriction of the muscle, and a thin layer of tendon on the surface especially below; the attachment to the hyoid bone is very feeble, and the two anterior bellies are separated from one another by a distinct interval in which the mylo-hyoid is exposed. The anterior attachment is a considerable distance from the symphysis.

In the Chinchillidæ the attachment to the hyoid bone is well marked.

In the Hystricidæ the above description applies in *Hystrix*, but in *Sphingurus* the posterior belly ends in a tendon which is firmly inserted into the hyoid bone; from the anterior or upper side of this tendon the anterior belly runs to its attachment on the mandible.

The sciuromorphine type of digastric is well described by Kunstler[1] in the Marmot. The anterior and posterior bellies are separated by a distinct tendon which is firmly attached to the hyoid bone. From the inner surfaces of the tendons of the two sides fibrous bands run inwards to meet one another, forming a tendinous arch with its convexity in front. From the front of this arch the two anterior bellies spring; they are in contact in the middle line nearly as far as the symphysis, where they separate a little to expose the transverse mandibular muscle.

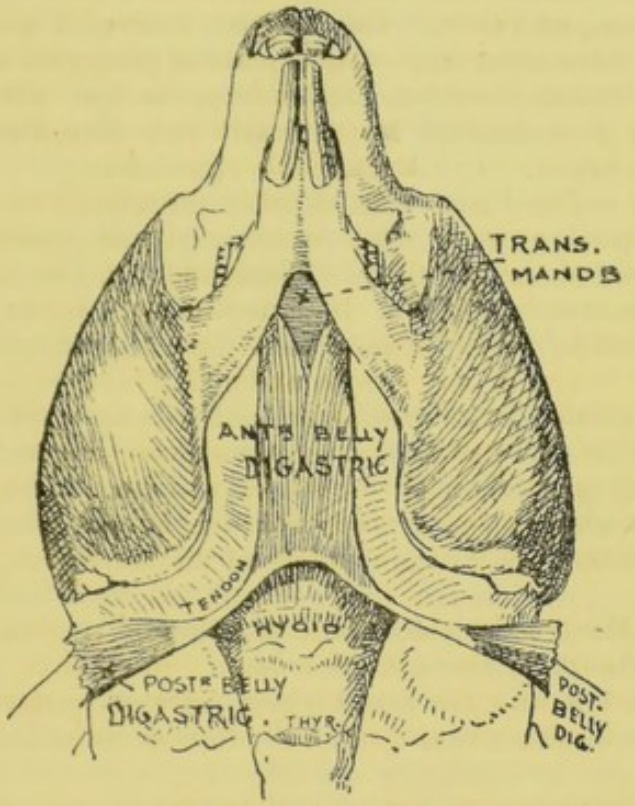
The tendinous arch gives attachment to some of the fibres of the mylo-hyoid as well as the anterior bellies of the digastric. This arrangement is common to all the Sciuromorpha (*Sciurus*, *Pteromys*, *Xerus*, *Spermophilus*, *Arctomys*, *Castor*) as well as the Dipodidæ (*Dipus ægyptius*, *D. hirtipes*, *Alectaga indica*).

Transverse Mandibular Muscle.—This muscle is accurately described by Kunstler in the Marmot; it was present in all the Rodents with a movable symphysis menti examined. I have not

[1] Annales des Sciences naturelles, sér. 7, t. iv. p. 150.

seen it at all in the true Hystricomorpha, but it is present in the Dipodidæ; it is also present in all the Sciuromorpha except *Castor*. It consists of a round bundle of fibres running across between the two halves of the mandible close to the symphysis; it is superficial to the mylo-hyoid but deep to the digastric. Its nerve-supply is from the mylo-hyoid of the inferior dental.

Fig. 1.



Digastric of *Pteromys*.

Mylo-hyoid.—The mylo-hyoid in the Hystricomorpha resembles the same muscle in Man; in the Sciuromorpha it is connected posteriorly to the tendinous arch of the digastrics.

Genio-hyoid.—In the Caviidæ and Dasyproctidæ this muscle rises by a thin tendon from the symphysis; in the Sciuromorpha the two muscles tend to coalesce before reaching the hyoid bone. The muscle has the usual human attachments.

Genio-hyoglossus.—This muscle has the human attachments. In *Myopotamus* it was noticed that the part running to the tongue was fleshy in its origin, while that going to the hyoid bone was tendinous.

Styloid Muscles.—The stylo-hyoid rises from the base of the skull just internal to the paroccipital process; it passes deep to the digastric to be attached to the epihyal cartilage close to the hyoid bone.

The styloglossus rises lower down than the last from the carti-

laginous rod joining the hyoid bone to the skull and is inserted into the tongue.

The stylo-pharyngeus has pratically the same origin as the stylo-hyoid, but is seldom well marked. The animal in which it was most clearly seen was *Sphingurus*.

Sterno- and Cleido-mastoid.—These two muscles are distinct in their whole length. Except in the exact origin of the cleido-mastoid they are subject to very little variation.

The sterno-mastoid rises from the side of the anterior portion of the sternum, and is inserted into the side of the paroccipital process and the curved line of the occipital bone running inwards from this. The cleido-mastoid rises from the bony clavicle and is inserted nearer the middle line (dorsal) and often under cover of he sterno-mastoid. In all cases the spinal accessory nerve runs deep to both muscles and supplies them entirely.

In the Dipodidæ the muscles are of equal size; the sterno-mastoid is inserted ventral to the cleido-mastoid and does not cover it. The cleido-mastoid rises from the middle third of the clavicle in *D. ægyptius* and *D. hirtipes*, but from the outer third in *Alectaga indica*.

In the Octodontidæ the cleido-mastoid rises from the inner third of the clavicle and at its insertion overlaps the sterno-mastoid instead of being overlapped. In the Hystricidæ and Chinchillidæ the muscles are normal, except that in the Chinchilla they are inserted into the back of the great tympanic bulla.

In the Dasyproctidæ the cleido-mastoid is small and rises from the middle of the clavicle near the junction of the bony and ligamentous parts (*Dasyprocta*, *Cœlogenys*).

In the Caviidæ the two muscles are separated by a much greater interval than in other cases. The cleido-mastoid is the larger and runs from the rudimentary clavicle to the curved line of the occipital bone internal to the insertion of the sterno-mastoid. The two muscles are separated by a larger interval in *Ceredon rupestris* than in *Cavia cobaya*; in the latter the origin of the cleido-mastoid blends with the deltoid.

In the Sciuromorpha the two muscles are much more fused towards their insertion, the cleido-mastoid rising from the innermost part of the clavicle.

In *Arctomys*, *Xerus*, and *Spermophilus* there seem to be two cleido-mastoids, owing to some of the fibres of the trapezius being separated from the rest by the levator claviculæ (see *Trapezius*). In *Castor* the sterno-mastoid has a large origin from the ventral surface of the presternum overlapping the pectoralis. The cleido-mastoid rises from the inner half of the clavicle.

Sterno-hyoid and Thyroid.—These muscles present the human attachments and characteristics.

In *Myopotamus* the sterno-hyoid is inserted into the hyoid bone and raphe between the mylo-hyoids for some distance, so that the borders near the insertion become superior and inferior instead of lateral. In the Caviidæ the sterno-thyroid is very small.

In *Pteromys* the sterno-hyoid is inserted by a thin tendon.

Omo-hyoid.—The omo-hyoid may be present or not. When it is present it has the human attachments to the hyoid bone and anterior border of the scapula, but it never has any tendinous interval; it runs, moreover, a straight course between its two attachments.

In the Dipodidæ it is present (*D. ægyptius*, *D. hirtipes*, *Alectaga indica*; in the last it is specially well marked).

In the Octodontidæ it is not constant. In *Octodon* and *Capromys* it is feebly developed, in *Myopotamus* it is absent, while in *Aulacodus* it is well marked. In the Hystricidæ it is well marked in *Sphingurus* and *Erethizon*[1], but in *Hystrix* it was seen as a thin layer of muscular fibres disappearing in the fascia under the sterno-mastoid.

In the Chinchillidæ and Dasyproctidæ it is absent (*Chinchilla*, *Lagostomus*, *Dasyprocta*, *Cœlogenys*).

In the Caviidæ it is also absent (*Cavia cobaya*, *Cercdon rupestris*, *Dolichotis*).

In the Sciuromorpha it is always present (*Sciurus*, *Pteromys*, *Xerus*, *Spermophilus*, *Arctomys*, *Castor*).

Levator Claviculæ.—The levator claviculæ rises either from the basioccipital behind the origin of the scalenus anticus, or from the ventral arch of the atlas; it is inserted chiefly into the acromion and metacromion and the fascia of the shoulder, but sometimes it extends to the acromial end of the clavicle. It is supplied by branches from the cervical plexus.

In the Dipodidæ it rises from the front of the atlas and runs to the outer end of the clavicle. In the Octodontidæ it is not constant. In *Aulacodus*, *Capromys melanurus*[2], and *Myopotamus* it rises from the basioccipital, but in *Octodon* from the atlas. In the Hystricidæ it rises from the atlas in *Sphingurus* and *Erethizon*[3], but in *Hystrix* it comes from the base of the skull and is inserted into the acromion and fascia of the arm as low as the elbow. (See fig. 10.)

In the Chinchillidæ it rises from the atlas in *Chinchilla*, and from the basioccipital in the Viscacha; in the latter animal it is inserted into the outer half of the clavicle as well as the metacromion.

In the Dasyproctidæ it rose from the atlas in the specimen of *D. cristata* which I dissected; in the specimen dissected by Mivart and Murie it rose from the basioccipital[4]. In *Cœlogenys* it rises from the basioccipital and is very large.

In the Caviidæ it rises from the basioccipital in *C. cobaya*, *Ceredon rupestris*, and *Dolichotis*.

In all the Sciuromorpha it rises from the atlas and is inserted into the metacromion, never seeming to reach the clavicle. In

[1] Journal of Anatomy, vol. xxii. p. 126.
[2] Dobson, P. Z. S. 1884, p. 234.
[3] Mivart, P. Z. S. 1882, p. 271.
[4] P. Z. S. 1866, p. 383.

Castor it is entirely covered by the trapezius, and is inserted into the upper border of the acromial process and the outer part of the spine of the scapula.

The above observations show that the levator claviculæ is a muscle of very little use for classificatory purposes among the Hystricomorpha; in this group it seems to vary even in different individuals of the same species; it is possible that it is in process of shifting its attachment from the basioccipital to the front of the atlas. The number of observations, however, are not sufficient for generalization.

Rectus Capitis Anticus Major and Minor.—The rectus capitis anticus major rises in the Hystricomorpha from the transverse processes of two or three cervical vertebræ below the atlas, and is inserted into the basioccipital bone in front and internal to the scalenus anticus; except in the Caviidæ it is difficult to separate from the longus colli. In the Sciuromorpha the muscle usually rises from a greater number of transverse processes. The rectus capitis anticus minor and lateralis have the human attachments; the latter is large and closely connected to the superior oblique.

Longus Colli.—The longus colli closely resembles the same muscle in Man; it consists of two oblique and one straight part. The posterior oblique part rises from the bodies of the anterior three or four thoracic vertebræ, and is inserted into the transverse processes of the posterior cervical vertebræ. The anterior oblique portion runs from the insertion of the last part to the longus colli tubercle on the ventral arch of the atlas. The straight part runs from the bodies of the anterior thoracic vertebræ to those of the anterior cervical. In *Castor* it extends a long way into the thorax.

Scalenus Anticus.—As there is a good deal of difficulty in identifying the scalene muscles of Rodents with the three scalenes of human anatomy, I have given the name of scalenus anticus only to a muscle inserted into the first rib between the subclavian artery and vein. This muscle when present rises by a tendon from the basioccipital in front and internal to the levator claviculæ; in *Cœlogenys* it also derives a few fibres from one or two cervical transverse processes. It is absent in the Hystricidæ (*Hystrix*, *Sphingurus*) and in all the Sciuromorpha, but present in the other animals examined.

Scalenus Medius and Posticus.—These two muscles are most conveniently described together, as it is often impossible to say where one ends and the other begins.

In *Aulacodus*, which is a good type of the arrangement in the Octodontidæ, one muscle, which I take to represent the scalenus medius, rises from the transverse processes of the first four cervical vertebræ and is inserted into the sides of the 4th and 5th ribs between the serrations of the serratus magnus. Another muscle, probably the scalenus posticus, rises from the posterior three cervical transverse processes and is inserted into the first and second ribs.

In *Chinchilla* the arrangement is almost identical.

In *Hystrix* and *Sphingurus* only one muscle can be made out; it rises from all the cervical transverse processes and is inserted into the anterior four ribs.

In *Lagostomus*, *Agouti*, and *Cœlogenys* the muscle rises from all the cervical transverse processes; the fibres from the anterior three or four are attached to the outer surfaces of the ribs from the second to the fifth and interdigitate with the serratus magnus; in *Lagostomus* the sixth rib is reached. The fibres from the posterior transverse processes are attached to the first rib behind the subclavian artery.

In the Caviidæ the fibres which are attached to the side of the chest come from the 3rd and 4th cervical transverse processes, and are inserted into the 3rd and 4th ribs. The slip to the first rib comes from all the cervical transverse processes.

Muscles of the Anterior Extremity.

The Pectoral Muscles.—As the pectoralis major and minor are not always distinct muscles, I have followed Owen's example in his description of *Capromys* [1], and have divided the whole pectoral mass into four different parts, which are usually easy to make out. These four parts have generally the following attachments:—

(α) The most superficial part, rising from the anterior portion of the sternum and sometimes the sternal end of the clavicle, is inserted fairly low down on the humerus, often crossing obliquely the fibres of the next part, which is on a deeper plane.

(β) This portion rises from the greater part of the sternum posterior to the last and is inserted into the pectoral ridge of the humerus.

(γ) The abdominal portion rises from the linea alba; being closely connected to and embraced by the panniculus carnosus, its fibres pass deep to β, and are usually inserted into the top of the pectoral ridge and the upper extremity of the humerus.

(δ) The deep portion, which perhaps corresponds to the pectoralis minor of human anatomy, rises from the cartilages of some of the true ribs, close to their junction with the sternum. The fibres run upwards and outwards to the outer part of the clavicle, coracoid, or shoulder-capsule.

In the Octodontidæ α and β are almost if not completely fused. γ goes to the lesser tuberosity of the humerus. δ rises from the cartilages of 3rd to 6th ribs and is inserted into the outer part of the clavicle and coracoid process. This arrangement applies to *Myopotamus*, *Aulacodus*, and *Capromys pilorides*; it also agrees with Dobson's description of the muscle in *Capromys melanurus* [2].

[1] P. Z. S. 1832, p. 74.
[2] P. Z. S. 1884, p. 234.

In *Octodon*, α and β rise respectively from the anterior and posterior halves of the sternum and are not so closely united.

In the Hystricidæ α forms a separate band which runs obliquely across the rest of the muscle to be inserted quite at the lower half of the humerus, some fibres passing to the fascia of the fore-arm. γ and δ are inserted with β; so that this family is remarkable for having the insertion of the pectoral almost entirely into the humerus (*Hystrix*, *Sphingurus*, *Erethizon dorsatus*[1]).

The Chinchillidæ resemble the Octodontidæ in having α and β fused. δ in the Chinchilla is inserted into the outer part of the clavicle, but in the Viscacha it is inserted into the coracoid process and first rib external to the origin of the subclavius.

In the Dasyproctidæ α is a distinct oblique slip as in the Hystricidæ. γ is inserted into the upper extremity of the humerus. δ in *Dasyprocta* goes to the outer part of the clavicle blending with the sternoscapular. In *Cœlogenys* this part was not seen. This description differs from that of Mivart and Murie[2] in classing part of their pectoralis as deltoid. I find that the portion in question is supplied by the circumflex nerve and not by the anterior thoracic; as the circumflex also supplies the deltoid it is probable that the slip belongs to that muscle instead of to the pectoralis. (See *Deltoid*.)

In the Caviidæ there are no special fibres rising from the costal cartilages (*Cavia cobaya*, *Ceredon rupestris*).

In the Sciuromorpha α has the usual origin and is inserted about the middle of the humerus. β rises from the whole of the sternum and runs almost horizontally to the whole of the pectoral ridge. γ joins δ at its insertion. δ rises from the 2nd, 3rd, and 4th cartilages in *Sciurus* and *Pteromys*; from 2nd, 3rd, 4th, 5th, and 6th in *Arctomys* and *Spermophilus*. The insertion is into the shoulder-capsule and the coracoid process.

Sterno-scapularis.—This muscle consists of two parts which display a good deal of variety in different members of the group. The internal part or subclavius rises from the first rib at its junction with the sternum and is inserted into the posterior surface of the outer third of the clavicle. The outer part or scapulo-clavicularis, when it is present, rises from the clavicle close to the insertion of the subclavius, with which it is usually more or less continuous, and is inserted into the spine and vertebral border of the scapula, covering the supraspinatus as a broad thin sheet.

In the Dipodidæ the scapulo-clavicularis is absent but the subclavius is well marked (*D. ægyptius*, *D. hirtipes*, *Alectaga indica*).

In the Octodontidæ the two parts of the muscle communicate very slightly if at all in *Octodon*, *Myopotamus*, *Capromys pilorides* and *C. melanurus*[3], but in *Aulacodus* many fibres are continuous.

In the Hystricidæ the two parts are continuous in *Hystrix*, but quite separate in *Sphingurus*.

[1] P. Z. S. 1882, p. 281.
[2] P. Z. S. 1866, p. 383.
[3] Dobson, P. Z. S. 1884, p. 234.

In the Chinchillidæ the muscles are largely attached to the clavicle.

In the Dasyproctidæ the scapulo-clavicularis is especially well developed, being considerably larger than the supraspinatus.

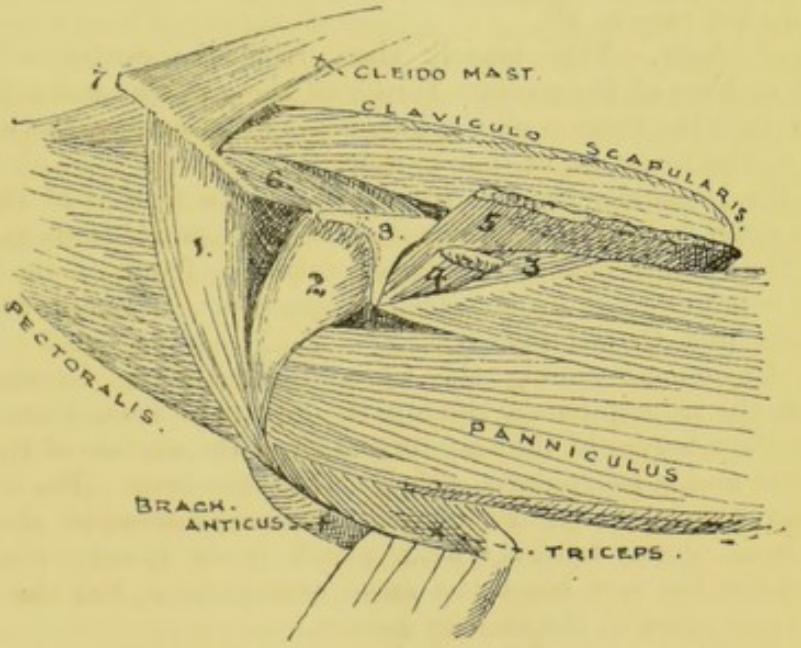
In the Caviidæ the small clavicle is between the two muscles in *Cavia cobaya*, having both attached to it; but in *Ceredon rupestris* the subclavius was found to send a few fibres into the clavicle and a few into the scapulo-clavicularis, but its insertion was chiefly into the anterior border of the acromial process. The scapulo-clavicularis rose chiefly from the clavicle.

In the Sciuromorpha the subclavius had the usual human attachments, but the scapulo-clavicularis was absent in all the animals examined.

It is interesting to notice that the Dipodidæ, so far as this muscle is concerned, differ from all the rest of the Hystricomorpha.

The nerve-supply of both parts of this muscle is from a branch from the upper part of the outer cord of the plexus, corresponding to the human nerve to the subclavius.

Fig. 2.



Shoulder-muscles of *Ceredon rupestris*.

1. Deltoid (clavicular).	5. Trapezius (cut).
2. ,, (acromial).	6. Subclavius.
3. ,, (spinous).	7. Clavicle.
4. Levator clav. (cut).	8. Acromion and metacromion.

Deltoid.—The deltoid in Rodents consists of three parts, which are liable to become more or less fused with one another. The first part rises from the outer part of the clavicle, the second from the acromial and metacromial processes, while the third part

comes from the spine of the scapula and fascia over the infraspinatus. Mivart and Murie, in their description of the myology of the Agouti [1], prefer to describe the clavicular portion as part of the pectoralis, but I have been able to satisfy myself that its nerve-supply is derived from the circumflex and not the anterior thoracic. The insertion of the deltoid is into the pectoral ridge close to that of the pectoralis. The clavicular fibres are often prolonged to the elbow and in all cases are inserted lowest, while the part from the spine is inserted deep to the acromial slip.

In the Dasyproctidæ the clavicular portion is continued down almost to the external condyle.

In *Sciurus* and *Pteromys* the clavicular and acromial fibres are closely united owing to the development of the clavicle. *Sphingurus* has the same arrangement.

In *Arctomys* and *Spermophilus* the clavicular part divides into a superficial and deep portion; the latter has the usual insertion, but the former is continued down to the coronoid process of the ulna. In *Castor*, owing to the great development of the muscle, the intervals between the three parts are slight. The other animals examined present nothing remarkable in this muscle.

Supraspinatus, Infraspinatus, and Subscapularis.—These muscles have the human attachments and, except in their comparative size, do not vary at all.

Teres Major.—This muscle rises from the posterior quarter (more or less) of the axillary border of the scapula, and is inserted either into the tendon of the latissimus dorsi or into the humerus close to the insertion of that muscle.

In the Dipodidæ the insertion is posterior to that of the latissimus dorsi as in Man (*D. ægyptius*, *D. hirtipes*, *Alectaga indica*).

In the Octodontidæ it is inserted into the front of the tendon of latissimus dorsi (*Aulacodus*, *Myopotamus*, *Octodon*, *Capromys pilorides* and *C. melanurus*) [2].

In *Lagostomus* among the Chinchillidæ, owing to the great size of the infraspinatus, the muscle only rises from about $\frac{1}{8}$th of the axillary border of the scapula and from the surface of the infraspinatus and subscapularis, which overlap the bone. The insertion is into the rudimentary bicipital groove somewhat above the latissimus dorsi tendon, with which it is closely connected. *Chinchilla* has very much the same arrangement, but the muscle rises from more of the axillary border.

In the Hystricidæ the lower border of the muscle is wrapped round by the latissimus dorsi close to the insertion (*vide* latissimus dorsi) (*Hystrix*, *Sphingurus*).

In the Dasyproctidæ it was inserted nearer the shoulder than the latissimus dorsi in my specimen of *Dasyprocta*, but according to Mivart and Murie [3] the two muscles are inserted together. In *Cœlogenys* it is inserted with, and in front of, the latissimus dorsi.

[1] P. Z. S. 1866, p. 383.
[2] Dobson, P. Z. S. 1884, p. 234.
[3] P. Z. S. 1866, p. 383.

In the Caviidæ the arrangement is the same as in *Cœlogenys* (*C. cobaya*, *Ceredon rupestris*).

Teres Minor.—The teres minor rises from the humeral third to half of the axillary border of the scapula, and is inserted just below the insertion of the infraspinatus. It is sometimes a perfectly distinct muscle, but in most cases is so closely united to the infraspinatus that, were it not for its being supplied by the circumflex nerve, it would be most conveniently described with that muscle. The teres minor was seen most distinctly in *Lagostomus*, in which animal a fibrous band was found running from the metacromial process to the origin of the long head of the triceps, covering the infraspinatus and teres minor near their insertions.

In the Sciuromorpha the muscle is specially indistinct.

Biceps Cubiti.—The biceps always rises by a strong tendon from the margin of the glenoid cavity at the base of the coracoid process; it may or may not have a second head rising from the tip of that process, or from the surface of the coraco-brachialis. Its insertion is into the radius, ulna, or both bones just below the sigmoid cavity, occasionally, however, it is prolonged farther down the bones. The semilunar fascia from the inner side of its tendon to the fascia of the forearm is very indistinct, but by careful dissection a few fibres may be traced.

In the Dipodidæ there is only one head, and the insertion is almost entirely into the ulna (*Dipus ægyptius*, *Alectaga indica*).

In the Octodontidæ there are two heads; the insertion is into both radius and ulna (*Myopotamus*, *Aulacodus*, *Capromys*, *Octodon*).

In the Hystricidæ there is only one head in *Hystrix*, but two in *Sphingurus* and *Erethizon dorsatus*[1]; it is inserted largely into the radius in the Tree-Porcupines, but chiefly into the ulna in *Hystrix*.

In the Chinchillidæ there are two heads; the insertion is into the coronoid process of the ulna and the oblique line of the radius (*Chinchilla*, *Lagostomus*). In the Viscacha I dissected there were three heads to the biceps on the left side, the extra one rising from the front of the great tuberosity of the humerus.

In the Dasyproctidæ there is only one head, and the insertion is entirely into the ulna (*Dasyprocta*, *Cœlogenys*).

In the Caviidæ the arrangement is the same as that in the Dasyproctidæ (*Cavia cobaya*, *Ceredon rupestris*, *Dolichotis*[2]). In the Sciuromorpha, *Sciurus*, *Pteromys*, *Arctomys*, and *Xerus* have the muscle rising chiefly by the glenoid or long head, but also by some fibres from the front of the coraco-brachialis (representing a short head). The insertion is almost entirely into the tubercle of the radius so as to act as a supinator. *Spermophilus* differs in the absence of the short head. *Castor* has only one head and the insertion is entirely into the ulna.

Coraco-brachialis.—The three parts of this muscle described by

[1] Mivart, P. Z. S. 1882, p. 271.
[2] Beddard, P. Z. S. 1891, p. 236.

Wood[1] are well illustrated in the Rodents, though all three parts are seldom present together. They all rise from the tip of the coracoid process—the first part (rotator humeri) being inserted into the surgical neck of the humerus above the insertion of the latissimus dorsi tendon, the second part into the middle of the shaft of the humerus, while the third part runs down to the internal condyle. The musculo-cutaneous nerve always passes between the first and second parts when these are present.

In the Dipodidæ the first and third heads are present in *D. ægyptius* and *D. hirtipes*, but in *Alectaga* apparently the second only.

In the Octodontidæ only the second head is present (*Aulacodus*, *Octodon*, *Capromys pilorides* and *melanurus*[2], *Myopotamus*).

In the Hystricidæ only the second part is present in *Hystrix*, while in *Sphingurus*, *Erethizon dorsatus*[3] and *E. epixanthus*[4] the second and third heads are found. The third head in *Sphingurus* differed from the same part in the other animals I dissected in having the median nerve separating it from the rest of the muscle.

In the Chinchillidæ only the second head is present in *Chinchilla*. In *Lagostomus* the muscle was entirely absent on both sides, but possibly this specimen was abnormal.

In the Dasyproctidæ the first and second parts are present (*Dasyprocta*, *Cœlogenys*).

In the Caviidæ only the second head is found (*Cavia cobaya*, *Ceredon rupestris*, *Dolichotis*[5]).

In the Sciuromorpha the rotator humeri is always present. In *Sciurus*, *Pteromys*, *Xerus*, and *Spermophilus* all three parts are found, but the second and third are blended. In *Arctomys* the first and second are present, while in *Castor* apparently the first and third are found. The lower part in this animal is inserted by a narrow tendon just above the inner condyle.

Brachialis Anticus.—This muscle generally consists of an external and an internal part. The external rises from the back of the neck of the humerus and winds round to the front, lying just external to the pectoral ridge, which, when it is well marked as in *Aulacodus*, has a broad shallow groove for it to lie in. The internal head, when it is present, is much smaller and rises from the anterior border of the humerus below the pectoral ridge. The two parts are inserted into the ulna just below the lesser sigmoid cavity, a smaller slip being often sent to below and behind the tubercle of the radius. The muscle is supplied by the musculo-cutaneous and musculo-spiral nerves, but I was unable to satisfy myself that each head had a different nerve-supply.

In the Octodontidæ both heads are present.

In the Hystricidæ, *Hystrix* has both heads, while *Sphingurus* only has the external.

[1] Journ. Anat. vol. i. p. 45.
[2] Dobson, P. Z. S. 1884, p. 234.
[3] Mivart, P. Z. S. 1882, p. 271.
[4] Windle, Journ. Anat. vol. xxii. p. 126.
[5] Beddard, P. Z. S. 1891, p. 236.

In the Chinchillidæ, *Chinchilla* has one head, *Lagostomus* two.

In the Dasyproctidæ both heads are found in *Dasyprocta* and *Cœlogenys*, although the inner head in the latter is very small and blended with the outer.

In the Caviidæ only the outer head is found in *Ceredon* and *Cavia cobaya*, but in *Dolichotis*, according to Beddard [1], both parts are present.

In the Sciuromorpha both heads appear to be present, but they are so closely blended as to be indistinguishable (*Sciurus*, *Pteromys*, *Xerus*, *Spermophilus*, *Castor*). In *Arctomys*, however, no trace of the inner head was seen.

Triceps and Anconeus.—The triceps consists of the usual three heads. The external head has a small origin from the back of the neck of the humerus just above that of the brachialis anticus. The middle or long head rises from a large part of the humeral end of the axillary border of the scapula. The inner head rises from the greater part of the posterior surface of the humerus and is continuous with the anconeus. The insertion is into the posterior part of the upper surface of the olecranon, the internal head usually being inserted separately in front of the other two; the anconeus is attached to the outer side of the process.

The triceps showed little variation in the different animals examined; in the Beaver it is well developed and attached to both sides of the olecranon as well as to the top; the anconeus is especially well marked and rises from the enormous external supracondylar ridge, it is inseparable from the inner head of the triceps.

Epitrochleo-anconeus.—In all the Rodents examined a small round fleshy muscle rises from the internal condyle of the humerus and is inserted into the inner side of the olecranon process, covering the ulnar nerve. In *Castor* it is specially well developed.

Pronator Radii Teres.—This muscle rises from the internal condyle of the humerus; it never has a deep head from the ulna, and the median nerve always lies deep to it. It is inserted into the convexity of the radius, usually about the middle. In *Sciurus* and *Pteromys*, which possess a supracondylar foramen, the muscle rises from the arch of bone forming it.

In *Aulacodus*, *Hystrix*, *Erethizon dorsatus* [2], *Arctomys*, and *Xerus* the muscle is inserted near the distal end of the radius. In all the other animals examined its insertion, as above stated, was into the middle.

In the Agouti I did not see the continuation of this muscle to the carpus described by Mivart and Murie [3].

Flexor Carpi Radialis.—This muscle presented the usual human attachments and relations in all the animals examined.

Palmaris Longus.—The palmaris longus rises from the internal condyle, and is inserted into the ulnar cartilaginous disk which

[1] P. Z. S. 1891, p. 236.
[2] P. Z. S. 1882, p. 271.
[3] P. Z. S. 1866, p. 383

seems to be developed in the palmar fascia. In *Octodon* and *Myopotamus* it rises only from the inner side of the olecranon process, while in *Castor* it comes from both the olecranon and internal condyle.

In *Cœlogenys* and *Xerus* the muscle was formed by some of the internal and superficial fibres of the flexor sublimis digitorum: this arrangement corresponds to what Mivart and Murie found in *Dasyprocta*, though in the specimen of this animal which I dissected the muscle was absent. In *Myopotamus* the insertion was into the radial and ulnar palmar cartilages. The muscle was not seen in *Chinchilla* or *Sciurus*. In *Spermophilus* the tendon was broad and fascia-like in its whole length. Apparently this muscle is liable to great individual variation in Rodents as in Man.

Flexor Sublimis Digitorum.—This muscle rises from the internal condyle in common with part of the flexor profundus; it divides into slips for the middle phalanges of the 2nd, 3rd, 4th, and usually the 5th digits, which slips are perforated for the passage of the profundus tendons. Just before the perforation there is usually a strong fibrous loop, which passes under the profundus tendon and comes into contact with the sesamoid bones in front of the metacarpo-phalangeal joints; this is very well marked in *Cœlogenys*.

In the Octodontidæ and Dasyproctidæ there are only three tendons for the 2nd, 3rd, and 4th digits. This is also the case in *Castor*. Mivart and Murie[1] found a slip to the 5th digit in the Agouti on one side but not on the other. In *Cœlogenys* I met with a more interesting arrangement still; in it the tendinous loop representing the perforated portion of the tendon was present in the 5th digit on one side, but was entirely unconnected with the flexor sublimis, which sent no slip to this digit.

Possibly the explanation of these facts may be that the Dasyproctidæ show a stage in the gradual suppression of the slip to the 5th digit, a process which is complete in the Octodontidæ. In *Castor* the muscle has an extra origin from the olecranon.

Flexor Carpi Ulnaris.—This muscle usually rises, as in Man, from the inner side of the olecranon process, from the internal condyle, and, by aponeurosis, from the upper part of the posterior border of the ulna. It is inserted into the pisiform bone. In the Octodontidæ and Dasyproctidæ the condylar origin is wanting, as it is also in *Castor* and *Spermophilus*.

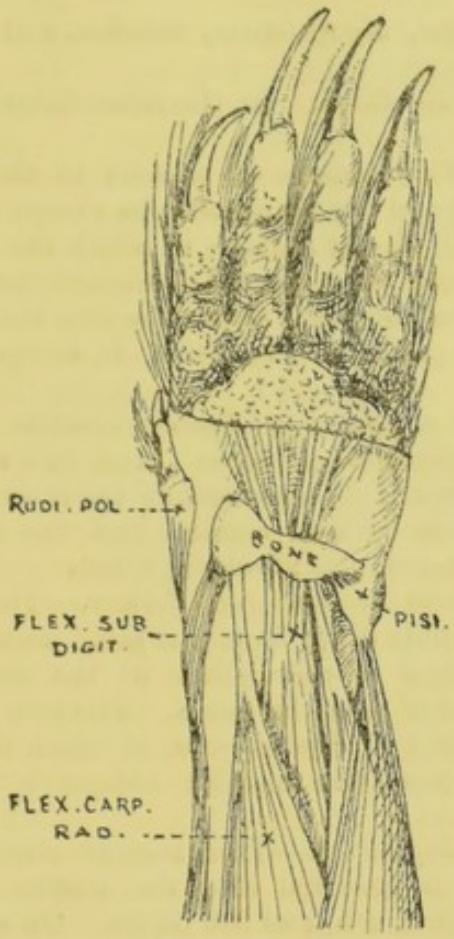
Flexor Profundus Digitorum.—This muscle, which includes both flexor profundus digitorum and flexor longus pollicis of human anatomy, rises usually by four heads; two of these come from the internal condyle, one from the flexor surface of the ulna, and the last from the flexor surface of the radius. The muscle usually divides into four tendons for the outer digits, and often gives off a small tendon at right angles to the rest for the pollex. The tendons perforate the flexor sublimis and are inserted into the terminal phalanges of the digits.

[1] P. Z. S. 1866, p. 383.

In the Octodontidæ there are always four tendons to the digits and one to the thumb. There are also four lumbricales.

In the Hystricidæ no slip is sent to the thumb in *Hystrix* and *Sphingurus*, but Mivart describes the muscle as dividing into five tendons in *Erethizon dorsatus* [1].

Fig. 3.



Left fore foot of *Sphingurus prehensilis* (superficial dissection).

There were three lumbricales in *Hystrix* and *Erethizon*[1], four in *Sphingurus*.

The Chinchillidæ have no slip to the thumb and four lumbricales. In the Dasyproctidæ there is no slip to the thumb and three lumbricales. In the Caviidæ the arrangement is the same.

In the Sciuromorpha there are four tendons in *Sciurus*, *Pteromys*, and *Arctomys*, but *Xerus* and *Castor* have five.

The number of the lumbricales in Rodents seems liable to individual variation, as a rule the one on the ulnar side is larger than the rest and rises from the front of the flexor profundus before it divides.

Pronator Quadratus.—This muscle is usually well marked,

[1] P. Z. S. 1882, p. 271.

although, as a general rule, pronation is only allowed through about one-eighth of a circle. The extent of the muscle varies from one-third to the whole of the interosseous space, being much more extensive in the Hystricomorpha than in the Sciuromorpha.

In *Aulacodus* and *Dasyprocta* it is attached to the whole length of the contiguous margins of the radius and ulna.

In *Cœlogenys* to the lower three-quarters. In *Lagostomus* to the lower two-thirds.

In *Hystrix*, *Sphingurus*, *Myopotamus*, *Octodon*, and *Ceredon* to the lower half.

In *Castor* to the middle third. In the other Sciuromorpha to the lower third.

Supinator Longus.—This muscle is present in the Dipodidæ, some of the Hystricidæ, and the Sciuromorpha except *Castor*.

In the Dipodidæ, as in all the animals in which the muscle was found, the origin is from the external supracondylar ridge; the insertion, however, instead of being normal, is into the base of the metacarpal bone of the pollex (*D. ægyptius*, *D. hirtipes*, *Alectaga indica*).

In the Hystricidæ it is absent in *Hystrix cristata* and *Sphingurus*, but present in *Erethizon dorsatus* [1], and, in a rudimentary condition, in *E. epixanthus* [2]; its attachments are normal. In the Sciuromorpha the muscle is well marked and the attachments normal; as above mentioned, it is absent in *Castor*.

Extensor Carpi Radialis Longior and Brevior.—These muscles are always present, and only differ from the same muscles in Man in that they are attached to the middle of the shafts of the metacarpal bones instead of near the bases. The two muscles are about the same size except in *Myopotamus*, in which the brevis is much the larger and rises from a more extensive origin than its neighbour.

Extensor Communis Digitorum.—This muscle rises from the external condyle, and is inserted into the middle and distal phalanges of the 2nd, 3rd, 4th, and 5th digits. On each side of the slip to the terminal phalanx there is a strong elastic band running from the head of the middle to the base of the distal phalanx; this serves to keep the terminal joint of the digit in a state of constant extension. The four divisions to the fingers are connected by vincula, which in *Myopotamus* are broad and membranous.

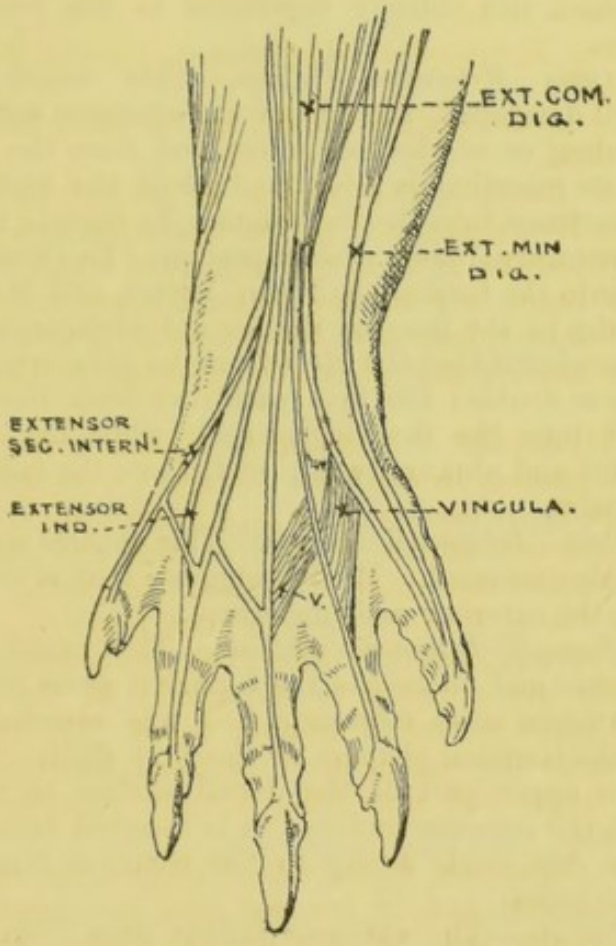
In *Dasyprocta* the muscle rises from the upper two-thirds of the posterior surface of the shaft of the ulna as well as from the external condyle; it divides into three slips, of which the middle goes to the 2nd, 3rd, and 4th digits, the radial one joins the tendon of the middle part to the index, while the ulnar slip goes to the 3rd and 5th digits. This practically corresponds to what Mivart and Murie found [3].

[1] Mivart, P. Z. S. 1882, p. 271.
[2] Windle, Journ. Anat. vol. xxii. p. 126.
[3] P. Z. S. 1866, p. 383.

In *Cavia cobaya* there are two slips, the radial goes to the index and middle, the ulnar to middle, ring, and little fingers.

In *Pteromys* and *Arctomys* the radial slip goes to all the fingers, while the ulnar only goes to the middle and ring.

Fig. 4.



Left fore foot of *Castor canadensis* (extensor tendons).

Extensor Minimi Digiti.—The extensor minimi digiti rises from the external condyle in common with the extensor communis digitorum, and is usually inserted into the tendons of that muscle on the dorsum of the 4th and 5th digits. Its tendons are also usually connected to the ulnar sesamoid bones on the palmar surface of the metacarpo-phalangeal joints. In the following animals the insertion differed from the above description:—

Sphingurus and *Sciurus* to 3rd, 4th, and 5th digits; *Chinchilla*, *Pteromys*, and *Castor* to 5th only. In *Aulacodus* the muscle was completely fused with the extensor communis. From the difference in the number of tendons in animals otherwise closely allied I should suspect this muscle of being liable to a good deal of individual variation.

Extensor Carpi Ulnaris.—This muscle possessed the same attachments as in Man with the exception of *Sphingurus*, in which the insertion had worked round to the palmar surface of the base of the fifth metacarpal bone.

Supinator Brevis.—This muscle rises from the external condyle, and is inserted into the upper third of the extensor surface of the radius, wrapping round that bone very little. It only consists of one layer, which lies entirely superficial to the posterior interosseous nerve.

Extensor Ossis Metacarpi Pollicis.—This muscle, which is generally well developed, rises from the extensor surfaces of the radius and ulna, or of the ulna alone, and from the interosseous membrane; its insertion is into the base of the first metacarpal bone and sometimes into the trapezium. In *Hystrix* the insertion is into the metacarpal bone and trapezium. In *Cavia cobaya* the insertion is into the trapezium, but in Mivart and Murie's case it also sent a slip to the base of the second metacarpal [1]. In the Sciuromorpha except *Castor* it rises from the ulna only. In *Castor* the muscle was double: the first part rose from the radius and was inserted into the first metacarpal, while the second rose from the radius and ulna and was inserted into the radial sesamoid bone of the palm.

Extensor Primi Internodii Pollicis.—This muscle was absent in all the animals examined. Meckel suggests that it may be incorporated with the extensor ossis metacarpi.

Extensor Secundi Internodii Pollicis.—This muscle was only found in *Hystrix* and *Castor*; in the former it arose from the ulna below the extensor ossis metacarpi, and was inserted by a thin tendon into the terminal phalanx of the first digit. In *Castor* it rises from the upper part of the dorsal surface of the ulna in common with the extensor indicis; it is inserted into the thumb as in *Hystrix*, but sends a slip to the common tendon on the dorsum of the index.

Extensor Indicis.—The extensor indicis rises from the dorsal surface of the ulna about its middle, and joins the tendon of the extensor communis digitorum on the dorsum of the index. In *Hystrix* a small slip was noticed, which ran down to lose itself on the dorsum of the fourth metacarpal bone. In *Castor* the muscle is blended with the extensor primi internodii as above stated.

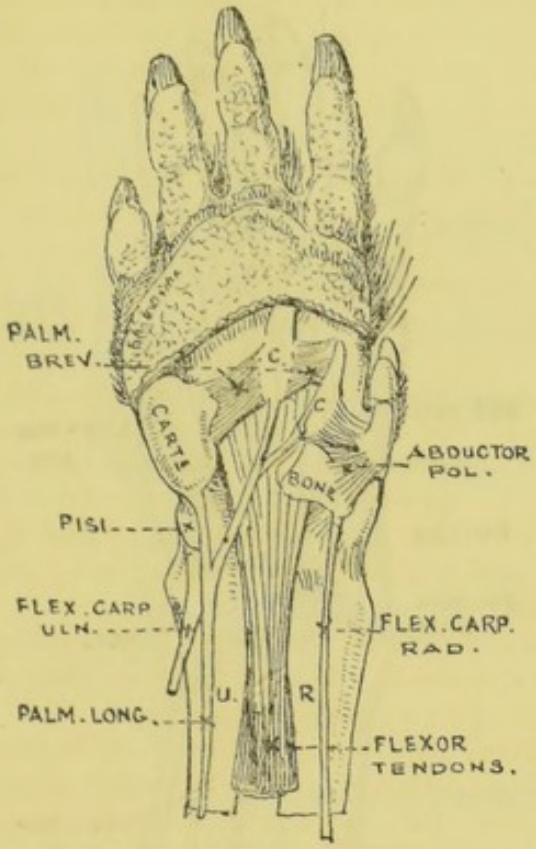
Palmaris Brevis.—This muscle is usually well marked and is attached to the pisiform bone and skin on the inner side of the palm; from this it runs transversely across to the radial side, being interrupted by the palmar cartilage or cartilages to which it is attached. In the Dipodidæ, in which a transverse bar of bone runs across the palm, it is very slightly marked.

In *Capromys melanurus* Dobson [2] describes it as sending a slip to act as the flexor perforatus of the little finger; this slip is what I describe, after Mivart and Murie, as flexor brevis manus.

[1] P. Z. S. 1866, p. 383.
[2] P. Z. S. 1884, p. 234.

In *Cœlogenys* the muscle is interrupted by three palmar cartilages.

Fig. 5.



Right fore foot of *Cœlogenys paca*.

Flexor Brevis Manus.—This muscle rises from the palmar ossicle on the radial side of the palm, and runs obliquely across to form the flexor perforatus for the fifth digit, usually joining the small flexor sublimis slip to that digit. It is supplied by the ulnar nerve.

Muscles of the Thumb.—Owing to the slight development of the thumb these muscles are difficult to define accurately. The abductor pollicis is the most definite; it always rises from the radial part of the palmar cartilage, and is inserted into the base of the proximal phalanx of the thumb. In the Dipodidæ and Caviidæ this and the other thumb-muscles are practically absent.

When the flexor brevis is present it rises either from the semilunar cartilage over the bases of the metacarpals (as in *Cœlogenys*) or from the palmar cartilage (*Capromys* according to Dobson [1]).

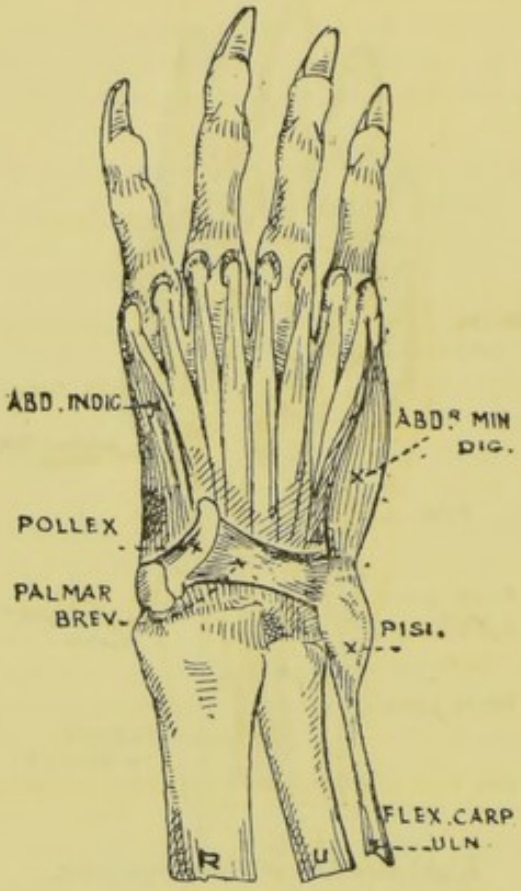
The opponens consists of a very few fibres; it is found in most of the Sciuromorpha except *Castor*; its attachments are from the above-mentioned semilunar cartilage to the metacarpal bone.

The adductor is best marked in the Octodontidæ (*Octodon*, *Myopotamus*, and *Capromys* [1]); in *Myopotamus* it is quite distinct,

[1] P. Z. S. 1884, p. 234.

and runs from the base of the third metacarpal to the proximal phalanx of the thumb.

Fig. 6.

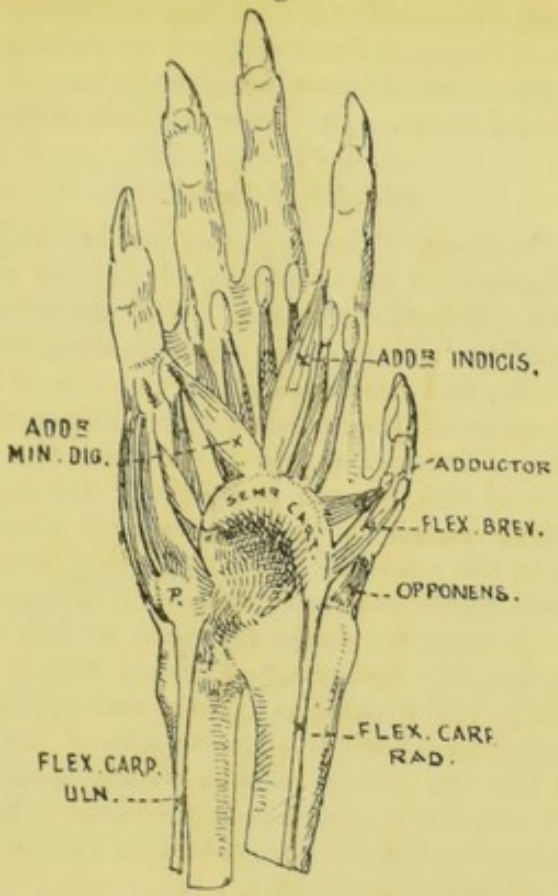


Left fore foot of *Ceredon rupestris*.

Muscles of the Little Finger.—Two muscles in most cases rise from the pisiform and run to the inner sesamoid bone on the palmar surface of the head of the metacarpal bone, and so to the base of the proximal phalanx; both of these I regard as abductor minimi digiti. The flexor brevis minimi digiti is represented by the ulnar slip of the interosseous layer of muscles going to the same place as the last. The opponens minimi digiti I have never seen. The adductor minimi digiti is sometimes present, running from the centre of the semilunar cartilage, superficial to the interossei, to the outer sesamoid bone of the little finger; it is present in *Myopotamus*, *Hystrix*, *Cœlogenys*, and *Xerus*. (See fig. 7.)

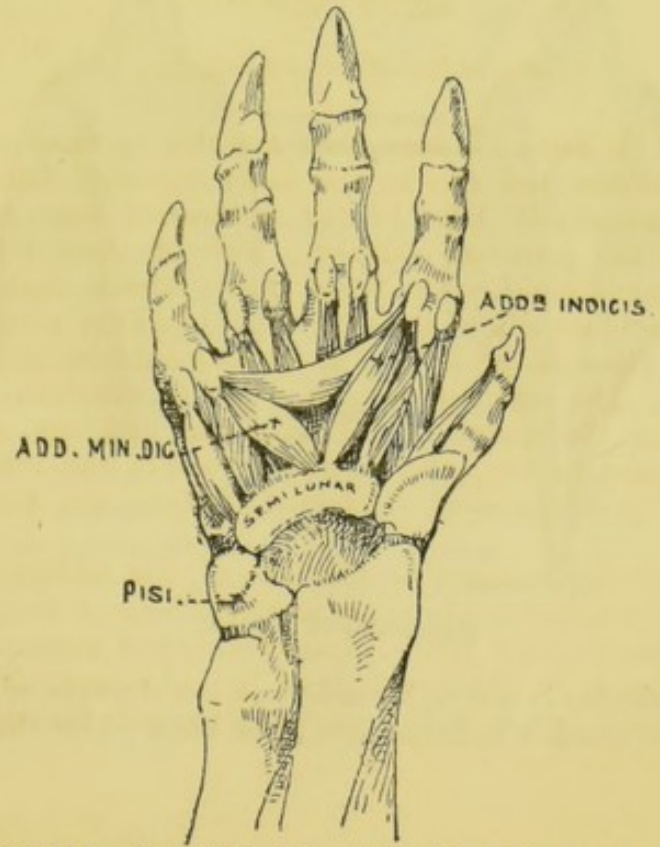
Adductor Indicis.—Rises by the side of the adductor minimi digiti, and is attached to the ulnar sesamoid bone of the index. In *Hystrix* a muscle rises from its insertion, and runs across the metacarpal bones to the insertion of the adductor minimi digiti in a semilunar curve, with the concavity towards the tips of the fingers. (See fig. 8, p. 273.)

Fig. 7.



Right fore foot of *Cœlogenys paca* (deep dissection).

Fig. 8.



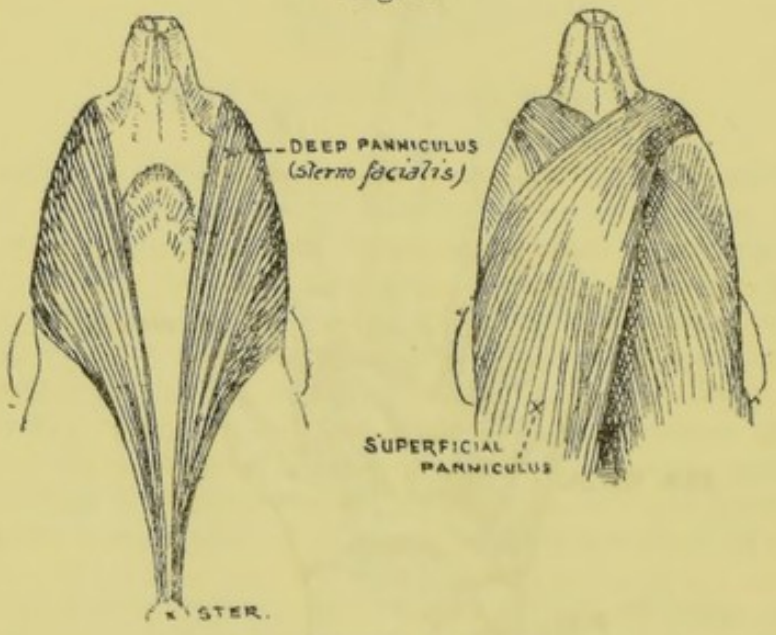
Right fore foot of *Hystrix cristata* (deep dissection).

Interossei.—There are eight interossei, which all lie in the same plane, rising from the semilunar cartilage and being inserted into the eight sesamoid bones in front of the four metacarpo-phalangeal joints. The most ulnar of these has already been described as the flexor brevis minimi digiti. In *Castor* only six of these are present.

Muscles of Trunk.

Panniculus Carnosus.—The panniculus is well marked in Rodents, and consists in many places of two or more layers of fibres running in different directions. The superficial panniculus in the neck rises from some of the face-muscles, more especially the orbicularis oris, and runs back along the side of the neck to be attached to the spine of the scapula; it probably corresponds to the human platysma. In *Spermophilus*, in which the cheek-pouches are present, part of this muscle is specially developed, and runs from the end of the pouch to the metacromial process. On the ventral surface of the neck the fibres decussate across the middle line, and run backwards and outwards over the pectoral region; as a rule, these decussating fibres are more or less scattered, but in *Octodon* they are very well marked, rising from a small origin a little to the side of the symphysis menti, and spreading out in a fan-shaped manner to cover the opposite side of the neck. Deep to these fibres lies the sterno-facialis, which is attached to the anterior part of the sternum and runs forwards to spread out over the masseter, covering the sterno-mastoid in its course; it is very well marked in all the Octodontidæ.

Fig. 9.



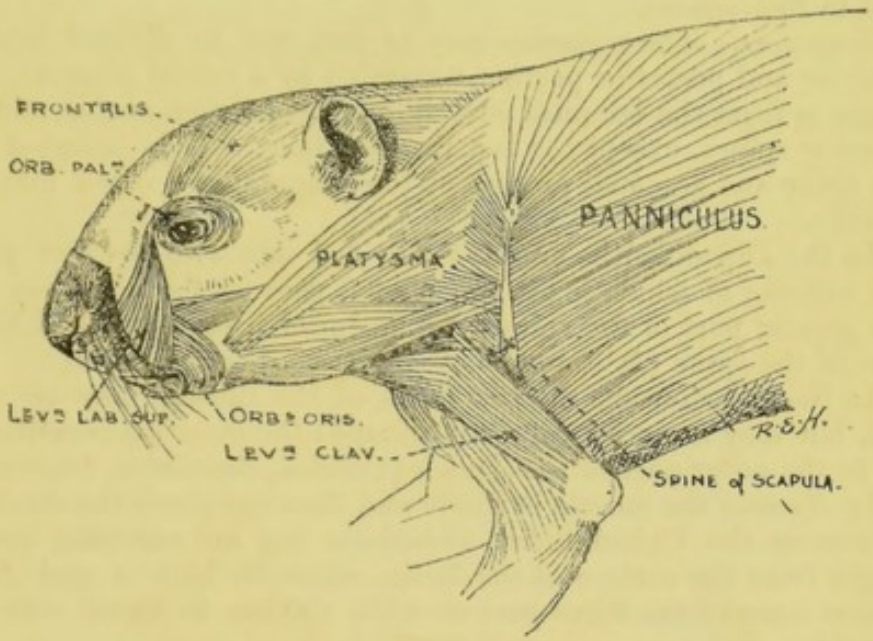
Panniculus of *Octodon*.

The panniculus is not well marked on the dorsum of the neck, but over the trunk it is found as a thick mass; over the shoulders

the fibres of this converge to be attached to the acromion and spine for a variable extent, as well as to the fascia of the outer side of the arm and the pectoral ridge of the humerus. In the Caviidæ these fibres to the arm are specially well developed, and in *Ceredon* some of them extend as far as the internal condyle.

The abdominal panniculus divides about the lateral line of the body into a superficial and a deep layer, which, as they approach the ventral region, embrace the pectoral, the superficial fibres passing over the muscle to be lost on its surface, the deep being attached to the cartilages of some of the true ribs close to the sternum and deep to the pectoral[1]. Posteriorly the panniculus

Fig. 10.



Panniculus of *Hystrix cristata*.

ends in a fairly well-defined margin over the gluteal muscles; the fibres of this part running round to the front and inner side of the thigh to terminate in the fascia there. I have never seen any attachment to the femur. Over the inguinal region there are several planes of fibres; some of these unite in the middle line under the ventral surface of the penis, forming a sling to keep that organ close to the body; this arrangement is well seen in *Cœlogenys*. The ventral and lateral parts of the panniculus of the body are supplied by the great internal anterior thoracic nerve, which runs back from the internal chord of the brachial plexus: the cervical part is supplied by the superficial cervical and facial nerves.

Latissimus Dorsi.—The latissimus dorsi rises from a large number of the posterior thoracic spinous processes, the posterior three or

[1] See author's contribution to Proc. Anat. Soc., printed in the Journal of Anatomy, xxvi. p. x (1892).

four ribs, and the lumbar aponeurosis. It is inserted by a flat tendon into the upper part of the anterior surface of the humerus internal to the pectoral ridge. Its relation to the teres major has already been noticed under the head of that muscle. Very often some of the fibres of the muscle are continued across the axilla to blend with the pectoralis major. The dorso-epitrochlearis is always present, occasionally blending with the fascia over the triceps, but more often being well marked and inserted into the olecranon process. In the Hystricidæ and in *Castor* the tendon of the muscle is inserted in front, behind, and below the teres major in such a manner that a section of it would appear like the letter **J**. In *Capromys* and *Castor* a number of fibres were seen passing in front of the axillary vessels to the pectoral. The dorso-epitrochlearis is, perhaps, least well seen in *Lagostomus* and *Dasyprocta*, best in *Sphingurus*.

Trapezius.—The trapezius may or may not be divided into an anterior and posterior portion, separated by a fascial interval. Its origin is from the occipital curved line, ligamentum nuchæ, and the thoracic spines, except the last three or four. It is inserted into the spine and acromial process of the scapula, and often into the clavicle.

In the Dipodidæ the muscle is divided into two distinct parts, the anterior of which is the larger, and goes to the acromion and the greater part of the spine: the posterior is only attached to the root of the spine (*D. ægyptius*, *D. hirtipes*, *Alectaga indica*).

In the Octodontidæ the two parts of the muscle may be made out, but they are practically continuous: the insertion is continued on to the outer part of the clavicle (*Octodon*, *Aulacodus*, *Capromys*).

In *Hystrix* the muscle is single and does not reach the clavicle.

Among the Chinchillidæ, *Chinchilla* has an extended cranial origin from the surface of the bulla, while in both it and *Lagostomus* some of the fibres pass over the clavicle to blend with the deltoid.

In the Dasyproctidæ the muscle is divided into two parts, some of the cranial fibres being prolonged down on the outer side of the humerus for some distance (*Dasyprocta*, *Cœlogenys*).

In the Caviidæ the muscle is divided into two distinct parts and does not reach the clavicle (*C. cobaya*, *Ceredon rupestris*, *Dolichotis patagonica* [1]).

In the Sciuromorpha the muscle has one continuous origin: in *Sciurus* and *Pteromys* it is not attached to the clavicle, while in *Castor* it just reaches the outer end of that bone. In *Arctomys*, *Spermophilus*, and *Xerus* the inner part of the muscle is separated from the rest by the levator claviculæ, and lies over the cleidomastoid, making that muscle appear double: in *Arctomys* this slip is shifted so far inwards that it becomes attached to the front of the sternum.

Rhomboideus.—The rhomboideus capitis major and minor rise by one continuous origin from the superior curved line of the

[1] Beddard, P. Z. S. 1891, p. 236.

occiput, from the ligamentum nuchæ, and from the anterior three or four dorsal spines and supraspinous ligaments ; the insertion is into the whole length of the vertebral border of the scapula, the occipital fibres also going to the fascia over the inner part of the supraspinatus.

Sciurus and *Pteromys* differ in having a slight separation between the occipital and cervical portions, but this is not seen in *Xerus* and *Spermophilus*.

Serratus Magnus and Levator Anguli Scapulæ.—These two muscles are in the same plane and usually have a continuous origin, so that it is difficult to define their line of demarcation. They rise from the transverse processes of several cervical vertebræ, and from the sides of 7 to 9 of the anterior ribs by fleshy digitations. The insertion is into the vertebral border of the scapula. In the following animals a separate slip rising from the atlas was found :—*Myopotamus*, *Sphingurus*, *Lagostomus*, *Sciurus*, *Pteromys*, and *Arctomys*.

The exact number of vertebræ and ribs from which these muscles arise in various Rodents are as follows :—

Dipus ægyptius	1–7 c. v.	1–8 ribs.
Capromys pilorides	2–7 „	1–9 „
„ *melanurus*[1]	3–7 „	1–6 „
Aulacodus	2–7 „	1–9 „
Myopotamus	1st & 3–7 „	1–8 „
Octodon	5–7 „	1–8 „
Hystrix	4–7 „	1–8 „
Sphingurus	1–7 „	1–7 „
Chinchilla	2–7 „	1–9 „
Lagostomus	1–7 „	1–8 „
Dasyprocta cristata	2–7 „	1–8 „
Cœlogenys	1–7 „	1–8 „
Cavia cobaya	1–7 „	1–9 „
Ceredon	2–7 „	1–9 „
Sciurus	1st & 3–7 „	1–8 „
Pteromys	1–7 „	1–7 „
Xerus	4–7 „	1–8 „
Arctomys marmotta	1st & 3–7 „	1–9 „
Castor canadensis	2–7 „	1–7 „

Serratus Posticus.—This muscle varies very much in different genera and apparently in different individuals. *Aulacodus* seems to show most satisfactorily its full development. In this animal the anterior part of the muscle rises from the ligamentum nuchæ and spines of the anterior dorsal vertebræ to be inserted into the ribs from about the 4th to the 12th, the direction of its fibres being backwards and outwards. The posterior part rises from the spines of the posterior dorsal and lumbar vertebræ by means of the lumbar fascia, and runs forwards and outwards to the posterior

[1] Dobson, P. Z. S. 1884, p. 234.

ribs from about the 9th to the last: there are thus two distinct layers of fibres running in opposite directions in the dorsal region. The variations that are met with consist of more or less complete suppression of these parts. In *Dasyprocta* and *Cavia cobaya*, for example, the posterior part is wanting and the anterior well developed, so that in the former there is a continuous layer of muscle, the fibres of which run in the same direction, stretching from the 4th to the 13th rib.

In *Sphingurus*, on the other hand, each part is equally diminished, so that there is a space between them resembling the arrangement in Man.

In the Dipodidæ the muscle is almost entirely represented by fascia.

Among the other animals examined *Ceredon* and *Pteromys* resembled *Aulacodus*, while *Cœlogenys*, *Arctomys*, and *Xerus* had the arrangement found in *Dasyprocta*. *Octodon* resembled *Sphingurus*, but was remarkable for having the posterior part of the muscle better developed than the anterior.

Sacro-lumbalis.—This muscle has the usual attachments. It is continued forwards by the accessorius, the limits of which are indistinguishable. This is succeeded by the cervicalis ascendens, which is attached to the transverse processes of the posterior three cervical vertebræ, except in *Dasyprocta* and *Cœlogenys*, where it only goes to the last two.

Longissimus Dorsi.—This muscle, as well as the semispinalis and multifidus, has the usual arrangement: their exact attachments vary with the number of vertebræ.

Transversalis Capitis and Colli.—When both these muscles are present they are continuous. The latter is attached to the transverse processes, except sometimes the first and often the last one or two. The transversalis capitis or trachelo-mastoid is attached to the base of the paroccipital process, except in *Castor*, where it goes to the base of the mastoid process. It is present in all the Sciuromorpha, as well as in the Octodontidæ, Hystricidæ, and Dasyproctidæ. In the Caviidæ it is present in *Ceredon*, but absent in *Cavia cobaya*. In the remaining families the muscle was not examined.

Splenius Capitis et Colli.—The splenius capitis is always present, and has the human attachments and relations.

The splenius colli was found in the Dasyproctidæ, where it was inserted into the anterior three transverse processes in *Dasyprocta* and into the transverse process of the atlas only in *Cœlogenys*.

A small slip representing this muscle was found in *Myopotamus*, but in no other animal was it seen.

Complexus.—This muscle has the usual attachments. It shows signs of being divided longitudinally into two parts; of these the outer is inserted by tendon and the inner by flesh. In some of the Hystricomorpha a slight tendinous intersection was seen in the inner part, reminding one of the biventer of Man; but this arrangement was not seen in the Sciuromorpha, except in *Castor*,

in which, moreover, the inner and outer halves of the muscle were very distinct.

Intercostals and Triangularis Sterni.—These muscles have nothing remarkable in their attachments: the latter usually rises from the posterior 4 or 5 pieces of the sternum.

Tail-Muscles.

The following muscles can be identified:—Extensor caudæ, externus and internus; Abductor caudæ, externus and internus; Flexor caudæ, externus, internus, and profundus.

With the following exceptions these muscles correspond to Meckel's general description of the tail-muscles of mammals[1]:—The abductor caudæ internus rises from one transverse process and arches over to the next but one, passing dorsal to the intermediate transverse process.

The abductor caudæ externus in *Myopotamus* does not rise from the tuber ischii, its usual origin, but from the pelvic fascia by the side of the lower part of the rectum.

In *Sphingurus* the ischial origin of this muscle is very well marked, as are also all the tail-muscles. In the flexor caudæ internus the most internal of the superficial tendons are inserted first, the deeper tendons coming to the surface round the outer side of these. In the flexor caudæ externus the most external tendons are first inserted, and the deeper ones reach the surface round the inner side of these.

In *Castor* a series of fleshy bellies rose from the articulations of the chevron bones to the caudal vertebræ; these soon became tendinous and ran backwards and outwards to be lost in the fat over the transverse process of the next vertebra but one. Each tendon was perforated by the one behind it.

Obliquus Externus Abdominis[2].—This muscle rises by fleshy digitations from a large number of the posterior ribs, generally about two-thirds of the total number, as well as from the lumbar aponeurosis. The fibres pass downwards and backwards to be inserted into the crest of the ilium, from which they pass across as Poupart's ligament to the anterior part of the body of the pubes. The next fibres are separated from these by a large triangular gap, the external abdominal ring, and are inserted into the anterior part of the body of the pubes. The fibres anterior to these pass ventral to the rectus to reach the linea alba. In the anterior part of the abdomen the fibres blend with those of the rectus, and in some cases are continued forwards with that muscle to the first rib. The intercolumnar fibres over the ring are well marked and form a pouch for the testes. There is very little aponeurosis near the linea alba, the most tendinous part being at Poupart's ligament.

[1] Traité général d'Anatomie comparée, p. 175.

[2] Owing to the fact that many of the animals I dissected had been eviscerated before they came to me, my observations on the abdominal muscles are not so complete as I could have wished.

In *Lagostomus*, *Hystrix*, and *Sphingurus* the muscle, on careful dissection, was found not to be continued forwards to the first rib with the rectus. In *Arctomys* it went not only to the first rib, but also to the junctions of the 2nd, 3rd, and 4th with the sternum.

Internal Oblique and Transversalis.—These muscles are closely blended, requiring careful examination to make out their separate attachments.

The internal oblique rises from the lumbar fascia, the crest of the ilium, and a large part of Poupart's ligament. The fibres run forwards and inwards to a few of the posterior ribs and to the linea alba. At the abdominal ring a muscular pouch representing the cremaster supports the testis. There is usually more aponeurosis ventrally than in the external oblique. The transversalis rises from the inner surfaces of a large number of the posterior ribs, from the lumbar fascia, from the iliac crest, and from the outer part of Poupart's ligament, and is inserted into the linea alba, passing deep to the rectus in its whole extent.

In *Aulacodus*, *Octodon*, *Dasyprocta*, *Cavia cobaya*, and *Sciurus* the muscles are practically inseparable, but in *Dasyprocta* a white line was noticed running downwards and backwards from the cartilage of the last false rib to the outer edge of the rectus, which appeared to mark the place where the internal oblique became aponeurotic. In *Lagostomus* the internal oblique becomes aponeurotic near the edge of the rectus, forming a linea semilunaris. It passes superficial to the rectus, while the transversalis remains fleshy and passes deep to it.

In *Hystrix*, *Sphingurus*, *Cœlogenys*, and *Arctomys* the muscles are more separable, and the internal oblique rises from the outer three-quarters of Poupart's ligament as well as its other origins, and is inserted into the posterior ribs—into three in *Hystrix*, five in *Sphingurus*, and six in *Cœlogenys*.

Rectus Abdominis.—The rectus arises by one head from the ventral surface of the symphysis pubis and runs forwards between the internal oblique and transversalis, with which it is closely blended, to the ventral surface of the first rib near its junction with the sternum; it is also inserted into the succeeding four or five costal cartilages at their sternal ends by small slips. It has already been noticed that the external oblique is usually continued forwards with it. In *Sphingurus* it only reaches as far forwards as the second rib. The lineæ transversæ are very feebly marked; they are usually five or six in number, but in *Arctomys* only three could be made out.

The Octodontidæ are remarkable for having a well-marked decussation of the two recti close to their origin; this has been pointed out by Owen [1] and Dobson [2] in *Capromys fournieri* and *C. melanurus*, as well as by Martin in *Myopotamus* [3] and *Octodon* [4].

[1] P. Z. S. 1832, p. 68.
[2] P. Z. S. 1884, p. 234.
[3] P. Z. S. 1835, p. 176.
[4] P. Z. S. 1836, p. 72.

Owen describes the left rectus in *Capromys fournieri* as passing through a slit in the right, the right being therefore both superficial and deep to the left; this is practically what I found in *Octodon*, the only difference being that each rectus rose by two heads, the two belonging to the left muscle passing together between the two belonging to the right. In *Myopotamus*, according to Martin, the four heads alternate, one of the left being most superficial. The rectus in *Aulacodus* was not noticed.

Mivart and Murie [1] describe a well-marked decussation in the Agouti; this I did not see; indeed, in none of the animals examined was there any decussation approaching in distinctness that found in the Octodontidæ.

Psoas Parvus.—The psoas parvus varies very much in development among the Hystricomorpha; it rises from the sides of the bodies of a variable number of lumbar vertebræ, and is inserted into the ilio-pectineal eminence on the brim of the pelvis.

In the Dipodidæ the muscle is large and rises from all the lumbar vertebræ except the last one or two (*D. ægyptius, D. hirtipes*).

Among the Octodontidæ it is small and rises from the anterior 3 or 4 vertebræ, and from the crura of the diaphragm in *Aulacodus*, *Myopotamus*, and *Capromys*. In *Octodon* it was absent.

In the Hystricidæ it has the same arrangement (*Hystrix*, *Sphingurus*).

In the Chinchillidæ the muscle is large, and rises from all or nearly all the lumbar vertebræ (*Chinchilla*, *Lagostomus*).

In the Dasyproctidæ it is small, and rises from two or three of the central lumbar vertebræ.

In the Caviidæ it is very small and apparently often absent. In one specimen of *Ceredon* it was absent, while in another it rose from the 4th and 5th vertebræ. In two specimens of *Cavia cobaya* it was present, in one it was absent.

In the Sciuromorpha it is always present and well marked; it usually rises from the anterior four or five lumbar vertebræ.

Psoas Magnus.—This muscle shows much less variation than that of the psoas parvus. It rises from the sides of the bodies and ventral surfaces of the transverse processes of all the lumbar vertebræ, and occasionally from the first sacral. The muscle is usually more or less distinctly divided into an inner and outer part by some of the branches of the lumbar plexus, this division being specially well seen in *Spermophilus*. It has the usual insertion as in Man.

Iliacus.—The iliacus rises from the iliac surface of the ilium; it soon joins the psoas, with which it is inserted. Nothing characteristic was noticed about it in the different animals examined.

Quadratus Lumborum.—This muscle rises from the sides of the bodies of the posterior dorsal vertebræ, usually the last six, and from the tips of the transverse processes of the lumbar vertebræ; it is inserted by a narrow tendon into the ventral surface of the

[1] P. Z. S. 1866, p. 383.

ilium just external to the synchondrosis. Its arrangement is very constant.

Muscles of Posterior Extremity.

Gluteus Maximus, Tensor Fasciæ Femoris, and Sartorius.—These three muscles in Rodents are so closely united that they form practically one sheet, which rises from the anterior extremity or crest of the ilium, and from the fascia over the gluteus medius by which they are connected to the spinous processes of the posterior lumbar, sacral, and anterior caudal vertebræ. Occasionally it also rises from the outer part of Poupart's ligament and the inferior border of the ilium. The fibres which rise most anteriorly cross the front of the thigh obliquely, and are inserted into the fascia above and to the inner side of the patella; these fibres correspond to the sartorius. The fibres rising behind these run down the outer side of the thigh and are inserted into the fascia, there forming the tensor fasciæ femoris. The rest of the muscle, or the gluteus maximus proper, is inserted partly into the fascia of the outer side of the thigh, and partly into the femur, sometimes quite high up, at others near its lower end. The nerve supply of these three muscles is the superior gluteal.

In the Dipodidæ few, if any, fibres were noticed going to the femur (*Dipus ægyptius*).

In the Octodontidæ the sartorius is well developed, reaching to the patella, while the bony insertion of the gluteus maximus is into the posterior surface of the femur at the junction of the middle and lower thirds (*Myopotamus*, *Capromys*, *Pilorides*, *Aulacodus*).

In the Hystricidæ the arrangement is the same, except in *Sphingurus*, in which the insertion of the gluteus maximus is into the middle of the femur (*Hystrix cristata*, *Sphingurus*, *Erethizon dorsatus*[1]).

In the Chinchillidæ and Dasyproctidæ the arrangement is the same (*Chinchilla*, *Lagostomus*, *Dasyprocta cristata*, *Cœlogenys*).

In the Caviidæ the gluteus maximus has the same bony attachment as in *Sphingurus* (*Cavia cobaya*, *Ceredon rupestris*).

Among the Sciuromorpha the sartorius rises from the outer part of Poupart's ligament and runs to the inner side of the knee, where it blends with the gracilis in *Sciurus*, *Spermophilus*, and *Pteromys oral.* The gluteus maximus is inserted by two slips, one into the third trochanter, the other into the lower part of the femur. It also has, of course, the usual fascial insertion.

In *Xerus* the arrangement is the same, except that the gluteus maximus has its bony insertion into the junction of the upper and middle thirds of the femur.

In *Arctomys marmotta* this muscle is inserted into the third trochanter and fascia.

In *Castor canadensis* no sartorial portion was seen, the gluteus maximus being inserted into a ridge halfway down the femur.

[1] P. Z. S. 1882, p. 271.

Gluteus Medius.—The gluteus medius rises from the fascia over the posterior part of the erector spinæ, and its continuation into the tail-muscles, from the crest of the ilium and the inferior border of that bone for some distance. It is usually a very large muscle. It is inserted into the outer side of the great trochanter by a number of tendinous slips placed close together.

This description applies to all the animals dissected, except the Octodontidæ, in which there is no origin from the ilium (*Myopotamus*, *Capromys*, *Aulacodus*).

Gluteus Minimus.—This muscle rises from the external surface of the ilium, below the great sciatic notch, and is inserted into the top and front of the great trochanter. It is usually small and very difficult to clearly separate from the gluteus medius, scansorius, and pyriformis. In *Aulacodus* it is a large muscle folded on itself, rising from the fascia over the tail-muscles as far forwards as the crest of the ilium, then from the outer side of the ilium as far back as the acetabulum; it thus springs from a horseshoe-shaped origin above, below, and in front of the sacro-sciatic notch, which it encloses in the concavity of the horseshoe. *Capromys* presents a somewhat similar arrangement, but in the other animals examined there was no variation of any importance from the normal.

Scansorius.—The scansorius may be present as a distinct muscle, or may be so blended with the gluteus minimus as to make it impossible to distinguish it. When it is distinct it rises from the inferior border of the ilium, and is inserted into the anterior surface of the great trochanter.

In the Dipodidæ it is present as a distinct muscle (*Dipus ægyptius*).

In the Octodontidæ it is probably represented by the inferior portion of the gluteus minimus; in *Myopotamus* it is more distinct than in *Capromys* or *Aulacodus*.

In the Hystricidæ nothing was seen of it in *Hystrix* or *Sphingurus*; in *Erethizon dorsatus* it is absent according to Mivart [1], but in *E. epixanthus* it is well marked according to Windle [2].

In the Chinchillidæ I made it out in *Viscacha*, but failed to in *Chinchilla*.

In the Dasyproctidæ it is present both in *Dasyprocta* and *Cœlogenys*, but is much more distinct in the former.

In the Caviidæ it is present, and is inserted into a tubercle on the outer side of the great trochanter at its junction with the shaft (*Cavia cobaya*, *Ceredon rupestris*).

It was absent in all the Sciuromorpha examined (*Sciurus*, *Pteromys*, *Xerus*, *Spermophilus*, *Arctomys*, *Castor*).

Pyriformis.—The pyriformis rises from the ventral surface of the sacrum close to the sciatic notch, through which its fibres pass, and from the outer surface of the ilium in front of the notch; by the latter part of its origin it is often fused with the gluteus minimus. It is inserted into the top of the great trochanter.

[1] P. Z. S. 1882, p. 271. [2] Journ. Anat. vol. xxii. p. 126.

The intra-pelvic portion seems often to be wanting, in which case it is very difficult to define the muscle.

In the Dipodidæ it is continuous with the gluteus minimus (*Dipus ægyptius*).

Among the Octodontidæ it is found between the two layers of the folded gluteus minimus in *Aulacodus* and *Capromys*; in *Myopotamus* and *Octodon* it is normal.

In the Hystricidæ it was not seen in *Hystrix*, but was present in *Sphingurus*.

In the Chinchillidæ it was not seen in *Chinchilla*, but was made out with some difficulty in *Viscacha*.

In the Dasyproctidæ it is large and well marked, partly overlapping the gluteus medius (*Dasyprocta*, *Cœlogenys*).

In the Caviidæ it rises from the sacrum, but is continuous with the posterior border of the gluteus minimus (*Cavia cobaya*, *Ceredon rupestris*).

In all the Sciuromorpha examined it was present and normal, except in *Castor*, where it was not seen.

Obturator Internus and Gemelli.—These muscles usually have the same origin as in Man, but they are inserted into the digital (trochanteric) fossa of the femur. The gemelli are large, especially the anterior one.

When the obturator internus is cut through a number of tendons are seen on its deep surface converging to the digital fossa; this is well shown in *Cœlogenys*. In *Castor canadensis* the origin of the obturator internus and gemellus posterior was taken up by the great tail-muscles, so that the anterior gemellus was the only part of this group present.

Obturator Externus.—In all the Rodents dissected, this muscle had the usual human attachments. Its insertion into the digital fossa is deep to that of the obturator internus.

Quadratus Femoris.—The quadratus femoris rises from the outer side of the tuber ischii, and is inserted into the back of the femur midway between the great and small trochanters. In the Hystricomorpha it is usually inserted by a narrow tendon, but in *Sphingurus* and the Sciuromorpha the insertion is fleshy and the muscle quadrilateral.

Biceps Femoris.—The biceps rises from the spines of the anterior caudal vertebræ and the fascia over the tail-muscles; also by a deep head from the tuber ischii. These two parts, as a rule, unite and are inserted into the outer side of the patella, and the fascia of the leg from the knee almost, if not quite, to the ankle.

This arrangement obtains in all the Rodents dissected, with the following exceptions:—In *Sphingurus* the two parts remain distinct, the superficial or caudal portion being inserted into the outer side of the patella and ligamentum patellæ, while the deep portion from the tuber ischii is joined by a slip from the posterior sacral vertebræ and is inserted into the fascia of the leg continuing the plane of insertion of the former part. In *Erethizon dorsatus*[1]

[1] P. Z. S. 1882, p. 271.

and *E. epixanthus*[1] the same arrangement is found. This corresponds to the arrangement that Mivart and Murie[2] have described in the Agouti, but presents a clearer illustration of it than is found in that animal.

In *Sciurus* and *Pteromys* the superficial head is small, and instead of rising from the caudal vertebræ comes from the deep surface of the gluteus maximus. *Xerus*, *Spermophilus*, *Arctomys*, and *Castor* as well as all the other rodents have the typical arrangement. In *Myopotamus* a strong tendon runs to the head of the fibula.

Semitendinosus.—The semitendinosus rises by two heads, the most superficial of which springs from the sacral and anterior caudal spines and slightly from the lumbar fascia. The deep head rises from the tuber ischii deep to the biceps. These two parts unite in the upper part of the thigh, and are inserted into the cnemial crest of the tibia and the fascia of the leg below this.

This arrangement applies to all the animals dissected, except the Hystricidæ and *Pteromys*.

In the Hystricidæ the muscle rises only from the sacral and caudal spines, but in *Hystrix cristata* and *Erethizon dorsatus*[3] a small slip is given to reinforce the biceps from this. In *Sphingurus* no slip goes to the biceps. In *Pteromys* the muscle rose from the tuber ischii; but I am inclined to regard this as an individual variation, because all the other Sciuromorpha, including *Sciurus*, have both heads.

Semimembranosus.—This muscle consists of two parts, which are sometimes distinct, at others blended. The main part of the muscle rises from the tuberosity and adjacent part of the ramus of the ischium, and is inserted by a rounded tendon into the internal tuberosity of the tibia. It is supplied by the great sciatic nerve.

The second portion is often included in the description of the adductors, with which it is frequently closely blended; its insertion is always into just above the internal condyle of the femur where, in Man, the adductor tubercle is situated; this insertion is separated from that of the adjacent adductors by the femoral artery. The origin of this part of the muscle is not constant—sometimes it rises separately from the sides of the caudal vertebræ, sometimes from the tuberosity of the ischium in common with the other head of the muscle, and sometimes from the ramus of the ischium, as part of the adjacent adductor magnus. Whatever its origin it is always supplied by the great sciatic nerve and never by the obturator which supplies the adductors.

In the Dipodidæ the muscle rises from the tuberosity of the ischium, and is inserted into the lower part of the back of the femur and the internal tuberosity of the tibia; the oblique condylar slip is separate and also rises from the tuber (*Dipus ægyptius*).

In the Octodontidæ the origin is from the tuber and ramus of

[1] Journ. Anat. 1888, p. 126.
[2] P. Z. S. 1866, p. 383.
[3] P. Z. S. 1882, p. 271.

the ischium; the insertion is normal, but an expansion is continued forwards deep to the internal lateral ligament of the knee.

The oblique slip in *Myopotamus* and *Octodon* rises from the tuber ischii, but in *Aulacodus* it comes from the sacral vertebræ as in *Hystrix* (*Aulacodus*, *Capromys melanurus*[1], *Myopotamus*, *Octodon*).

In the Hystricidæ the arrangement is not constant: *Hystrix* and *Erethizon* entirely resemble *Aulacodus* in the origin of the two parts, but in *Sphingurus* the second slip rises from the tuber ischii with the rest of the muscle instead of from the sacral vertebræ; it soon becomes distinct to run to the internal condyle.

Among the Chinchillidæ, *Lagostomus* has the same arrangement as *Hystrix* and *Aulacodus*, but *Chinchilla* resembles *Sphingurus*.

In the Dasyproctidæ the two parts of the muscle rise together from the tuber and ramus and only separate towards the lower part of the thigh (*Dasyprocta*, *Cœlogenys*).

In the Sciuromorpha the condylar portion of the muscle is separate from the rest and closely connected to the adductor mass, with which it will for convenience be described; it is, however, still supplied by the great sciatic nerve (*Sciurus*, *Pteromys*, *Xerus*, *Spermophilus*, *Arctomys*, *Castor*).

It will be seen that the Rodents illustrate the changes by which part of the semimembranosus becomes part of the adductor magnus.

In *Cœlogenys*, for example, the slip going to the condyle of the femur is part of the semimembranosus: in *Sphingurus* it rises with that muscle but soon separates from it; in *Hystrix* it is a perfectly distinct muscle, having a different origin to the semimembranosus or adductors, while in *Sciurus* it is intimately blended with the adductors, though still preserving its original nerve supply. It is remarkable, too, that, except for its constant arrangement in the Sciuromorpha, it seems to be of very little classificatory value.

Gracilis.—The gracilis is very often double. The most anterior portion, which has sometimes been described as the sartorius, rises from the ilio-pectineal line and from the anterior part of the ventral surface of the symphysis pubis; it is inserted into the inner border of the patella and ligamentum patellæ. The posterior gracilis usually rises from the posterior part of the ventral surface of the symphysis and from the subpubic arch; its insertion is into the cnemial crest of the tibiæ and the fascia of the leg, which makes it a powerful internal rotator of the tibiæ. The two muscles are always supplied by the obturator nerve.

Sometimes the gracilis is a single muscle, but it then usually shows signs of a separation.

The general rule seems to be that the Hystricomorpha have two graciles and the Sciuromorpha one. The two exceptions that I have met with are *Aulacodus*, in which the muscle is single, and *Castor*, in which it is double.

Pectineus.—The pectineus rises from the ilio-pectineal eminence and line under cover of the anterior gracilis, and is inserted into

[1] P. Z. S. 1884, p. 234.

the upper third to half of the linea aspera of the femur. The only exceptions to this that I have met with are the Caviidæ, in which the muscle rises by a tendon from the ilio-pectineal eminence only (*Cavia cobaya*, *Ceredon rupestris*), and *Castor*, in which it is very strongly developed and is inserted into the whole length of the shaft of the femur.

Quadriceps Extensor Cruris.—The four muscles composing the quadriceps have the same origin and insertion that they have in Man, and are practically the same in all the Hystricomorpha and Sciuromorpha. The rectus rises by two heads, which are sometimes quite distinct, but at others so short as to be almost indistinguishable. They are perhaps most distinct in the Hystricidæ, least so in the Sciuridæ. The crureus rises from the whole of the anterior surface of the femur by a series of about 30 fleshy arches. The two vasti can usually be separated easily from the crureus; as a rule the vastus externus is the larger.

Adductors.—It is extremely difficult in dissecting a Rodent to say which part of the adductor mass corresponds to the adductor longus, brevis, or magnus of human anatomy.

In *Dipus ægyptius* the adductor longus rises from the front of the pubes under cover of the gracilis and runs to the inner side of the patella. The adductor magnus and brevis come from the whole subpubic arch and are inserted into the upper two-thirds of the back of the femur. A good deal of the adductor mass, however, in this animal seems to be blended with the semimembranosus.

In the Octodontidæ and Chinchillidæ the adductors longus and brevis seem to be fused, although in *Aulacodus* and *Octodon* a division was readily made out. These coalesced muscles rise from the inner part of the pectineal line and ventral surface of the symphysis, and are inserted into the upper half of the linea aspera.

In the Hystricidæ, as Meckel[1] observes, the three parts of the muscle can be seen; this is especially the case in *Sphingurus*, but it is doubtful whether the three parts correspond morphologically with the three adductors in Man.

Among the Dasyproctidæ, *Dasyprocta* has very much the same arrangement as the Chinchillidæ, but in *Cœlogenys paca* the adductor brevis has a distinct insertion by a ribbon-like tendon into the upper part of the linea aspera.

It will be noticed that nothing has been said here about fibres passing to just above the internal condyle; these have already been described with the semimembranosus.

Among the Sciuromorpha the adductor mass is much more broken up.

In *Sciurus*, which serves as a good type, there are five portions inclusive of the slip already described with the semimembranosus. The following is the arrangement in *Sciurus*:—(1) Most anterior portion from the ilio-pectineal line to the middle of the posterior border of the femur; this part is distinct from the pectineus. (2) A slip from the posterior part of the pubic symphysis to above

[1] Traité général d'Anatomie comparée, vol. vi. p. 378.

the internal condyle. (3) A slip rising behind this by a very thin tendon from the same origin and running to the middle third of the posterior border of the femur. These three probably represent the adductors longus and brevis. (4) A slip from the tuber ischii running obliquely across the leg to above the internal condyle and also to the posterior surface of the femur above it. This is supplied by the great sciatic nerve instead of the obturator, and is the second part of the semimembranosus joined to the adductors. (5) A massive muscular slip from the outer side of the tuber ischii to the upper part of the shaft of the femur. In *Spermophilus*, *Xerus*, *Arctomys*, and *Castor* the arrangement is essentially the same, but in *Pteromys* an extra deep slip was observed running behind the obturator nerve to the upper part of the femur, while the portion described as No. 4 in *Sciurus* had a much more extensive attachment up the femur. Meckel describes five heads in *Arctomys*. In *Castor*, although the arrangement is identical with that of *Sciurus*, the muscle is very massive and the separate parts much less easy to identify.

Tibialis Anticus.—This muscle usually rises from the upper part of the outer surface of the tibia, and is inserted into the internal cuneiform and first metatarsal by two slips. In those cases in which the halux is absent or rudimentary the tendon does not divide into two at its insertion.

In *Dipus ægyptius* its insertion is into the inner side of the base of the great metatarsal bone.

Among the Octodontidæ, *Myopotamus* and *Capromys* have a double insertion, *Aulacodus* and *Octodon* a single one. In the Hystricidæ it has a double insertion (*Hystrix*, *Sphingurus*, *Erethizon*). Meckel[1] says that in *Hystrix* it is blended with the extensor proprius hallucis; but this I did not find. In the Chinchillidæ it not only rises from the tibia but from the tendon of origin of the extensor longus digitorum (*Chinchilla*, *Lagostomus*).

In the Dasyproctidæ it rises from the front of the external condyle of the femur by a tendon which is anterior to that of the extensor longus digitorum, as well as by fleshy fibres from the upper part of the tibia; it is inserted by a single tendon, which in *Dasyprocta* goes to the base of the internal (2nd) metacarpal, and in *Cœlogenys* to the internal cuneiform. In the Caviidæ it has the same origin as in the Chinchillidæ, and is inserted into the rudimentary fused internal cuneiform and first metatarsal, which is found under the base of the internal (2nd) metatarsal.

Mivart and Murie[2] found a femoral origin, as in the Dasyproctidæ, in some of the Guinea-pigs they dissected. Beddard[3] describes the same arrangement in *Dolichotis patagonica*.

In three Guinea-pigs I have not found a femoral origin once, and the specimen of *Ceredon rupestris* I dissected did not show it. I also did not see it in *D. patagonica*. Further observation is needed

[1] *Op. cit.* p. 410.
[2] P. Z. S. 1866, p. 383.
[3] P. Z. S. 1891, p. 236.

to show how far a femoral origin of this muscle is characteristic of the Caviidæ.

In the Sciuromorpha the muscle is specially well developed and encroaches on to the head of the fibula. There is no femoral head except in *Castor*, but here it is not nearly as well developed as in the Dasyproctidæ and does not rise as in them by a definite tendon (*Sciurus*, *Pteromys*, *Xerus*, *Spermophilus*, *Arctomys*, *Castor*).

Extensor Longus Digitorum.—This muscle in all cases rises by a tendon from the front of the external condyle just outside the patellar surface on that bone. This is its only origin, except in *Sphingurus* and *Dipus*, where a few accessory fibres rise from the outer tuberosity of the tibia. The muscle passes down and becomes tendinous in the lower part of the leg, being bound down by two well-marked annular ligaments, the lower of which is attached to the calcaneum and forms a distinct sling.

The tendon divides for the four outer toes, when these are present, being inserted into the middle and terminal phalanges. When there are only three toes the middle one sometimes has a double tendon, as in *Lagostomus* and *Cavia cobaya*. The tendons are united by vincula, which in *Myopotamus* spread out in the web between the toes; they are strongly marked in *Castor*.

Extensor Proprius Hallucis.—This small muscle rises from the middle or lower third of the front of the fibula and is inserted into the terminal phalanx of the hallux, when that toe is present. In *Dipus ægyptius* it is absent. In the Octodontidæ it either unites with or sends a slip to the extensor longus digitorum tendon to the second toe (*Aulacodus*, *Octodon*, *Myopotamus*). In the Hystricidæ it rises from the lower part of the shaft of the fibula.

In the Chinchillidæ it is absent (*Chinchilla*, *Lagostomus*).

In the Dasyproctidæ it is a large muscle and rises from the upper three-quarters of the fibula; in *Cœlogenys* it is inserted as in the Octodontidæ; while in *Dasyprocta*, in which the hallux is wanting, it goes entirely to the second toe, joining the long extensor tendon there.

In the Caviidæ it is present and runs to the second (internal) toe; it is bound down to the inner side of the base of the innermost metatarsal by a short fibrous tunnel (*Ceredon rupestris*, *Cavia cobaya*, *Dolichotis patagonica*[1]).

Among the Sciuromorpha it rises from the middle of the fibula and is inserted only into the hallux in *Sciurus*, *Spermophilus*, *Xerus*, and *Arctomys*. In *Pteromys* it springs from the lower third of the bone and sends a small slip to the second toe. In *Castor* it rises from a strong oblique fibrous band which runs from the head of the fibula to the lower end of the tibia, so that the muscle has no bony origin; it rises opposite the middle of the fibula, and is inserted into the first two toes.

Extensor Brevis Digitorum.—This muscle rises from the upper and anterior part of the calcaneum, and runs to join the tendons of

[1] Beddard, P. Z. S. 1891, p. 236.

the extensor longus on the dorsum of the toes. It is present in all the Sciuromorpha and Hystricomorpha except *Dipus*. In no case was it seen to give a tendon to the hallux, but tendons to the second and third toes were always met with. In *Cœlogenys*, *Arctomys*, and *Erethizon dorsatus*[1] it sends a small slip to the fourth toe, but it does not follow that when the four outer toes are well developed a tendon goes to each; for in *Octodon*, in which all the five toes are present, the muscle only sends slips to the second and third.

Peroneus Longus.—The peroneus longus showed very little variation in the Rodents examined. It rises from the head and the upper part of the outer surface of the shaft of the fibula, also in many cases by a few fibres from the external lateral ligament of the knee. Its tendon passes through a groove on the outer side of the external malleolus, grooves the cuboid, and is inserted into the base of the first metatarsal bone, or, when that is absent, into the second. In one specimen of *Hystrix* I failed to find it, but it was present in another which I looked at.

Peroneus Brevis.—The peroneus brevis rises either from the upper or middle portions of the outer surface of the fibula. Its exact origin is very variable and is not constant for animals of the same group. It passes behind the external malleolus and is inserted into the base of the fifth metatarsal bone.

In *Dipus ægyptius* it is absent.

In the Octodontidæ, Hystricidæ, and Chinchillidæ it is present.

In the Dasyproctidæ it is absent in *Dasyprocta*, but present in *Cœlogenys*.

In the Caviidæ it is present in *Cavia cobaya* and *Ceredon*, but absent in *Dolichotis*[2]. In the two former it is inserted into a nodule of bone (rudimentary fifth metatarsal?) under the base of the fourth metatarsal. In one specimen of Guinea-pig I found it dividing into two parts; the anterior, which was the smaller, had the usual insertion, while the posterior was attached to the anterior and upper part of the external surface of the calcaneum. Beddard describes a somewhat similar arrangement in the peroneus quarti digiti of *Dolichotis*[2].

The muscle is present and normal in all the Sciuromorpha.

Peroneus Quarti Digiti.—This muscle arises from the lower part of the outer surface of the fibula below the origin of the peroneus quinti, when that muscle is present. When the p. quinti is absent the p. quarti rises from the upper part of the outer surface of the fibula. The insertion is into the extensor tendon on the dorsum of the fourth toe.

In *Dipus ægyptius* it is present and rises from just below the p. longus. In the Octodontidæ it rises from the lower part of the fibula (*Octodon*, *Myopotamus*, *Capromys*, *Aulacodus*).

In the Hystricidæ it is present in *Hystrix*, but absent in *Sphin-*

[1] P. Z. S. 1882, p. 271.
[2] P. Z. S. 1891, p. 236.

gurus, and presumably in *Erethizon dorsatus* and *epixanthus*, as it is not mentioned by Mivart [1] or Windle [2].

In the Chinchillidæ it rises from the upper part of the fibula, the p. quinti being absent (*Chinchilla*, *Lagostomus*).

In the Dasyproctidæ it rises from the whole outer surface of the fibula in *Dasyprocta*, in which there is no p. quinti; in *Cœlogenys* it only rises from the lower third of the bone.

In the Caviidæ it resembles the Chinchillidæ in *Ceredon* and *Cavia cobaya*. Beddard mentions that it is present in *Dolichotis*.

It is always present in the Sciuromorpha, having the usual attachments.

In *Sciurus*, *Pteromys*, *Xerus*, and *Spermophilus* it rises from the lower quarter of the fibula and runs to the fourth digit.

In *Arctomys marmotta* it sent an additional slip to the third toe.

In *Castor* it was joined by a small muscular slip from the calcaneum, probably part of the extensor brevis digitorum.

It will be noticed that the only animals in which this muscle was wanting were the Tree-Porcupines.

Peroneus Quinti Digiti.—The p. quinti when it is present rises from the outer surface of the fibula above the last muscle, and is inserted into the extensor longus tendon on the dorsum of the fifth toe. It is present in the Octodontidæ (*Myopotamus*, *Capromys*, *Octodon*, *Aulacodus*), in the Hystricidæ (*Hystrix*, *Sphingurus*, *Erethizon*), in *Cœlogenys*, and in all the Sciuromorpha examined.

It is absent in *Dipus ægyptius*, in the Chinchillidæ (*Chinchilla*, *Lagostomus*), in the Caviidæ (*Cavia cobaya*, *Ceredon*, *Dolichotis*), and in *Dasyprocta*.

The presence or absence of the p. quinti seems to depend entirely on the degree of development of the fifth toe. It is not nearly as persistent a muscle as the extensor proprius hallucis, which is so often found when no hallux exists; it seems indeed to precede the disappearance of its toe, because in *Chinchilla* the muscle is wanting, although there is a small fifth toe.

Gastrocnemius.—The gastrocnemius rises by two heads from the upper and back part of the two condyles, fabellæ often being present. The two heads unite with the soleus to form the tendo Achillis. The fibres of this tendon are twisted so that those that are derived from the inner head of the gastrocnemius become superficial and eventually external. In *Castor canadensis* the two heads remain separate as far as their insertion.

The presence or absence of the fabellæ does not seem to depend on the affinities of the animal, as they are large in *Aulacodus* on both sides, while in *Myopotamus* only the outer one is present. In *Dasyprocta* they are both present, in *Cœlogenys* both absent.

In the Sciuromorpha, however, they were found in every case except that of *Castor canadensis* (*Sciurus*, *Pteromys*, *Xerus*, *Spermophilus*, *Arctomys*, *Castor*).

Soleus.—The soleus rises in all cases from the posterior aspect

[1] P. Z. S. 1882, p. 271.
[2] Journ. Anat. vol. xxii. p. 126.

of the head of the fibula and in most cases joins the outer head of the gastrocnemius to help form the tendo Achillis. In *Cœlogenys* and *Cavia cobaya*, however, the muscle continued separate to its insertion in the tuber calcis, while in *Ceredon* it was inserted into the os calcis by a round tendon from its inner portion, while the outer portion blended with the tendo Achillis.

Plantaris.—The plantaris rises just above the outer head of the gastrocnemius; it forms a muscular belly as large as, or larger than, either one of the gastrocnemius. It soon contracts into a narrow tendon, which winds round the inner side of the tendo Achillis, and passes over the back of the tuber calcis to the sole, where it spreads out into a broad fascia, which eventually splits into slips for the four outer toes or as many as are present.

Each of these slips acts as a flexor perforatus, allowing the long flexor tendons to pass through, and is then inserted in the same way as the flexor sublimis in the fore limb. In *Castor*, where the muscle is perhaps better developed than in any other Rodent, the tendon divides into a superficial and a deep layer when it reaches the commencement of the sole. The superficial layer is fibrous and corresponds to the plantar fascia; the deep layer develops muscular fibres and doubtless represents the flexor brevis digitorum of human anatomy. In many cases a loop is given off from the deep surface of each tendon before it is perforated; this loop embraces the long flexor tendon as in the anterior extremity.

Popliteus.—The popliteus always has the usual human attachments, except that it is often inserted only into the inner border of the upper third of the tibia instead of into the posterior surface right across.

Flexor Longus Hallucis (*Flexor Fibularis*).—The long flexors of Rodents have been so thoroughly described by Dobson[1] that it would be waste of space to do more than refer the reader to his Monograph. I have repeated his dissections in many animals and can confirm the accuracy of his descriptions. The additional animals that I have dissected fully bear out his point that among the Hystricomorpha the flexor fibularis is joined in the sole by the flexor tibialis and is inserted into the terminal phalanges of all the toes. In the Sciuromorpha, on the other hand, the flexor fibularis goes to all the toes without being joined by the flexor tibialis in the sole. In *Aulacodus* and *Dasyprocta* no fibres were continued to the innermost toe from the flexor fibularis.

Flexor Longus Digitorum (*Flexor Tibialis*).—This muscle, as Dobson[1] points out, rises from the back of the tibia and in the Hystricomorpha joins the flexor fibularis in the sole, its fibres being continued chiefly to the inner toes. In the Sciuromorpha it does not join the flexor fibularis, but in *Sciurus*, *Xerus*, *Spermophilus*, and *Arctomys* is inserted into a sesamoid bone below the internal cuneiform, from which some ill-marked fibrous tissue is continued on to the hallux. In *Castor* it terminated in the inner half of the double scaphoid. The only exception to this arrange-

[1] Journ. Anat. vol. xviii. p. 159.

ment that I have seen was in *Pteromys oral*, in which the flexor tibialis divided into two slips, one of which had the usual Sciuromorphine insertion below the internal cuneiform, while the other joined the tendon of the flexor fibularis. Possibly this was an individual variation foreshadowing the arrangement in the Hystricomorpha.

Tibialis Posticus.—The description of the tibialis posticus is included in that of the "Long Flexors of Rodents" by Dobson [1]. In *Castor* it is inserted into an extra bone on the inner side of the internal cuneiform.

Lumbricales.—The number of the lumbricales seems to depend on the number of toes; thus all the Sciuromorpha and the Hystricomorpha possessing five toes, such as *Myopotamus*, have four lumbricales. *Cœlogenys*, although it has five toes, has only three lumbricales. Animals having three toes usually only possess two lumbricales, e. g. *Dasyprocta*, *Cavia cobaya*, and *Ceredon rupestris*. In *Dolichotis* Beddard only found one [2], but in another specimen which I had the opportunity of looking at there were two.

Muscles of the Foot.

The accessorius is absent in the Dipodidæ and Caviidæ, but present in the other animals examined, including the Sciuromorpha. It rises from the outer surface of the calcaneum, usually from the anterior part, and is inserted into the plantar surface of the flexor tendon just before it divides for the toes. The angle which it forms with the flexor fibularis is a very open one, about 45°, but in *Hystrix* it must be about 70° or 80°.

When the foot is well developed there are two interossei to each metatarsal bone. When the hallux is well developed, as in *Myopotamus*, the abductor hallucis rises from the sustentaculum tali, or from the scaphoid, as in *Octodon*, but when it is not developed the muscle is absent. In the Sciuromorpha the abductor minimi digiti often rises from the calcaneum as well as from the base of the fifth metatarsal; in this case the part between the calcaneum and the metatarsal will form an abductor ossis metatarsi quinti.

On the plantar surface of the interossei there are frequently found two muscles rising from the deep cartilage of the sole which forms the sheath of the peroneus longus tendon; from this they run forwards, diverging from one another like the limbs of a V. The inner of these is in some of the Sciuromorpha inserted into the outer sesamoid bone under the head of the metatarsal bone of the hallux, forming an adductor hallucis, but more often, as in *Myopotamus*, *Octodon*, *Hystrix*, and *Cœlogenys*, it is attached to a corresponding situation on the second toe forming an adductor secundi digiti. The adductor minimi digiti (the outer of the two muscles) is attached to the inner sesamoid bone of the little toe. These two muscles are wanting in the Dipodidæ and the Caviidæ,

[1] Journ. Anat. vol. xvii. p. 159.
[2] P. Z. S. 1891, p. 236.

except in *Ceredon*, in which a small adductor secundi digiti was found, but no adductor minimi digiti.

General Summary.

The amount of facts at my disposal does not, of course, justify anything like an attempt at a definite and complete summary of the muscles of the Hystricomorpha and Sciuromorpha. The following generalizations are merely suggested for future investigation.

A. *Differences between the Hystricomorpha and Sciuromorpha.*

1. In the Hystricomorpha the anterior deep part of the masseter passes through the infraorbital foramen. In the Sciuromorpha it does not.

2. In the Hystricomorpha, with the exception of the Dipodidæ, the digastric has no complete division into two bellies, and the muscles of opposite sides do not communicate. In the Sciuromorpha, as well as in the Dipodidæ, a tendon completely divides the two bellies, and the muscles are connected across the middle line by a tendinous arcade.

3. The transverse mandibular muscle is absent in the Hystricomorpha, with the exception of the Dipodidæ. It is present in the Sciuromorpha, with the exception of *Castor*.

4. The genio-hyoid muscles of opposite sides coalesce posteriorly in the Sciuromorpha, but not in the Hystricomorpha.

5. The omo-hyoid is present or absent in the Hystricomorpha. It is always present in the Sciuromorpha.

6. The levator claviculæ rises either from the atlas or the basi-occipital in the Hystricomorpha. Always from the atlas in the Sciuromorpha.

7. The scalenus anticus is present in the Hystricomorpha, except in the Hystricidæ. It is absent in the Sciuromorpha.

8. The trapezius is often divided into an anterior and posterior part in the Hystricomorpha. Never in the Sciuromorpha.

9. The sterno-scapular muscle is composed of the subclavius and the scapulo-clavicularis in the Hystricomorpha. In the Sciuromorpha, as well as in the Dipodidæ, only the subclavius is present.

10. The first part of the coraco-brachialis (rotator humeri) is always present in the Sciuromorpha. In the Hystricomorpha it is present or absent.

11. The pronator quadratus is always attached to more than a third of the bones of the forearm in the Hystricomorpha. In the Sciuromorpha it is attached to a third.

12. The supinator longus is present in all the Sciuromorpha except *Castor*. It is absent in the Hystricomorpha except in *Erethizon* and the Dipodidæ.

13. The scansorius is always wanting in the Sciuromorpha. It is often distinct in the Hystricomorpha.

14. The quadratus femoris usually has a tendinous insertion in the Hystricomorpha. It is fleshy in the Sciuromorpha.

15. The supracondylar slip of the semimembranosus is either separate or connected to the rest of the muscle in the Hystricomorpha. In the Sciuromorpha it is fused with the adductors, but has a distinct nerve supply.

16. The flexor longus digitorum joins the flexor longus hallucis in the sole in the Hystricomorpha. In the Sciuromorpha the two muscles do not join.

B. *Chief characteristics of the different Families of the Hystricomorpha.*

Dipodidæ.—The Dipodidæ, as has been pointed out, agree with the Hystricomorpha in the arrangement of the masseter and in the tendons of the foot, but differ from them and approach the Sciuromorpha in the arrangement of the digastric, in the presence of a transverse mandibular muscle, and in the absence of the scapulo-clavicularis. They present in addition the following characteristics:—(1) The teres major is inserted posteriorly to the latissimus dorsi. (2) There is only the long head to the biceps cubiti, which is inserted chiefly into the ulna. (3) The supinator longus is present. (4) The trapezius is in two portions. (5) There is no bony insertion to the gluteus maximus. (6) The scansorius is distinct. (7) The supracondylar slip of the semimembranosus rises from the tuber ischii. (8) The extensor proprius hallucis is absent. (9) The peroneus brevis is absent. (10) There is no peroneus quinti digiti. (11) The omo-hyoid is present.

Octodontidæ.—(1) The teres major is inserted in front of the latissimus dorsi. (2) Both heads of the biceps cubiti are present, and the muscle is inserted into the radius and ulna. (3) The coraco-brachialis only consists of the second part. (4) The flexor sublimis digitorum gives no slip to the fifth finger. (5) The flexor profundus digitorum sends a slip to the thumb. (6) The trapezius is undivided. (7) The rectus abdominis decussates at its origin with the opposite muscle. (8) The gluteus medius does not rise from the ilium. (9) The scansorius is not a distinct muscle. (10) The extensor proprius hallucis communicates with the extensor longus digitorum on the dorsum of the second toe.

Hystricidæ.—It is difficult to point out many points which are characteristic of the Porcupines as a group, owing to the great differences between the muscles of the Ground- and Tree-Porcupines. Whether these differences are due to their different mode of life, or indicate that the animals are less nearly allied than the genera of other families, requires further investigation to determine. The following are some of the chief distinctions:—(1) The digastric differs in *Hystrix* and *Sphingurus*. (2) The omo-hyoid is rudimentary in *Hystrix*, large in the Tree-Porcupines. (3) The levator claviculæ comes from the skull in *Hystrix*, from the atlas in the Tree-Porcupines. (4) The two parts of the sterno-scapularis are continuous in *Hystrix*, separate in *Sphingurus*. (5) The biceps cubiti has one head in *Hystrix*, two in the Tree-Porcupines.

(6) The coraco-brachialis has only the second part in *Hystrix*, in the Tree-Porcupines the second and third parts are present. (7) The brachialis anticus consists of two parts in *Hystrix*, while in *Sphingurus* only the external is present. (8) The extensor secundi internodii pollicis is present in *Hystrix*, absent in the Tree-Porcupines. (9) The pyriformis is absent in *Hystrix*, present in *Sphingurus*. (10) The biceps femoris is normal in *Hystrix*, while the two parts are distinct in the Tree-Porcupines. (11) The peroneus quarti digiti is present in *Hystrix*, absent in the Tree-Porcupines.

The only two definite muscular characteristics of the Hystricidæ as a family are: (1) The latissimus dorsi at its insertion wraps round the lower border of the teres major. (2) The scalenus anticus is absent.

Chinchillidæ.—(1) There are two heads to the biceps cubiti, which is inserted into both bones of the forearm. (2) The tibialis anticus rises from the tendon of origin of the extensor longus digitorum, as well as from the tibia. (3) The extensor proprius hallucis is absent. (4) There is no peroneus quinti digiti. (5) The omo-hyoid is absent.

Dasyproctidæ.—(1) The scapulo-clavicularis is specially well developed. (2) The deltoid reaches down as far as the elbow. (3) The biceps cubiti has only the long head and is inserted into the ulna. (4) The first and second heads of the coraco-brachialis are present. (5) The trapezius is divided into an anterior and a posterior part. (6) A splenius colli is present. (7) The scansorius is distinct. (8) The supracondylar slip of the semimembranosus rises from the tuber ischii. (9) The tibialis anticus rises by tendons from the front of the external condyle of the femur, as well as from the front of the tibia. (10) The omo-hyoid is absent.

Caviidæ.—(1) The biceps cubiti has one head and is inserted into the ulna. (2) The coraco-brachialis only has the second part. (3) The trapezius is double. (4) There is a distinct scansorius. (5) The pectineus rises by a narrow tendon. (6) Tibialis anticus rises from tendon of origin of extensor longus digitorum as well as from the tibia. (7) The extensor proprius hallucis goes to the second toe. (8) The peroneus quinti digiti is absent. (9) The omo-hyoid is absent. (10) The levator claviculæ rises from the basioccipital.