On the anatomy of the Apteryx Australis, Shaw / by Richard Owen.

X. *On the Anatomy of the* Apteryx Australis, *Shaw.* Part II. (Myology.)

By Richard Owen, *F.R.S., F.Z.S., &c. &c.*

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THE first part of the present memoir on the Anatomy of the *Apteryx australis*[1] includes the description of the osteology and splanchnology, with the male organs of generation; the present part is devoted to the illustration of the myology of the same rare and anomalous bird. The specimens which I have dissected for that purpose were afforded me by the Earl of Derby, President, and by Mr. George Bennett, F.L.S., of Sydney, Corresponding Member of the Zoological Society, to whom I feel deeply indebted for such valuable opportunities of completing this monograph on the Apteryx.

The muscular system offers a subject of peculiar interest to the comparative anatomist when studied in a species which, in its general proportions and habits of life, deviates in so extreme a degree from the rest of the circumscribed and well-marked class to which it belongs. It is also a department of the anatomy of birds which, from the minute attention and length of time required for its accurate investigation, has been commonly passed over, but which the rarity of the *Apteryx* and the excellent state of preservation of the second specimen dissected (Mr. Bennett's), have both stimulated and enabled me to pursue with a degree of care which will be found, I trust, if tested by subsequent dissection, to have left little to be added to the myology of the species.

In the application of the facts detailed to the higher generalizations of the philosophy of organized bodies, it will be found that the unity of the ornithic type is strictly preserved, though under the extremest modifications; the characteristic peculiarities, for example, of the muscles of the spine and those of the wing, are all present, but the proportionate development of these classes of muscles are reversed, the spinal muscles being at their maximum, the alar muscles at their minimum of development. Very interesting peculiarities are likewise manifested by the muscles of the skin, with which I propose to introduce the details of the muscular system.

Muscles of the Skin.

No detailed description of the muscles of the skin in Birds has been given either in the systematic works on comparative anatomy, or in particular treatises; these muscles appear indeed in general to be too irregularly or too feebly developed to have attracted

[1] Transactions of the Zoological Society, Vol. II. Part 4, p. 257.

much attention; brief notices are recorded of some peculiarly developed cutaneous muscles, as those which spread the plumes of the Peacock, and erect the hackles of the Cock; the compressors of the subcutaneous air-cells are noticed in the anatomical account of the Gannett (*Sula Bassana*), and a more constant cutaneous muscle, viz. that which supports the crop in Gallinaceous birds, is briefly mentioned and figured by Hunter.

In the *Apteryx*, the subject of the present Myography, the cutaneous system of muscles presents a more distinct and extensive development than has hitherto been met with in the class of Birds—a condition which is evidently connected with the peculiar thickness of the integument, and probably with the burrowing habits of the present species, which possesses in this structure the power of shaking off the loose earth from its plumage, while busy in the act of excavating its chamber of retreat and nidification.

Constrictor colli (Pl. X. XIII. *a*).—The whole of the neck is surrounded by a thin stratum of muscular fibres, directed for the most part transversely, and extending from an attachment along the median line of the skin at the back of the neck, to a parallel raphé on the median line of the opposite side: this muscle is strongest at its commencement or anterior part, where the fibres take their origin in a broad fasciculus from the outer part of the occipital ridge; these run obliquely downwards and forwards on each side of the neck, but are continued uninterruptedly with those arising from the dorsal line of the skin above mentioned; the direction of the fibres insensibly changing from the oblique to the transverse. The outer surface of this muscle is attached to the integument by a thin and dense layer of cellular tissue, devoid of fat; the under surface is more loosely connected with the subjacent parts by a more abundant and finer cellular tissue.

Use.—To brace the cervical integument, raise the neck feathers, and in combination with the following muscle to shake these parts.

Sterno-cervicalis (Pl. X. *b*).—*Origin.* Fleshy, from the posterior incurved angular process of the sternum, from the ensiform prolongation and middle line of the outer and posterior surface of the same bone. *Insertion.* The fibres pass forward, and diverging in gently curved lines, ascend upon the sides of the broad base of the neck, and are inserted by a thin but strong fascia into the median line of the dorsal integument. This muscle is a line in thickness at its origin, but becomes thinner as it expands; the anterior part is covered by the posterior fibres of the *constrictor colli*.

Use.—To retract the skin of the neck, and brace that portion which covers the base of the neck; when these are the fixed points, it will depress and protract the sternum, and thus aid in inspiration.

Obs.—In its position and the general course of the fibres, this muscle is analogous to that which supports and assists in emptying the crop in the common fowl; but the

† Proceedings of the Zoological Society, 1832, p. 91.

‡ In description of pl. 10, vol. i. of Physiological Catalogue of Hunterian Collection, 4to. 1833–1841.

œsophagus presents no partial dilatation in the *Apteryx*, and the situation of the crop is occupied by a large mass of fat enclosing one or two absorbent glands (Pl. XIII. *g*).

Sterno-maxillaris (Pl. XIII. *c*).—This muscle appears at first view to be the anterior continuation of the preceding, but is sufficiently distinct to merit a separate description and name. *Origin.* Fleshy; from the anterior part of the middle line of the sternum. *Ins.* It passes directly forwards along the under or anterior part of the neck, expanding as it proceeds, and gradually separating into two thin symmetrical fasciculi, which are insensibly lost in the integument covering the throat and the angle of the jaw. It adheres pretty closely to the central surface of the *constrictor colli*, along which it passes to its insertion.

Use.—To retract the fore-part of the skin of the neck, and also the head. Each lateral portion acting alone would incline the head to its own side: the whole muscle in action would bend the neck; but the movements of the head and neck are more adequately and immediately provided for by the appropriate deeper-seated muscles, and the immediate office of the present muscle is obviously connected with the skin. Nevertheless, in so far as this muscle acts upon the head, it produces the same movements as the *sterno-mastoideus* in Mammalia; and it is interesting to observe, that in the long-necked Ruminants (as the Giraffe) the sterno-mastoid muscles arise by a common origin, and the insertion is by an extended fascia into the angles of the jaw: I consider, therefore, that the sterno-mastoid is represented by the *sterno-maxillaris* in the *Apteryx* ~~(the only bird in which this muscle has hitherto been described)~~.

Dermo-transversalis (Pl. XIII. *d*).—The skin covering the dorsal aspect of the lower two-thirds of the neck, besides being acted upon by the *constrictor colli*, is braced down by a thin stratum of oblique and somewhat scattered fibres, which take their origins by fasciæ attached to the inferior transverse processes of the sixth to the twelfth cervical vertebræ inclusive; the fibres pass obliquely upwards and backwards, and are inserted by a thin fascia into the median line of the skin, covering the back of the neck.

Platysma myoides (Pl. X. *e*).—The representative of this cutaneous muscle is a thin triangular layer of muscular fibres, taking their origin from the outer side of the ramus of the jaw, and diverging as they descend to spread over the throat, and meeting their fellows at a middle raphé of insertion beneath the upper larynx and beginning of the trachea, which they thus serve to compress and support.

Dermo-spinalis (Pl. X. *f*).—*Origin.* By a thin fascia from the ends of the spinous processes of the three anterior dorsal vertebræ. *Ins.* The fibres slightly converge to be attached to the integument covering the scapular region.

Dermo-iliacus (Pl. X. *g*).—*Origin.* Fleshy, from the anterior margin of the ilium. *Ins.* The fibres pass forwards and slightly converge to be inserted into the scapular integument.

Dermo-costalis (Pl. X. *h*).—A muscle resembling the preceding in form. *Origin.* Fleshy, from the costal appendages of the seventh and eighth ribs. *Ins.* The fibres pass

forwards and join those of the preceding muscle, to be inserted into the scapular integument.

Obs. The three preceding muscles are broad and thin, but well-defined; they would appear to influence the movements of the rudimentary spur-armed wing through the medium of the integument, as powerfully as do the rudimental representatives of the true muscles of ~~the anterior~~ extremity.

There are also two muscles belonging to the cutaneous series, and inserted directly into the bones of the wing. One of these, the *Dermo-ulnaris* (Pl. X. *i*.) is a small, slender, elongated muscle, which takes its origin from the fascia beneath the *dermo-costalis*; its fibres pass backwards, and converge to terminate in a very slender tendon which expands into a fascia, covering the back part of the elbow joint.

Use.—To extend the elbow-joint and raise the wing.

The *Dermo-humeralis* (Pl. X. *k*.) is also a long and narrow strip, deriving its origin from scattered tendinous threads in the subcutaneous cellular tissue of the abdomen: it passes upwards, outwards and forwards, and is inserted fleshy into the proximal part of the humerus, which it serves to depress[1].

Muscles of the Trunk.

A. On the Dorsal Aspect.

The muscles on the dorsal aspect of the vertebral column in Birds have only of late years received any attention from Comparative Anatomists: they have been mentioned rather than described by Tiedemann and Meckel: Carus has given a side-view of the superficial layer of muscles in the Sparrow-hawk; their best description is contained in the second edition of the 'Leçons d'Anatomie Comparée' of Cuvier.

The muscles of the back are in general so feebly developed in birds of flight, that they were affirmed by Cuvier to be wanting altogether in the first edition of the 'Leçons;' and this is almost true as respects their carneous portion, for they are chiefly tendinous in Birds of Flight. In the Struthious birds, and in the Penguin, in which the dorsal vertebræ are unfettered in their movements by anchylosis, these muscles are more fleshy and conspicuous; but they attain their greatest relative size and distinctness in the *Apteryx*.

From the very small size of the muscles which pass from the spine to the scapula and

[1] In Mammalia the cutaneous muscles form a more continuous stratum than in the *Apteryx* and other birds, and hence have been grouped together under the common term *panniculus carnosus*; they have also, in general, both their origins and insertions in the integument; but in Birds, in which the integument supports so extraordinary an abundance of the epidermic material under the form of feathers, the muscles destined to its especial motions require a more fixed attachment from which to act. The Rhinoceros, in which the integuments, from the thickness and density of its corium, is in a similar condition as regards the resistance to be overcome by the skin-muscles, presents an analogous condition of its *panniculus carnosus*, having it divided into several distinct muscles, most of which take their origin from bone or fasciæ attached to bone.

humerus in the *Apteryx*, the true muscles of the back, which correspond to the second layer of the dorsal muscles in Man, become immediately visible on removing the dorsal integuments and fasciæ; they consist of the *sacro-lumbalis*, *longissimus dorsi*, and *spinalis dorsi*. The first two muscles are blended together at their posterior origins, but soon assume the disposition characteristic of each as they advance forwards.

The *sacro-lumbalis* (Pl. XI. XII. *l*.) is a strong and fleshy muscle, six lines in breadth, and three or four lines in thickness: it is, as usual, the most external or lateral of the muscles of the back, and extends from the anterior border of the ilium to the penultimate cervical vertebra. *Origin*. By short tendinous and carneous fibres from the outer half of the anterior margin of the ilium, and by a succession of long, strong, and flattened tendons (Pl. XII. *l* 1–*l* 5.) from the angles of the fifth and fourth ribs, and from the extremities of the transverse processes of the third, second, and first dorsal vertebræ; also by a shorter tendon (*l* 6.) from the transverse process of the last cervical vertebra; these latter origins represent the *musculi accessorii ad sacro-lumbalem*; ~~they have not hitherto been described in the class of Birds.~~ to bring them into view, the external margin of the *sacro-lumbalis* must be raised, as in Pl. XII. fig. 2. These accessory tendons run obliquely forward, expanding as they proceed, and are lost in the under surface of the muscle.

Insertion. By a fleshy fasciculus with very short tendinous fibres into the angle of the sixth rib, and by a series of corresponding fasciculi, which become progressively longer and more tendinous, into the angles of the fifth, fourth, third and second ribs (Pl. XI. *l**), and into the lower transverse processes of the first dorsal and last two cervical vertebræ; the last insertion is fleshy and strong; the four anterior of these insertions are concealed by the upper and outer fleshy portions of the *sacro-lumbalis*, which divides into five elongated fleshy bundles (Pl. XI. *l***), inserted successively into the upper transverse processes of the first three dorsal and last two cervical vertebræ. These last insertions seem to represent the continuation of the *sacro-lumbalis* in Man, which is termed the *cervicalis descendens* or *ascendens*.

Longissimus dorsi (Pl. XI. XII. *m*).—This muscle is blended posteriorly both with the *sacro-lumbalis* and the *multifidus spinæ*, and anteriorly with the outer portion of the *spinalis dorsi*. It extends as far forward as the thirteenth cervical vertebræ. *Origin*. From the inner or mesial half of the anterior margin of the ilium: from a strong aponeurosis attached to the spines of the eighth, seventh and sixth dorsal vertebræ; and from the transverse processes of the sixth, fifth, fourth and third dorsal vertebræ. *Ins*. The carneous fibres continued from the second origin, or series of origins, incline slightly outwards as they pass forward, and are inserted into the posterior articular processes of the first three dorsal vertebræ, receiving accessory fibres from the *spinalis dorsi*. The fasciculi from the transverse processes ~~above mentioned~~ incline inwards, and are also inserted into the posterior oblique processes of the vertebræ anterior to them; they receive fibres from the iliac origin, and soon begin to form a series of oblique carneous

fasciculi, which become more distinct as they are situated more anteriorly; they are at first implanted in the vertebra next in front of that from which they rise, and then into the vertebra next but one in front (*m**) : the most anterior of these tendons of insertions, to which can be traced any of the fibres of the main body of the *longissimus dorsi* (reflected back in fig. 1, *m*) is that which is implanted into the thirteenth cervical vertebra (*m***) ; it is this fasciculus which is joined by the first or most posterior of the *fasciculi obliqui* of the *longus colli posticus* (*o* 1).

Obliquus colli (Pl. XI. XII. *m* 1—9).—A series of oblique carneous fasciculi, evidently a continuation of, or part of the same system with those in which the *longissimus dorsi* terminates anteriorly, is continued between the upper transverse process of one cervical vertebra to the posterior oblique processes of the next vertebra but one in advance, as far forward as the fourth cervical vertebra. This series of muscles seems to represent the *transversalis colli*[1], which is the anterior continuation of the *longissimus dorsi* in Mammalia, but it differs in being inserted into the oblique, instead of the transverse processes. In the direction of their fibres these fasciculi resemble the *semispinalis colli*, but are inserted into the oblique processes instead of the spines of the vertebræ. There are no other muscles with which they can be compared in the Mammalia than these two, with neither of which however do they precisely correspond; they seem however clearly to represent the second series of oblique muscular fasciculi in the trunk of Fishes. Rather than hazard expressing an incomplete or false analogy, I shall term these collectively the *fasciculi obliqui*.

The *fasciculi obliqui* which rise from the first two dorsal and five lower cervical vertebræ are joined near their tendinous terminations by corresponding oblique fasciculi (*o* 1—8) of the *longus colli posticus*, and the strong round tendons continued from the points of convergence of these fascicles are inserted successively into the posterior oblique processes of the twelfth to the sixth cervical vertebra inclusive; the two fasciculi next in succession receive no accessory fibres from the *longus colli posticus*; the anterior one (*m* 9) derives an extensive origin from the upper transverse processes of the eighth, seventh, and sixth cervical vertebræ. It must be observed, however, that the whole of each fasciculus is not expended in the strong round tendinous insertion above described; the portion (*m**) which arises from the anterior ridge of the transverse process passes more directly inwards than the rest, and is attached to the tendon which terminates the fasciculus immediately behind; at the middle of the neck these accessory fibres approach to the character of distinct origins. The tendons of insertion, moreover, severally receive accessory fleshy fibres (*n n*) from the base of the oblique processes of the two ver-

[1] It is the '*grand transversaire*' of Cuvier, loc. cit. p. 282; but he describes it as passing from the anterior articular process of one vertebra to the posterior articular process of the next in front. Meckel, who calls this muscle '*intertransversalis cervicis*,' follows Cuvier in the description of its attachments, and adds, that it is a continuation of the outer division of the '*extensor communis dorsi*' (*sacro-lumbalis*). In the Apteryx it is plainly a continuation of the inner division or *longissimus dorsi*. See Vergleich. Anatomie, Th. 3. p. 294.

tebræ next behind; and thus they become the medium of muscular forces acting from not less than five distinct points, the power of which is augmented by each tendon being braced down by the oblique converging series of muscles immediately anterior to it. The fasciculus from the eighth cervical vertebra, besides its insertion by the ordinary tendon, sends off externally a small pyramidal bundle of muscular fibres (Pl. XI. n^*), which soon terminates in a long and slender tendon which is inserted into the oblique process of the third cervical vertebra. Corresponding portions of muscle (n^{**}) are detached from the two anterior fasciculi, which converge and terminate in a common slender tendon inserted into the posterior oblique process of the fourth cervical vertebra; and thus terminates this complex muscle or series of muscles.

Longus colli posticus (Pl. XII. *o*).—The most internal or mesial of the superficial muscles of the dorsal aspect of the thoracic and cervical regions, called *cervicalis ascendens* by Meckel, and compared in part with the *spinalis dorsi* by Cuvier, cannot be the representative of either of these muscles, since they both (l^{**} & p) co-exist separately with it in the *Apteryx*. At its posterior part the muscle in question seems to be rather a continuation of the *longissimus dorsi*; its mesial and anterior part offers a strong analogy with the *biventer cervicis*; it appears to me to be evidently the analogue of the first, or mesio-dorsal series of oblique fibres of the muscular system in Fishes, but I shall adopt the name of the *longus colli posticus* applied to it by Cuvier[1]. It commences by long and slender, but strong, subcompressed tendons from the spines of the sixth, fifth and fourth dorsal vertebræ (*o*): these tendons gradually expand as they proceed forwards and downwards, and send off from their under surface muscular fibres which continue in the same course, and begin to be grouped into distinct fasciculi at the base of the neck: the first of these bundles (*o* 1) joins the fasciculus of the *longissimus dorsi*, which is inserted into the posterior articular process of the thirteenth cervical vertebra; the succeeding fasciculi derive their origins from a broad and strong aponeurotic sheet attached to the spines of the fourth, third and second dorsal vertebræ: the second to the eighth fasciculi inclusive are compressed, broad and fleshy, and are inserted in the strong round tendons described in the preceding muscle, and attached to the oblique processes of the twelfth to the sixth cervical vertebræ inclusive: the ninth fasciculus (*o* 9), which forms the main anterior continuation of the *longus colli posticus*[2], is larger than the rest, and receives, as it advances, accessory fibres from the spinous processes of the seventh (o^x) to the third cervical vertebræ inclusive, and is inserted, partly fleshy, partly by a strong tendon, into the side of the broad spine of the *vertebra dentata*. A slender fasciculus is detached from the mesial and dorsal margin of the *longus colli posticus*, near the base of the neck, which soon terminates in a long round tendon (o^{xx}): this tendon is braced down by short aponeurotic fibres to the spine of the fifth, fourth, third and

[1] Leçons d'Anat. Comp., 2nd edit. vol. i. p. 284.

[2] '*Accessoires du long postérieur du cou*,' Cuvier, *loc. cit.* p. 284.

second cervical vertebræ inclusive, immediately beyond which it again becomes fleshy, and expands to be inserted into the occipital ridge: this portion is the *digastrique* or *biventer capitis* of Cuvier.

Spinalis dorsi (Pl. XII. fig. 1. *p*).—The displacement of the dorsal portion of the preceding muscle and the *longissimus dorsi* brings into view the *spinalis dorsi*, which is a well-developed and distinct muscle in the *Apteryx*. *Origin.* By two long, narrow, flattened tendons (*p*, 1. 2.) from the spines of the eighth and seventh dorsal vertebræ: these pass obliquely downwards and forwards, expanding as they proceed, and terminate in two fasciculi of muscular fibres: the posterior bundle passes forwards beneath the anterior one, and inclining inwards and upwards, divides into two portions, inserted by long tendons into the spines of the second and first dorsal vertebræ; it then sends a few fibres forwards to join the outer and anterior fasciculus, which is partly inserted by a slender tendon into the spine of the last cervical vertebra: the rest of the fibres of the second fasciculas join the portion of the *longissimus dorsi* which is implanted into the posterior oblique process of the last cervical vertebra. The three inserted tendons of the *spinalis dorsi* are also the medium of attachment of fibres continued from the *multifidus spinæ*, beneath them.

Multifidus spinæ (Pl. XII. fig. 1. *q*).—The series of muscles so called arises by fleshy fibres from the transverse processes of the five last dorsal vertebræ, which pass upwards, forwards and inwards, to be inserted by four flat tendons into the spines of the seventh to the third dorsal vertebræ inclusive, and by the tendons of the *spinalis dorsi* into the two anterior dorsal spines.

Obliquo-spinales (Pl. XII. fig. 3, *r*).—The removal of ~~this muscle~~ brings into view a series of long, narrow, flat tendons, coming off from the spines of all the dorsal vertebræ, and slightly expanding as they proceed forwards and obliquely downwards and outwards; they become fleshy half-way from their origin, and are inserted into the posterior oblique and transverse processes of the six anterior dorsal vertebræ, and into the posterior oblique processes of the three last cervical vertebræ.

Interspinales (Pl. XII. fig. 3. *s*).—The *interspinales* muscles do not exist in the region of the back, unless we regard the preceding oblique fibres as a modified representation of them. The most posterior fasciculus of muscular fibres, which is directly extended between the spinous processes, commences at the interspace of the spines of the two last cervical vertebræ, and the series is continued as far as the *vertebra dentata*.

Interarticulares (Pl. XII. fig. 3. *t*).—The muscles which form the more direct continuation of the *obliquo-spinales* are continued from the posterior oblique or articular processes of one vertebra to the posterior articular process of the next in front.

Obliquo-transversales, (~~Pl.~~ *v*.)—A third series of deep-seated intervertebral muscles is situated external to the preceding, and passes obliquely between the upper transverse process and the posterior articular process of the vertebra in front. These fasciculi appear to be a continuation of the *multifidus spinæ* in the neck.

Intertransversales, *Ib. w.*—There are also two series of short carneous fasciculi passing the one between the upper, and the other between the lower transverse processes.

Levatores costarum, *Ib. x.*—The first or most anterior of this series of muscles seems to represent the *scalenus medius* (*x**); it arises from both the upper and lower transverse processes of the last cervical vertebra, and expands to be inserted into the first rib, and into the upper and outer part of the second rib. The remaining *levatores* successively diminish in size as they are placed backwards; they come off from the transverse processes of the six first dorsal vertebræ; those from the first and second expand to be inserted into the rib attached to the same transverse process and to the one next behind; the rest have a single insertion: the angle and the part of the rib immediately beneath are the situations of their attachments.

Complexus (Pl. XI. *y*).—This strong triangular fleshy muscle arises from the articular and upper transverse processes of the fourth, third and second cervical vertebræ, and gradually expands as it advances forwards to be inserted into the occipital ridge, from the outer side of the insertion of the *biventer cervicis* to the mastoid process.

Recti capitis postici.—These small muscles are concealed by the preceding; they rise successively from the spines of the third, second and first cervical vertebræ, expand as they advance to be inserted into the occiput.

Trachelo-mastoideus (Pl. XI. *z*).—This strong, subdepressed carneous muscle arises from the upper transverse processes of the fifth, fourth, third and second cervical vertebræ, and is inserted into the side of the base of the occiput.

B. In Front of the Neck.

Longus colli (Pl. XIII. & XIV. fig. 2. *a*).—This large and long muscle, which appears simple when first exposed, as in Pl. XIII. fig. 2, is found to consist, when unravelled by further dissection, of a series of closely succeeding long, narrow fasciculi, arising from the hæmapophyses of the sixth dorsal to the first dorsal and from the ten posterior cervical vertebræ (Pl. XIV. *a a*); and sending narrow tendons (*ib. a**) which increase in length as they are given off more anteriorly, obliquely forwards and outwards, to be inserted into the costal processes of all the cervical vertebræ save the two first: the highest or foremost tendon (*ib. a***) is attached to the tubercle at the under part of the ring of the atlas; but this tendon is also the medium of insertion of five small fasciculi of muscular fibres (Pl. XIV. fig. 2, *a***) arising from the upper transverse processes of the sixth, fifth, fourth, third and second cervical vertebræ.

The *Rectus capitis anticus major* (Pl. XIV. *b*) is continued, or arises by as many distinct tendons, from the five superior tendons of insertion of the preceding muscle; these origins soon become fleshy, converge, and coalesce previous to their insertion into the base of the skull.

The *Rectus capitis anticus minor* (Pl. XIV. *c*) is a strong fleshy compressed triangular muscle arising from the anterior part of the body of the first four cervical vertebræ.

The *Rectus capitis lateralis* (Pl. XIV. *d*) arises from the upper transverse processes of the sixth to the second cervical vertebra inclusive.

C. Muscles of the Tail.

Levator caudæ.—Origin. From the posterior and superior extremity of the ischium. *Ins.* Into the spines of the caudal vertebræ.

Adductor caudæ superior.—This muscle is smaller than the preceding, with which it runs parallel; it rises below from the posterior extremity or tuber of the ischium, and is inserted into the transverse processes of the caudal vertebræ.

Adductor caudæ inferior.—Origin. From the tuber ischii, and the ligament connecting this with the posterior extremity of the pubis. *Ins.* Into the transverse processes of the caudal vertebræ.

Depressor caudæ.—Origin. From the under part of the middle line of pelvis. *Ins.* Into the inferior spines of the caudal vertebræ.

D. Muscles of the Abdomen.

Obliquus externus abdominis (Pl. XI. XIV. *e*).—*Origin.* Fleshy, from the second and third ribs, and by a strong aponeurosis from the succeeding ribs near the attachment of the costal processes, and from those processes. *Ins.* The fleshy fibres are continued from this aponeurotic origin to nearly opposite the ends of the vertebral ribs; they run almost transversely, very slightly inclined towards the pubis, to within half an inch of the linea alba, and there terminate, by an almost straight, parallel line, in their aponeurosis of insertion. The fibres of this aponeurosis decussate those of the opposite side, and adhere to the tendinous intersections of the *rectus* beneath. The aponeurosis from the last rib passes to be inserted into a strong ligament extending between the free extremities of the *ossa pubis*, leaving the abdomen behind the last rib, defended only by the *internal oblique* and *transversalis*.

Obliquus internus abdominis (Pl. XIV. *f*).—*Origin.* From the whole of the anterior and outer surface of the pubis; aponeurotic from the upper part, fleshy for half an inch from the lower or ventral extremity: the carneous fibres run longitudinally, and cannot be distinctly defined from the *intercostales* on their outer border, or from the *rectus abdominis* on their inner or mesial border, which forms the medium of the insertion of the internal oblique.

Rectus abdominis (Pl. XV. *g*).—I give this name to the mesial continuation of the preceding muscle, which arises by a strong, flat, triangular tendon from the lower or

ventral extremity of the pubis and from the inter-pubic ligament: it soon becomes fleshy; the carneous portion is interrupted by three broad, oblique, but distinct aponeurotic intersections (*g*), and is finally inserted into the xiphoid and lateral processes of the sternum and the intervening fascia.

Transversalis abdominis.—A layer of loose, dark-coloured cellular tissue divides the internal oblique from the transverse abdominal, except at its origin from the pubis, and for half an inch anterior to that part.

The *transversalis* then proceeds to derive carneous fibres from the inner surface of the vertebral ribs near their lower third; they pass obliquely upwards and forwards, and terminate by a regular, slightly concave line midway between their origins and the extremities of the ribs; a strong aponeurosis passes thence to the linea alba, but becomes thin at the pubic region, where a mass of fat is interposed between it and the peritoneum.

Diaphragm (Pl. VI.).—This muscle presents more of its normal mammalian character in this than in any other known bird. It is perforated by vessels only, in consequence of the non-development of the abdominal air-cells. The origin corresponding to that of the lesser muscle in Mammalia is by two strong and distinct, short tendinous pillars (*a a*), from the sides of the body of the last costal vertebra; they are united by a strong tendon or fascia, forming the anterior boundary of the aortic passage. The tendinous pillars may be traced forward for some way in the central aponeurosis, expanding without crossing; they are then lost in that aponeurosis, which is perforated by the gastric arteries and veins; decussates and divides anteriorly (at *b*) to give passage to the gullet and the apex of the heart; the aponeurosis expands over the anterior part of the thoracic air-cells, and becomes, at its lateral circumference, the point of attachment of muscular fibres arising from the inner surface of the anterior ribs, and forming apparently a continuation of the *transversalis abdominis*.

Appendico-costales (Pl. XI. *h*).—*Origin.* From the posterior edge and extremity of the costal processes or appendages. *Ins.* They run down to be inserted severally into the rib posterior to that to which the process affording them origin is attached. These processes are supported by strong triangular aponeuroses continued from their anterior and upper margins, severally, to the rib anterior to them.

The muscles of the jaws have already been described in the account of the digestive organs. The following are shown in Pl. XI.: *α*, *temporalis externus*; *β*, *temporalis internus*; *γ*, *biventer maxillæ*; the masseter has been removed. The strong orbicularis palpebrarum has been divided and reflected forwards at *δ*. The internal pterygoid muscle is shown in Pl. XIV. at *ε*; the external pterygoid at *ζ*.

Some of the muscles of the tongue, which are described in the first part of this memoir (p. 264), are delineated in Plate XII, fig.

Muscles of the Anterior Extremity.

Serratus magnus anticus (Pl. XI. *i*).—This muscle consists of three portions; the first and anterior portion arises by a short, strong aponeurosis from the last cervical rib, and is inserted into the lower edge of the anterior two-thirds of the scapula: the second, middle portion arises from the lower end of the second vertebral rib, near the attachment of the costal process, and from the anterior margin of the same rib, and is inserted into the lower edge of the posterior two-thirds of the scapula: the third, posterior and smallest portion rises from the costal process of the third rib, and ascends to be inserted into the posterior extremity of the scapula.

This muscle is a direct inspirator: by drawing down the scapula it depresses the sternum through the medium of the strong coracoideum, increases the angle between the vertebral and sternal ribs, and dilates the thoracic air-cells.

Levator scapulæ (Pl. XI. *k*).—This seems to be the most anterior portion of the series of muscles which constitute the *serratus magnus*. *Origin.* Two flat fleshy strips from the inferior transverse and costal processes of the last and penultimate cervical vertebræ. *Ins.* Into the inner and upper side of the middle third of the scapula. It depresses as well as draws forwards the scapula, and thus aids the *serratus* in the action of inspiration.

Serratus anticus minor.—*Origin.* From the outer part of the costal process of the sternum. *Ins.* Into the posterior part of the base of the coracoideum.

Trapezius (Pl. XIII. *l*).—This flattened oblong quadrilateral muscle arises from the fascia, extending upon the back from the spinous processes of the posterior cervical vertebræ, and is inserted into the conjoined extremities of the scapula and coracoideum.

There is no representative of the *rhomboidei*.

Latissimus dorsi (Pl. XIII. *m*).—This muscle consists, as usual in Birds, of two portions, both of which have their origin from a continuation of the fascia attached to the ~~dorsal spines~~, which ~~also~~ gives ~~origin~~ to the trapezius: the fibres of the smaller and anterior slip converge to their insertion: the fibres of the posterior and broader strip are slightly twisted, the posterior edge being folded inwards as they also converge to join the preceding, and to be inserted with it into the posterior and inner side of the proximal extremity of the humerus.

Deltoides (Pl. X. XIII. *n*).—This is a single long and narrow triangular muscle, of which the base is attached to the conjoined extremities of the scapula and coracoid, and to the capsule of the shoulder-joint; the apical insertion is into the upper and outer third of the humerus, which this muscle directly raises.

Infraspinatus (Pl. XI. *o*).—A muscle which may be compared either to the *infraspinatus* or *teres major* comes off from the lower margin of the anterior two-thirds of the scapula, passes behind the shoulder-joint, where it is closely attached to the ~~scapula~~, and is inserted into the inner and posterior part of the proximal end of the humerus.

Musculi pectorales.—The pectoral muscles, which present their feeblest condition and

lowest development in the *Apteryx*, are nevertheless similar in number and arrangement to those which in some birds of flight are known to outweigh all the other muscles of the body.

The *pectoralis major* (Pl. X. XI. XIV. *p*.) is represented by two very thin triangular layers of muscular fibres, the anterior of which is three lines broad at its base, and is attached to the sternum immediately exterior to the perforation of that bone: the second, posterior, and somewhat narrower portion, rises immediately behind the preceding, from the osseous bridge separating the perforation from the notch; the two portions converge as they extend upwards and outwards to unite and be inserted into the anterior and internal surface of the proximal third of the humerus.

The *pectoralis medius seu secundus* (Pl. XI. XIV. *q*.) is a similar, thin, feeble, but broader triangular layer of carneous fibres, which arise anterior to the preceding, just below the coracoid socket of the sternum, and converge as they wind over the shoulder-joint to be inserted into the upper surface of the proximal extremity of the humerus, of which they thus become an elevator.

The *pectoralis minor seu tertius* (Pl. XI. XIV. *r*) arises above and between the origins of the *pectoralis secundus* and the anterior strip of the *pectoralis major*, also partly from coracoid process; its fibres converge to be inserted into the proximal end of the humerus, above and behind the *pectoralis major*.

Coraco-brachialis (Pl. XIV. *s*).—This is represented by two small strips of muscular fibres which rise from the posterior part of the coracoideum, and are inserted, one directly below the other, into the proximal third of the humerus.

Obs.—The close adherence to the ornithic type of the muscular system of the anterior extremity in the *Apteryx* is very remarkable, especially as regards the position and course of the *pectoralis medius*, since the physiological conditions of the circumstances attending that muscle are wanting in the *Apteryx*.

Here we have a true bird, exhibiting a remarkable modification of the whole ornithic structure, in reference to exclusively terrestrial life and nocturnal habits; and we learn, I think, from this adherence to a typical organization, in a very rare exception, that the teleological conclusions respecting that typical construction, as it is manifested in the general rule, are in no ways affected by such an exception; because the modification of one part necessarily affects that of many others, perhaps of the whole body. If, for example, the fixation and structure of the lungs require a broad sternum and concomitant modifications of the coracoid and scapula for the mechanical part of the respiratory process, then it may be more convenient for the levator of the humerus to rise below that bone from the sternum, and act in the due direction by a modification of its course; although the locomotion of the bird may in no way be facilitated by the aggregation of muscle beneath the centre of gravity, nor the size of the levator be such as to render its particular position a matter of any consequence in regard to that centre.

A minute flexor (Pl. XIII. *t*.), wanting the attachment to the scapula which exists in birds of flight, and arising solely from the humerus, glides along the front of that bone, chiefly as a delicate tendon to be attached to the inner part of the head of the ulna.

A single extensor (Pl. XIII. *v*.), almost equally tendinous and delicate, arises from the scapula, and represents the 'long extensor' of Vicq. d'Azyr: it is inserted into the rudimental olecranon.

There is a tendinous trace of a flexor (*w*) and extensor (*x*) of the minute monodactyle manus.

The motions of the rudimental wing and its terminal hook would seem to be produced as much by the cutaneous muscles which converge to be inserted into the integument connected with it, as by the feeble representatives of the true wing-muscles above described.

Muscles of the Posterior Extremity.

The most superficial of the muscles on the outer side of the leg is that broad one which combines the functions of the *tensor vaginæ* and *rectus femoris*, according to the opinion of Cuvier and Meckel, those of the *glutæus maximus*; since however it is exclusively inserted into the leg, I shall describe it with the other muscles moving that segment of the posterior extremity. The removal of this muscle, of the *sartorius*, and the *biceps cruris*, is requisite to bring into view the *glutæi*.

Glutæus externus (Pl. XI. A).—The external *glutæus* (*glutæus medius* of Meckel), as in most Mammalia, is smaller than the middle or internal *glutæi*, but is relatively larger in the *Apteryx* than in birds of flight, in which it is described as the *pyri*[illegible] by Cuvier. This muscle, however, besides its origin from the outside of the pelvis, overlaps part of the *glutæus medius*, and has its insertion into the femur at some distance below the great trochanter, all of which are marked characteristics of the *glutæus magnus*. *Origin.* It takes its origin from the superior margin of the *os innominatum*, extends along an inch and a quarter of that margin, directly above the hip-joint, and is chiefly attached by distinct short tendinous threads, which run down upon the external surface of the muscle: it rises also by carneous fibres from the external surface of the innominatum for three lines below the superior margin. *Insertion.* The fibres converge and pass into a tendinous sheet, beginning on the external surface of the muscle half-way down its course, which ends in a broad, flat, strong tendon, inserted into a rising on the outer side of the femur nearly an inch below the great trochanter. It abducts and raises the femur.

Glutæus medius (Pl. XI. B).—*Origin.* A large triangular, strong and thick muscle, has an origin of three inches extent from the rounded anterior and superior margin of the ilium, and from the contiguous outer surface of the bone for an extent varying from an inch to eight lines. *Ins.* Its fibres converge to a strong, short, broad and flat tendon, implanted in the external depression of the great trochanter, having a bursa mucosa interposed between the tendon and the bony elevation anterior to the depression.

Glutæus minimus (Pl. XI. C).—*Origin.* It rises below the preceding muscle from the anterior and inferior extremity, and from one inch and three-fourths of the inferior and

* Leçons d'Anat. Comp. tom. i. ed. 1836, p. 502. † Vergleich. Anat. [illegible]

‡ loc. cit. p. 503, where it is here called 'pyramidal'.

outer margin of the ilium, and contiguous external surface, as far as the origin of the *glutæus medius*; also by some fleshy fibres from the outside of the last rib. *Ins.* These fibres slightly converge as they pass backwards to terminate in a broad flat tendon which bends over the outer surface of the femur, to be inserted into the elevation anterior to the attachment of the *glutæus magnus*.

A muscle (Pl. XI. D.) which may be regarded either as distinct or a strip of the preceding one, arises immediately behind it from half an inch of the outer and inferior part of the ilium; its fibres run nearly parallel with those of the *glutæus minimus*, and terminate in a thin flat tendon, which similarly bends round the outer part of the femur, to be inserted into the outer and under part of the trochanter immediately below the tendon of the *glutæus medius*. This muscle ~~is peculiar to the Apteryx~~ and the preceding portion, or *glutæus minimus*, is absent in most birds.

Use.—All the preceding muscles combine to draw the femur forwards, and to abduct and rotate it inwards.

Iliacus internus.—This is a somewhat short thick muscle, of a parallelogrammic form, fleshy throughout; rising from the tuberosity of the innominatum in front of the acetabulum immediately below the *glutæus minimus*, and inserted at a point corresponding to the inner trochanter, into the inner side of the femur near the head of that bone, which it thus adducts and rotates outwards. This muscle is present both in the Ostrich and Bustard, but Meckel says it is wanting in the Cassowary.—Arch. xiii. 261.

Pyramidalis.—The same kind of modification which affects the *iliacus internus*, viz. the displacement of its origin from the inner surface of the ilium to a situation nearly external, affects this muscle, which, from its insertion and triangular form, I regard as the analogue of the *pyramidalis*. It arises fleshy from the outer surface of the ischium for the extent of an inch, and converges to a broad flat tendon which is inserted into the *trochanter femoris* opposite, but close to, that of the *glutæus minimus*, which it opposes, abducting and rotating the femur outwards.

Adductor brevis femoris (Pl. XI. E).—A small, long and slender muscle arises from the innominatum immediately behind the acetabulum, passes over the back part of the great trochanter, becomes partially tendinous, and is inserted into the back part of the femur in common with the following muscle.

Adductor longus (Pl. XI. XIV. F).—A long broad and thin muscle, separated from the preceding by the ischiadic nerve and artery. The origin of this muscle extends one inch and a quarter from near the upper margin of the innominatum which is behind the acetabulum; it is joined by the preceding strip, and is inserted into the whole of the lower two-thirds of the back part of the femur.

Adductor magnus (Pl. XIV. G).—This broad and flat muscle has an extensive origin (two inches) from the outer edge of the ischium and the obturator fascia; its fibres slightly diverge as they pass downwards to be inserted into the back part of the lower half of the femur, and into the upper and back part of the tibia.

Obturator internus.—This arises from the inner side of the opposite margins of the pubis and ischium, where they form the posterior boundary of the *obturator foramen*, and from the corresponding part of the *obturator fascia*; the fleshy fibres converge in a slightly penniform manner to the strong round tendon which glides through the notch, separated from the rest of the foramen by a short, strong, transverse, unossified ligament, and is inserted into the posterior part of the base of the trochanter. In its length and size this muscle resembles the corresponding one in the Ostrich and other Struthious birds.

Gemellus.—This is represented by a single small fleshy strip arising from the margin of the *obturator foramen*, close to the emergence of the tendon of the *obturator internus*, with which it is joined, and co-inserted into the femur.

Quadratus.—I consider a broad fleshy muscle which arises from the pubis, below the *obturator foramen*, and which increases in breadth to be inserted into the femur internal and posterior to the obturator tendon, to be the true analogue of the *quadratus femoris*.

~~Muscles of the Leg.~~

Tensor vaginæ and *Rectus femoris* (Pl. X. H).—The largest and most remarkable of the muscles which act upon the bones of the leg is that already alluded to as the most superficial of those on the outer side of the thigh. It has a broad, thin, triangular form, arises from the spines of the sacrum by a strong but short aponeurosis which soon becomes fleshy; the carneous fibres converge as they descend, and pass into a thin aponeurosis at the lower third of the thigh: this is closely attached to the muscles beneath (*vastus externus* and *cruræus*), then spreads over the outer and anterior part of the knee-joint, is inserted into the patella, and into the anterior process of the head of the tibia.

Owing to the great antero-posterior extent of the origin of this muscle, its anterior fibres are calculated to act as a flexor, its posterior ones as an extensor of the femur: all together combine to abduct the thigh and extend the leg, unless when this is in a state of extreme flexion, when a few of the posterior fibres glide behind the centre of motion of the knee-joint.

Sartorius (Pl. X. XIV. I).—The origin of this muscle is ~~proportionally as much extended as~~ that of the preceding, with which it is posteriorly continuous: it comes off aponeurotic, from the anterior and superior margin or labrum of the ilium; the fibres soon become fleshy, and the muscle diminishes in breadth and increases in thickness as it descends: it is inserted by short and strong tendinous filaments obliquely into the

They are not divided into a superficial and deep layer, as in the Ostrich, but form a simple stratum, as in the Cassowary. Meckel regards the rectus as entirely wanting in the Cassowary, supposing the present muscle to be the analogue of the *glutæus maximus* and *tensor vaginæ* united. He says that Professor Nitzch observed a like absence of the *rectus femoris* in the Emeu. The muscle which these anatomists call the *rectus* in other birds, is a strip of the *cruræus*, arising high up from the femur, and which in the Ostrich takes its origin from the *os pubis*.

anterior part of the tendon of the broad rectus, and into the upper and anterior end of the tibia. Its insertion is partly covered by the internal head of the *gastrocnemius*. It bends and adducts the thigh, and extends the leg.

Biceps flexor cruris (Pl. X. XI. K).—This is a single muscle, corresponding with the preceding in the characteristic modifications of its extended origin, in relation to the great antero-posterior development of the pelvic bones. It is exposed by the removal of the broad *rectus*. *Orig.* By a broad and thin aponeurotic tendon, which at first is confluent with that of the rectus, but soon becomes distinct. *Ins.* The fleshy fibres converge as they descend along the back and outer part of the thigh, and finally terminate in a strong round tendon, which glides through a loop formed here principally by a splitting of the tendinous origin of the *gastrocnemius externus*, and is inserted into the process on the outside of the fibula one inch from its proximal extremity. By means of the loop, the weight of the hinder parts of the body is partially transferred, when the leg is bent, to the distal end of the femur; and the biceps is enabled, by the same beautiful and simple mechanism, to effect a more rapid and extensive inflection of the leg than it otherwise could have produced by the simple contraction of its fibres.

Semimembranosus (Pl. XI. XIV. L).—*Origin.* From the side of the coccygeal vertebræ, and from the posterior end of the ischium; it crosses the superficial or internal side of the *semitendinosus*. *Ins.* Into the fascia covering the *gastrocnemius* and the inside of the tibia.

Semitendinosus (Pl. XI. XIV. M).—This muscle arises from the posterior and outer part of the *sacrum* and *ischium*: it is a flattened triangular muscle, which receives the square *accessorius* muscle (N) from the lower and posterior part of the femur. It gradually diminishes as it descends, and having passed the knee-joint, sends off at right angles a broad and square sheet of aponeurosis, which glides between the two origins of the *gastrocnemius internus*, and is inserted into the lower part of the angular ridge continued from the inside of the head of the tibia. The terminal tendon, continued from the apex of the muscle, then runs along the outer or fibular margin of the internal head of the *gastrocnemius*, and becomes confluent with the terminal tendon of that muscle.

Cruræus (Pl. XI. XIV. O).—This is a simple but strong muscle: it commences at the upper and anterior part of the thigh by two extremities, of which the outer and upper one has its origin extended to the base of the trochanter; the inner and inferior comes off from the inner side of the femur, beneath the insertion of the *glutæus magnus*; the two portions blend into one muscle much earlier than in the Ostrich. *Ins.* By the ligamentum patellæ into the fore-part of the head of the tibia.

Gracilis (Pl. XIV. P).—On the inner side of the *cruræus*, but more superficially, lies a narrow, compressed, long muscle, which rises by two heads, one from the anterior and upper part of the femur, the other from the os pubis; both soon become blended

which in the common fowl is formed chiefly by a ligament extended from the back of the outer condyle of the femur to the head of the tibia, as in the common fowl, ostrich, &c.

together and transmit a broad thin tendon to be inserted into the lower and lateral part of the patella with the *cruræus*.

Vastus internus (Pl. XIV. Q).—Two other muscles succeed the preceding, and rise beneath it from the inner and anterior part of the femur; they have a similar insertion, and obviously represent the *vastus internus*. The fibres converge to a middle aponeurosis, which increases to a strong short tendon, inserted into the upper and anterior projection of the tibia.

Popliteus.—This small muscle is brought into view when the superficial muscles of the leg which are inserted into the foot are removed. Its carneous fibres extend from the fibula inwards and downwards to the tibia. It is of relatively smaller extent than in the Cassowary.

Gastrocnemius.—This consists, as in other birds, of several distinct portions, the chief of which correspond with the external and internal origins of the same muscle in the Mammalia. The *gastrocnemius externus* (Pl. X. XI. R) arises by a strong, narrow, rather flattened tendon (R*) from the ridge above the external condyle of the femur, which, about an inch below its origin, becomes firmly attached to the strong ligamentous loop attached by one end to the femur above the preceding tendon, and by the other to the outer ridge of the fibula. This trochlear loop, which is displayed by reflecting down the tendon of the *gastrocnemius* in Pl. XI., is lined by synovial membrane, and supports the tendon of the *biceps cruris*, which glides through it. The carneous fibres of the external *gastrocnemius* come off from the outer side of the tendon, and from the fascia covering the outer surface of the muscles of the leg: they are continued in a somewhat penniform arrangement two-thirds down the leg, upon the inner surface of the muscle, where they end in a strong subcompressed tendon. This joins its fellow tendon, from the internal *gastrocnemius*, behind the ankle-joint, and both expand into a thick, strong ligamentous aponeurosis (Pl. X. fig. 2. R), which extends over three-fourths of the posterior part of the tarso-metatarsal joint. The lateral margins of this fascia are bent down under the flexor tendons behind the joint, and become continuous with a strong ligamentous layer gliding upon the posterior surface of the distal condyles of the tibia, and attached to the tendons of the *peroneus* and *tibialis anticus*; the conjunction of the thickened tendons of the *gastrocnemii* with this deeper-seated layer of ligamento-tendinous substance constitutes a trochlear sheath (R**) lined by synovial membrane, through which the flexor tendons of the toes glide. The synovial membrane of the ankle-joint is continued upwards half an inch above the articular surface of the bone, between it and the cartilaginous pulley. Below the joint the margins are inserted into the lateral ridges of the tarso-metatarsal bone, becoming gradually thinner as they descend, and ending below in a thin semilunar edge directed downwards.

The *gastrocnemius internus* (Pl. XIV. R) has two powerful heads, one from the femur, the other from the tibia; the first arises fleshy from the internal condyle of the femur, expands as it descends, and receives additional fibres from the lower edge of the *acces-*

* This is described as the *soleus* in the Cassowary by Prof. Mayer, loc. cit. p. 15, but the origin of this muscle is not extended above the knee-joint.

sorius semitendinosi. About one-fifth down the tibia this muscular origin in the right leg terminated in a short flattened tendon (R*), which became attached to the inner side of the tibial portion of the *gastrocnemius internus* (R**). In the left leg the tendon soon divided; one portion passed to the soleus, the other went to join the tibial portion of the *gastrocnemius internus.* The second head, which is separated from the preceding by the insertion of the *semitendinosus*, arises partly from the internal and anterior part of the strong fascia of the knee-joint by short tendinous fibres, which almost immediately become fleshy, and partly from a well-defined triangular surface (R**) on the inner and anterior aspect of the head of the tibia: the fleshy fibres converge, receive the tendinous slip from the femoral portion, and end on the inner side of the muscle in a strong flattened tendon, about two-thirds down the leg: this joins the tendon of the *gastrocnemius externus*, and is inserted as described above.

Soleus (Pl. XIV. S).—A slender flattened muscle arising from the inner and posterior side of the tibia, the tendon of which joins that of the *gastrocnemius internus*, behind the tarsal joint.

Plantaris.—The *flexor perforans digitorum* (Pl. X. XI. XIV. 1) lies immediately anterior to the external *gastrocnemius*; it arises fleshy from the outer condyle of the femur, below the tendinous origin of that muscle, and terminates in a slender flat tendon halfway down the leg. Its tendon (1) glides behind the tarsal joint through the sheath of the *gastrocnemius*, expands beneath the metatarsal joint, and then bifurcates, sending its smallest division to the inner toe, and its larger one to blend with the tendon of the *peroneus longus.*

Flexor perforatus of the outer toe (Pl. X. XI. XIV. 2).—This arises by very short tendons from the proximal end of the fibula, and from the ligament attached to the bicipital pulley; it continues to derive a thin stratum of fleshy fibres from the fascia covering the anterior surface of the muscles of the leg: the fleshy fibres terminate half-way down the leg in a flattened tendon, which pierces the tendon of the first *perforatus* of the middle toe, then runs forward to the outer toe, expands into a thick ligamentous substance beneath the proximal phalanx, and sends off two tendinous attachments on each side, one to the proximal, the other to the second phalanx, and is continued to be finally inserted into both sides of the third phalanx.

Flexor perforatus digitorum (Pl. XI. XIV. 3, 4, 5, 6) is the strongest of the three; it arises fleshy from the posterior part of the distal extremity of the femur, above the external condyle (4), and also by a distinct flattened tendon (6), one inch in length, from the proximal end of the tibia: this tendon moreover receives the long slender tendon sent off obliquely across the front of the knee-joint from the *pectineus* (T), by which its origin is extended to the pelvis. This accessory tendon perforates the inner fleshy surface of the muscle, and is finally lost about half-way down the carneous part. Before the *flexor perforatus* is joined by the tendon of the *pectineus*, it subdivides posteriorly into four muscular fasciculi. The anterior division receives principally the above tendon,

and this division of the muscle becomes wholly tendinous two-thirds down the leg; its tendon (3) passes through the posterior part of the pulley of the *gastrocnemius*, and expands as it passes along the metatarsus: a thick ligamentous substance is developed in it, opposite the joint of the proximal phalanx of the second toe, into the sides of which it is inserted, dividing for that purpose, and giving passage to the two other flexor tendons of that toe. The second portion of the present muscle terminates in a tendon (4) situated behind the preceding, which passes through a distinct sheath behind the tarsal joint, expands into a sesamoid fibro-cartilage beneath the corresponding expansion of the previous tendon, which it perforates, and then becomes itself the perforated tendon of the second phalanx of the second toe, in the sides of which it is inserted. The third portion of this muscle ends in a somewhat smaller tendon (5) than the preceding, which forms the second *perforatus flexor* of the third or middle toe. The fourth and most posterior portion soon becomes a distinct muscle; its fleshy fibres cease on the inner side, one-fourth down the leg, but on the outside they are continued three-fourths down the leg; its tendon (6) passes through the gastrocnemial pulley behind the ankle-joint, and divides to form a sheath for the perforatus of the fourth toe; it is then joined by the tendon of the peroneus (7), passing through a pulley across the external malleolus, and finally becomes the perforated tendon of the first phalanx of the middle or third toe.

Pectineus (Pl. XI. XIV. T), (*Rectus anticus femoris* of Meckel).—This is a long, thin, narrow strip of muscle arising from the spine of the pubis, anterior to the acetabulum, and passing straight down the inner side of the thigh; it degenerates into a small round tendon near the knee, which tendon traverses a pulley, formed by an oblique perforation in the strong rotular tendon of the extensors of the leg, and thus passing across the knee-joint to the outer side of the leg, finally expands, and is lost in the *flexor perforatus digitorum* last described. It is this muscle which causes the toes to be bent when the knee is bent.

Peroneus longus (Pl. XI. XIV. 7).—*Origin.* Tendinous from the head of the tibia, and by carneous fibres from the upper half of the anterior margin of the tibia; these fibres pass obliquely to a marginal tendon, which becomes stronger and of a rounded form where it leaves the muscle. The tendon gives off a broad, thin, aponeurotic sheath to be inserted into the capsule of the tarsal joint; it is then continued through a synovial pulley on the side of the outer malleolus, and is finally inserted or continued into the perforated tendon of the middle toe (6).

Tibialis anticus (Pl. XI. XIV. 8).—This muscle is overlapped and concealed by the peroneus; it arises partly in common with that muscle, and partly by separate short tendinous threads from the outer part of the head of the tibia; it gradually becomes narrower, and finally tendinous two-thirds of the way down the leg; its strong tendon glides through the oblique pulley in front of the distal end of the tibia, expands as it passes over the ankle-joint, and is inserted into the anterior part of the proximal end of the tarso-metatarsal bone, sending off a small tendinous slip to the aponeurosis covering

the extensor tendons of the toes, and a strong tendon which joins the fibular side of the tendon of the following muscle.

Extensor longus digitorum (Pl. XIV. 9).—This lies between the *tibialis anticus* and the front and outer facet of the tibia, from which it derives an extensive origin; its tendon commences half-way down the leg, runs along the anterior part of the bone, first under the broad ligamentous band representing the anterior part of the annular ligament, then through a ligamentous pulley, and inclines to the inner or tibial side of the anterior surface of the metatarsal bone, where it expands and divides into three tendons. Of these the innermost is given off first, and subdivides into two tendons, one of which goes to be inserted into the base of the last phalanx of the second toe; the other portion is principally inserted into the middle toe, but also sends off a small tendon to the inner side of the proximal phalanx of the second toe. The second tendon is inserted by distinct portions into the second, third and last phalanges of the middle toe. The third tendon supplies the outer toe.

Extensor brevis digitorum (Pl. XIV. 10).—A small extensor muscle arises from the insertion of the *tibialis anticus*, and sends its tendon to the outer side of that of the great *extensor digitorum*.

Extensor pollicis brevis (Pl. XIV. 11).—An extensor of the small innermost toe arises from the upper and inner side of the tarso-metatarsal bone.

Peroneus medius, Cuv., *Accessorius flexoris digitorum*, Vicq. d'Azyr (Pl. XI. XIV. 12).—This strong penniform muscle arises fleshy from nearly the whole of the outer surface of the fibula, also from the posterior part of the tibia and the interosseous space; the tendon of the biceps perforates its upper part in passing to its insertion. It ends in a strong flat tendon at the lower third of the leg, which tendon runs through a particular sheath at the back part of the tarsal pulley, becomes thickened and expanded as it advances forwards beneath the tarsus, receives a strong accessorial tendon from the muscle which bends the innermost toe, and finally divides into three strong perforating tendons, which bend the last joints of the three long toes.

In the outer, or fourth toe, both the *perforans* and *perforatus* tendons are confined by a double annular ligament; the exterior one being continued from the adjoining toe, the inner and stronger one from the sides of the proximal phalanx of the outer toe.

The second and third toes have two perforated tendons; one inserted into the sides of first, and the other into sides of second phalanx.

On a review of the details of the Muscular System above recorded, it will be seen that the analogies of the muscles on the dorsal aspect of the spine with those of Man and the Mammalia, are in consequence of their unusually strong and distinct de-

velopment in the Apteryx, more clearly traceable than their condition in other birds perhaps admitted of. The remarkable concordance of the muscles of the rudimental wing in the Apteryx with those in ordinary Birds of Flight, has been already pointed out. Nor is the correspondence less remarkable in the muscles of the leg and foot, especially as manifested in the condition of the 'perching muscle' (pectineus), in which it could hardly have been anticipated. The strong flexors and extensors of the leg and toes are strictly adapted to the exigencies of a bird which obtains probably most of its nourishment from the earth, by means of feet resembling those of the *Gallinacea*, and which owes its safety to the speed with which it runs, by means of legs which have the proportions of those of the Struthous tribe; and which, finally, is reported to seek concealment and to incubate in subterraneous burrows.

DESCRIPTION OF THE PLATES.

(The figures are reduced one half the natural size.)

Plate X. Side view of the superficial muscles.
Plate XI. Side view of the second layer of muscles.
Plate XII. Side views of the deeper seated muscles of the back and neck.
Plate XIII. Side and front views of the second layer of muscles of the neck.
Plate XIV. Front view of the muscles of the Apteryx.

Female Organs of the Apteryx australis.

The trunk of a specimen of this species, transmitted to me by the lamented botanist Mr. Cunningham, having proved to be that of a female, enables me to complete this anatomical monograph, by the description of the organs of generation in that sex. These consisted of two ovaria and one oviduct. The right ovarium (Pl. XV. *a*) was, as usual in Birds, in an atrophied state, and situated in front of the corresponding suprarenal body, attached to that body and the adjoining trunk of the *vena cava*. It was a small, flattened, minutely granular body, measuring eight lines by five lines, and about one line in thickness.

The left ovarium (Pl. XV. *b*) was in a state of full development, of the usual racemose structure, consisting principally of one enormous calyx, ripe for dehiscence, containing the vitellus of an ovum, which measured three inches in length by two inches in breadth, indicating an unusually large egg for the size of the bird. All the other calyces were comparatively small, and the greater number of minute size.

The oviduct commenced by the usual simple unfringed or entire slit-shaped aperture (*c*), two inches in its long diameter: the tube soon contracted to a diameter of half an inch, with longitudinally plicated walls, indicating its dilatability: it then expanded to an inch diameter, and after slightly contracting, suddenly enlarged, to form the uterine

or shell-secreting part (*d*), which was nearly one inch and a half in diameter; here the muscular tunic is thicker, and the lining membrane presents a peculiar character, consisting of transverse, linear, sub-parallel streaks, sending off numerous short processes at right angles, both streaks and processes being of a white colour, relieved by the darker mucous membrane. A magnified portion of this structure is given at fig. 2. This structure occupied nearly two inches of the uterine dilatation, which reassumed the longitudinal plications about one inch before terminating in the uro-genital compartment of the cloaca. The terminal outlet (*e*) is of a narrow elliptical form, with a tumid margin covering a sphincteric arrangement of the muscular fibres.

PLATE XV.

The female organs of the *Apteryx australis*.

Fig. 1 *a*. The right ovarium.

b. The left ovarium.

c, *d*, *e*. The oviduct: the uterine portion laid open and a probe passed into it.

Fig. 2. A portion of the lining membrane, showing the disposition of the secreting follicles of the egg-shell.

XI. *On the Anatomy of the* Apteryx Australis, *Shaw*. Part II. (Myology.)

By Richard Owen, *F.R.S.*, *F.Z.S.*, *&c. &c.*

Read February 22, 1842.

THE former part of this memoir on the Anatomy of the *Apteryx australis*[1] includes the description of the osteology and splanchnology, with the male organs of generation; the present part is devoted to the illustration of the myology of the same rare and anomalous bird. The specimens which I have dissected for the muscles were afforded me by the Earl of Derby, President, and by Mr. George Bennett, F.L.S., of Sydney, Corresponding Member of the Zoological Society, to whom I am much indebted for such valuable opportunities of completing this monograph on the Apteryx.

The muscular system offers a subject of peculiar interest to the Comparative Anatomist when studied in a species which, in its general proportions and habits of life, deviates in so extreme a degree from the rest of the circumscribed and well-marked class to which it belongs. It is also a department of the anatomy of birds which, from the minute attention and length of time required for its accurate investigation, has been commonly passed over in anatomical monographs of species, but which the rarity of the *Apteryx* and the excellent state of preservation of the specimens dissected have both stimulated and enabled me to pursue with a degree of care which will be found, I trust, when tested by subsequent dissection, to have left little to be added to the myology of the species.

In the application of the facts detailed to the higher generalizations of the philosophy of organized bodies, it will be found that the unity of the ornithic type is strictly preserved, though under the extremest modifications; the characteristic peculiarities, for example, of the muscles of the spine and those of the wing, are all present, but the proportionate development of these classes of muscles is reversed, the spinal muscles being at their maximum, the alar muscles at their minimum of development. Very interesting peculiarities are likewise manifested by the muscles of the skin, with which I propose to introduce the details of the muscular system of the small Struthious bird of New Zealand.

Muscles of the Skin.

No detailed description of the muscles of the skin in Birds has been given either in the systematic works on Comparative Anatomy, or in particular treatises; these muscles appear indeed in general to be too irregularly or too feebly developed to have attracted

[1] Transactions of the Zoological Society, Vol. II. Part 4, p. 257.

much attention: brief notices are recorded of some peculiarly developed cutaneous, or rather cuticular, muscles, as those which spread the plumes of the Peacock, erect the hackles of the Cock, and make each individual feather stand on end in the web-footed birds[1]; the compressors of the subcutaneous air-cells are noticed in the anatomical account of the Gannett (*Sula Bassana*[2]); and a more constant cutaneous muscle, viz. that which supports the crop in Gallinaceous birds, is briefly mentioned and figured by Hunter[3].

In the *Apteryx*, however, the true cutaneous system of muscles presents a more distinct and extensive development than has hitherto been met with in the class of Birds —a condition which is evidently connected with the peculiar thickness of the integument, and probably with the burrowing habits of this species, which thereby possesses the power of shaking off the loose earth from its plumage, while busy in the act of excavating its chamber of retreat and nidification.

Constrictor colli (Pl. XXXI. XXXIV. *a*).—The whole of the neck is surrounded by a thin stratum of muscular fibres, directed for the most part transversely, and extending from an attachment along the median line of the skin at the back of the neck, to a parallel *raphe* on the median line of the opposite side: this muscle is strongest at its commencement or anterior part, where the fibres take their origin in a broad fasciculus from the outer part of the occipital ridge; these run obliquely downwards and forwards on each side of the neck, but are continued uninterruptedly with those arising from the dorsal line of the skin above mentioned; the direction of the fibres insensibly changing from the oblique to the transverse. The outer surface of this muscle is attached to the integument by a thin and dense layer of cellular tissue, devoid of fat; the under surface is more loosely connected with the subjacent parts by a more abundant and finer cellular tissue.

Use.—To brace the cervical integument, raise the neck feathers, and in combination with the following muscle to shake these parts.

Sterno-cervicalis (Pl. XXXI. *b*).—*Origin.* Fleshy, from the posterior incurved angular process of the sternum, from the ensiform prolongation and middle line of the outer and posterior surface of the same bone. *Insertion.* The fibres pass forward, and, diverging in gently curved lines, ascend upon the sides of the broad base of the neck, and are inserted by a thin but strong fascia into the median line of the dorsal integument. This muscle is a line in thickness at its origin, but becomes thinner as it expands; the anterior part is covered by the posterior fibres of the *constrictor colli.*

Use.—To retract the skin of the neck, and brace that portion which covers the base of the neck; when these are the fixed points, it will depress and protract the sternum, and thus aid in inspiration.

Obs.—In its position and the general course of the fibres, this muscle is analogous to

[1] Nitzsch, art. *Dermorhynchi*, Ersch und Grüber's Encyclopedie.

[2] Proceedings of the Zoological Society, 1832, p. 91.

[3] In description of pl. 10, vol. i. of Physiological Catalogue of Hunterian Collection, 4to. 1833–1841.

that which supports and assists in emptying the crop in the common Fowl; but the œsophagus presents no partial dilatation in the *Apteryx*, and the situation of the crop is occupied by a large mass of fat enclosing one or two absorbent glands (Pl. XXXIV. *a'*).

Sterno-maxillaris (Pl. XXXIV. *c*).—This muscle appears at first view to be the anterior continuation of the preceding, but is sufficiently distinct to merit a separate description and name. *Origin.* Fleshy; from the anterior part of the middle line of the sternum. *Insertion.* It passes directly forwards along the under or anterior part of the neck, expanding as it proceeds, and gradually separating into two thin symmetrical fasciculi, which are insensibly lost in the integument covering the throat and the angle of the jaw. It adheres pretty closely to the central surface of the *constrictor colli*, along which it passes to its insertion.

Use.—To retract the fore-part of the skin of the neck, and also the head. Each lateral portion acting alone would incline the head to its own side: the whole muscle in action would bend the neck; but the movements of the head and neck are more adequately and immediately provided for by the appropriate deeper-seated muscles, and the immediate office of the present muscle is obviously connected with the skin. Nevertheless, in so far as this muscle acts upon the head, it produces the same movements as the *sterno-mastoideus* in Mammalia; and it is interesting to observe, that in the long-necked Ruminants (as the Giraffe) the sterno-mastoid muscles arise by a common origin, and the insertion is by an extended fascia into the angles of the jaw: I consider, therefore, that the *sterno-mastoideus* is represented by the *sterno-maxillaris* in the *Apteryx*.

Dermo-transversalis (Pl. XXXIV. fig. 1. *d*).—The skin covering the dorsal aspect of the lower two-thirds of the neck, besides being acted upon by the *constrictor colli*, is braced down by a thin stratum of oblique and somewhat scattered fibres, which take their origins by fasciæ attached to the inferior transverse processes of the sixth to the twelfth cervical vertebræ inclusive; the fibres pass obliquely upwards and backwards, and are inserted by a thin fascia into the median line of the skin, covering the back of the neck.

Platysma myoides (Pl. XXXI. *e*).—The representative of this cutaneous muscle is a thin triangular layer of muscular fibres, taking their origin from the outer side of the ramus of the jaw, and diverging as they descend to spread over the throat, and meeting their fellows at a middle *raphe* of insertion beneath the upper larynx and beginning of the trachea, which they thus serve to compress and support.

Dermo-spinalis (Pl. XXXI. *f*).—*Origin.* By a thin fascia from the ends of the spinous processes of the three anterior dorsal vertebræ. *Ins.* The fibres slightly converge to be attached to the integument covering the scapular region.

Dermo-iliacus (Pl. XXXI. *g*).—*Origin.* Fleshy, from the anterior margin of the ilium. *Ins.* The fibres pass forwards and slightly converge to be inserted into the scapular integument.

Dermo-costalis (Pl. XXXI. *h*).—A muscle resembling the preceding in form. *Origin.* Fleshy, from the costal appendages of the seventh and eighth ribs. *Ins.* The fibres

pass forwards and join those of the preceding muscle, to be inserted into the scapular integument.

Obs. The three preceding muscles are broad and thin, but well-defined; they would appear to influence the movements of the rudimentary spur-armed wing through the medium of the integument, as powerfully as do the rudimental representatives of the true muscles of that extremity.

There are also two muscles belonging to the cutaneous series, and inserted directly into the bones of the wing. One of these, the *Dermo-ulnaris* (Pl. XXXI. *i*), is a small, slender, elongated muscle, which takes its origin from the fascia beneath the *dermo-costalis*; its fibres pass backwards, and converge to terminate in a very slender tendon which expands into a fascia, covering the back part of the elbow-joint.

Use.—To extend the elbow-joint and raise the wing.

The *Dermo-humeralis* (Pl. XXXI. *k*) is also a long and narrow strip, deriving its origin from scattered tendinous threads in the subcutaneous cellular tissue of the abdomen: it passes upwards, outwards and forwards, and is inserted fleshy into the proximal part of the humerus, which it serves to depress[1].

Muscles of the Trunk.

A. On the Dorsal Aspect.

The muscles on the dorsal aspect of the vertebral column in Birds have only of late years received any attention from Comparative Anatomists: they have been mentioned rather than described by Tiedemann and Meckel: Carus has given a side-view of the superficial layer of muscles in the Sparrow-hawk; their best description is contained in the second edition of the 'Leçons d'Anatomie Comparée' of Cuvier.

The muscles of the back are in general so feebly developed in birds of flight, that they were affirmed by Cuvier to be wanting altogether in the first edition of the 'Leçons:' and this is almost true as respects their carneous portion, for they are chiefly tendinous in birds of flight. In the Struthious birds, and in the Penguin, in which the dorsal vertebræ are unfettered in their movements by anchylosis, these muscles are more fleshy and conspicuous; but they attain their greatest relative size and distinctness in the *Apteryx*.

From the very small size of the muscles which pass from the spine to the scapula and

[1] In Mammalia the cutaneous muscles form a more continuous stratum than in the *Apteryx* and other birds, and hence have been grouped together under the common term *panniculus carnosus*; they have also, in general, both their origins and insertions in the integument; but in Birds the integument supports so extraordinary an abundance of the epidermic material under the form of feathers, that the muscles destined to its especial motions require a more fixed attachment from which to act. The Rhinoceros, in which the integuments, from the thickness and density of the corium, are in a similar condition as regards the resistance to be overcome by their peculiar muscles, presents an analogous condition of the *panniculus carnosus*, having it divided into several distinct muscles, most of which take their origin from bone or fasciæ attached to bone.

humerus in the *Apteryx*, the true muscles of the back, which correspond to the second layer of the dorsal muscles in Man, become immediately visible on removing the dorsal integuments and fasciæ; they consist of the *sacro-lumbalis*, *longissimus dorsi*, and *spinalis dorsi*. The first two muscles are blended together at their posterior origins, but soon assume the disposition characteristic of each as they advance forwards.

The *sacro-lumbalis* (Pl. XXXII. XXXIII. *l*) is a strong and fleshy muscle, six lines in breadth, and three or four lines in thickness: it is, as usual, the most external or lateral of the muscles of the back, and extends from the anterior border of the ilium to the penultimate cervical vertebra. *Origin.* By short tendinous and carneous fibres from the outer half of the anterior margin of the ilium, and by a succession of long, strong, and flattened tendons (Pl. XXXIII. fig. 2. *l* 1–*l* 5) from the angles of the fifth and fourth ribs, and from the extremities of the transverse processes of the third, second, and first dorsal vertebræ; also by a shorter tendon (*l* 6) from the transverse process of the last cervical vertebra; these latter origins represent the *musculi accessorii ad sacro-lumbalem*; to bring them into view, the external margin of the *sacro-lumbalis* must be raised, as in Pl. XXXIII. fig. 2. These accessory tendons run obliquely forward, expanding as they proceed, and are lost in the under surface of the muscle.

Insertion. By a fleshy fasciculus with very short tendinous fibres into the angle of the sixth rib, and by a series of corresponding fasciculi, which become progressively longer and more tendinous, into the angles of the fifth, fourth, third and second ribs (Pl. XXXII. *l**), and into the lower transverse processes of the first dorsal and last two cervical vertebræ: the last insertion is fleshy and strong; the four anterior of these insertions are concealed by the upper and outer fleshy portions of the *sacro-lumbalis*, which divides into five elongated fleshy bundles (Pl. XXXII. *l***), inserted successively into the upper transverse processes of the first three dorsal and last two cervical vertebræ. These last insertions seem to represent the continuation of the *sacro-lumbalis* in Man, which is termed the *cervicalis descendens* or *ascendens*.

Longissimus dorsi (Pl. XXXII. XXXIII. *m*).—This muscle is blended posteriorly both with the *sacro-lumbalis* and the *multifidus spinæ*, and anteriorly with the outer portion of the *spinalis dorsi*. It extends as far forward as the thirteenth cervical vertebræ. *Origin.* From the inner or mesial half of the anterior margin of the ilium; from a strong aponeurosis attached to the spines of the eighth, seventh and sixth dorsal vertebræ; and from the transverse processes of the sixth, fifth, fourth and third dorsal vertebræ. *Ins.* The carneous fibres continued from the second origin, or series of origins from the spinous processes, incline slightly outward as they pass forward, and are inserted into the posterior articular processes of the first three dorsal vertebræ, receiving accessory fibres from the *spinalis dorsi*. The fasciculi from the transverse processes incline inwards, and are also inserted into the posterior oblique processes of the vertebræ anterior to them; they receive fibres from the iliac origin, and soon begin to form a series of oblique carneous fasciculi, which become more distinct as they are situated more anteriorly; they are at

first implanted in the vertebra next in front of that from which they rise, and then into the vertebra next but one in front (*m**) : the most anterior of these tendons of insertions, to which can be traced any of the fibres of the main body of the *longissimus dorsi* (reflected back in Pl. XXXIII. fig. 1, *m*) is that which is implanted into the thirteenth cervical vertebra (*m***) ; it is this fasciculus which is joined by the first or most posterior of the *fasciculi obliqui* of the *longus colli posticus* (*o* 1) which is detached and reflected upwards in fig. 1. Pl. XXXIII.

Obliquus colli (Pl. XXXII. XXXIII. *m* 1—9).—A series of oblique carneous fasciculi, evidently a continuation of, or part of the same system with those in which the *longissimus dorsi* terminates anteriorly, is continued between the upper transverse process of one cervical vertebra to the posterior oblique processes of the next vertebra but one in advance, as far forward as the fourth cervical vertebra. This series of muscles seems to represent the *transversalis colli*[1], which is the anterior continuation of the *longissimus dorsi* in Mammalia, but it differs in being inserted into the oblique, instead of the transverse processes. In the direction of their fibres these fasciculi resemble the *semispinalis colli*, but they are inserted into the oblique processes instead of the spines of the vertebræ. There are no other muscles with which they can be compared in the Mammalia than these two, with neither of which, however, do they precisely correspond ; they seem clearly to represent the second series of oblique muscular fasciculi in the trunk of Fishes, but to avoid the expression of an incomplete or false analogy, I shall term them collectively the *fasciculi obliqui*.

The *fasciculi obliqui* which rise from the first two dorsal and five lower cervical vertebræ are joined near their tendinous terminations by corresponding oblique fasciculi (*o* 1—8) of the *longus colli posticus*, and the strong round tendons continued from the points of convergence of these fascicles are inserted successively into the posterior oblique processes of the twelfth to the sixth cervical vertebra inclusive ; the two fasciculi next in succession receive no accessory fibres from the *longus colli posticus* ; the anterior one (*m* 9) derives an extensive origin from the upper transverse processes of the eighth, seventh, and sixth cervical vertebræ. It must be observed, however, that the whole of each fasciculus is not expended in the strong round tendinous insertion above described ; the portion (*m**, fig. 1. Pl. XXXIII.), which arises from the anterior ridge of the transverse process, passes more directly inwards than the rest, and is attached to the tendon which terminates the fasciculus immediately behind ; at the middle of the neck these accessory fibres approach to the character of distinct origins. The tendons of insertion, moreover, severally receive accessory fleshy fibres (*n n*, fig. 1. Pl. XXXIII.) from the base of the

[1] It is the '*grand transversaire*' of Cuvier, *loc. cit.* p. 282 ; but he describes it as passing from the anterior articular process of one vertebra to the posterior articular process of the next in front. Meckel, who calls this muscle '*intertransversalis cervicis*,' follows Cuvier in the description of its attachments, and adds, that it is a continuation of the outer division of the '*extensor communis dorsi*' (*sacro-lumbalis*). In the Apteryx it is plainly a continuation of the inner division or *longissimus dorsi*. See Vergleich. Anatomie, Th. 3. p. 294.

oblique processes of the two vertebræ next behind; and thus they become the medium of muscular forces acting from not less than five distinct points, the power of which is augmented by each tendon being braced down by the oblique converging series of muscles immediately anterior to it. The fasciculus from the eighth cervical vertebra, besides its insertion by the ordinary tendon, sends off externally a small pyramidal bundle of muscular fibres (Pl. XXXII. n^{*}), which soon terminates in a long and slender tendon which is inserted into the oblique process of the third cervical vertebra. Corresponding portions of muscle (Pl. XXXII. & XXXIII. n^{**}) are detached from the two anterior fasciculi, which converge and terminate in a common slender tendon inserted into the posterior oblique process of the fourth cervical vertebra; and thus terminates this complex muscle or series of muscles.

Longus colli posticus (Pl. XXXII. & XXXIII. fig. 1. *o* 1—9).—The most internal or mesial of the superficial muscles of the dorsal aspect of the thoracic and cervical regions, called *cervicalis ascendens* by Meckel, and compared in part with the *spinalis dorsi* by Cuvier, cannot be the representative of either of these muscles, since they both (l^{**} & p) co-exist separately with it in the *Apteryx*. At its posterior part the muscle in question seems to be rather a continuation of the *longissimus dorsi*; its mesial and anterior part offers a strong analogy with the *biventer cervicis*; it appears to me to be evidently the analogue of the first, or mesio-dorsal series of oblique fibres of the muscular system in Fishes, but I shall adopt the name of the *longus colli posticus* applied to it by Cuvier[1]. It commences by long and slender, but strong, subcompressed tendons from the spines of the sixth, fifth and fourth dorsal vertebræ (Pl. XXXIII. *o*): these tendons gradually expand as they proceed forwards and downwards, and send off from their under surface muscular fibres which continue in the same course, and begin to be grouped into distinct fasciculi at the base of the neck: the first of these bundles (*o* 1) joins the fasciculus of the *longissimus dorsi* (m^{**}), which is inserted into the posterior articular process of the thirteenth cervical vertebra; the succeeding fasciculi derive their origins from a broad and strong aponeurotic sheet attached to the spines of the fourth, third and second dorsal vertebræ: the second to the eighth fasciculi inclusive are compressed, broad and fleshy, and are inserted in the strong round tendons described in the preceding muscle, and attached to the oblique processes of the twelfth to the sixth cervical vertebræ inclusive: the ninth fasciculus (*o* 9), which forms the main anterior continuation of the *longus colli posticus*[2], is larger than the rest, and receives, as it advances, accessory fibres from the spinous processes of the seventh (o^{x}) to the third cervical vertebræ inclusive, and is inserted, partly fleshy, partly by a strong tendon, into the side of the broad spine of the *vertebra dentata*. A slender fasciculus is detached from the mesial and dorsal margin of the *longus colli posticus*, near the base of the neck, which soon terminates in a long round tendon (o^{xx}): this tendon is braced down by short aponeurotic fibres to the spine of the fifth, fourth, third and

[1] Leçons d'Anat. Comp., 2nd edit. vol. i. p. 284.

[2] '*Accessoires du long postérieur du cou*,' Cuvier, *loc. cit.* p. 284.

second cervical vertebræ inclusive, immediately beyond which it again becomes fleshy, and expands to be inserted into the occipital ridge: this portion is the *digastrique* or *biventer capitis* of Cuvier.

Spinalis dorsi (Pl. XXXIII. fig. 1. *p*).—The displacement of the dorsal portion of the preceding muscle and the *longissimus dorsi* brings into view the *spinalis dorsi*, which is a well-developed and distinct muscle in the *Apteryx*. *Origin*. By two long, narrow, flattened tendons (*p*, 1 & 2.) from the spines of the eighth and seventh dorsal vertebræ: these pass obliquely downwards and forwards, expanding as they proceed, and terminate in two fasciculi of muscular fibres: the posterior bundle passes forwards beneath the anterior one, and inclining inwards and upwards, divides into two portions, inserted by long tendons into the spines of the second and first dorsal vertebræ (*p* 1*); it then sends a few fibres forwards to join the outer and anterior fasciculus, which is partly inserted by a slender tendon into the spine of the last cervical vertebra: the rest of the fibres of the second fasciculus join the portion of the *longissimus dorsi* (*m*) which is implanted into the posterior oblique process of the last cervical vertebra. The three inserted tendons of the *spinalis dorsi* are also the medium of attachment of fibres continued from the *multifidus spinæ*, beneath them.

Multifidus spinæ (Pl. XXXIII. fig. 1. *q*).—The series of muscles so called arises by fleshy fibres from the transverse processes of the five last dorsal vertebræ, which pass upwards, forwards and inwards, to be inserted by four flat tendons into the spines of the seventh to the third dorsal vertebræ inclusive, and by the tendons of the *spinalis dorsi* into the two anterior dorsal spines.

Obliquo-spinales (Pl. XXXIII. fig. 3. *r*).—The removal of the *multifidus spinæ* brings into view a series of long, narrow, flat tendons, coming off from the spines of all the dorsal vertebræ, and slightly expanding as they proceed forwards and obliquely downwards and outwards; they become fleshy half-way from their origin, and are inserted into the posterior oblique and transverse processes of the six anterior dorsal vertebræ, and into the posterior oblique processes of the three last cervical vertebræ.

Interspinales (Pl. XXXIII. fig. 3. *s*).—The *interspinales* muscles do not exist in the region of the back, unless we regard the preceding oblique fibres as a modified representation of them. The most posterior fasciculus of muscular fibres, which is directly extended between the spinous processes, commences at the interspace of the spines of the two last cervical vertebræ, and the series is continued as far as the *vertebra dentata*.

Interarticulares (Pl. XXXIII. fig. 3. *t*).—The muscles which form the more direct continuation of the *obliquo-spinales* are continued from the posterior oblique or articular processes of one vertebra to the posterior articular process of the next in front.

Obliquo-transversales (Pl. XXXIII. fig. 3. *v*).—A third series of deep-seated intervertebral muscles is situated external to the preceding, and passes obliquely between the upper transverse process and the posterior articular process of the vertebra in front. These fasciculi appear to be a continuation of the *multifidus spinæ* in the neck.

Intertransversales (Pl. XXXIII. fig. 3. *w*).—These are two series of short carneous fasciculi passing the one between the upper, and the other between the lower transverse processes.

Levatores costarum (Pl. XXXIII. fig. 3. *x*).—The first or most anterior of this series of muscles seems to represent the *scalenus medius* (*x**) ; it arises from both the upper and lower transverse processes of the last cervical vertebra, and expands to be inserted into the first rib, and into the upper and outer part of the second rib. The remaining *levatores* successively diminish in size as they are placed backwards ; they come off from the transverse processes of the first six dorsal vertebræ ; those from the first and second expand to be inserted into the rib attached to the same transverse process and to the one next behind ; the rest have a single insertion : the angle and the part of the rib immediately beneath are the situations of their attachments.

Complexus (Pl. XXXII. XXXIV. fig. 1. *y*).—This strong triangular fleshy muscle arises from the articular and upper transverse processes of the fourth, third and second cervical vertebræ, and gradually expands as it advances forwards to be inserted into the occipital ridge, from the outer side of the insertion of the *biventer cervicis* to the mastoid process.

Recti capitis postici.—These small muscles are concealed by the preceding ; they rise successively from the spines of the third, second and first cervical vertebræ, and expand as they advance to be inserted into the occiput.

Trachelo-mastoideus (Pl. XXXIV. fig. 1. *z*).—This strong, subdepressed carneous muscle arises from the upper transverse processes of the fifth, fourth, third and second cervical vertebræ, and is inserted into the side of the base of the occiput.

B. In Front of the Neck.

Longus colli (Pl. XXXIV. fig. 2. & XXXV. *a*).—This large and long muscle, which appears simple when first exposed, as in Pl. XXXIII. fig. 2, is found to consist, when unravelled by further dissection, of a series of closely succeeding long, narrow fasciculi, arising from the hæmapophyses of the sixth dorsal to the first dorsal and from the ten posterior cervical vertebræ (Pl. XXXV. *a a*) ; and sending narrow tendons (*ib. a**) which increase in length as they are given off more anteriorly, obliquely forwards and outwards, to be inserted into the costal processes of all the cervical vertebræ save the first two : the highest or foremost tendon (*ib. a***) is attached to the tubercle at the under part of the ring of the atlas ; but this tendon is also the medium of insertion of five small fasciculi of muscular fibres (Pl. XXXV. fig. 2. *a***) arising from the upper transverse processes of the sixth, fifth, fourth, third and second cervical vertebræ.

The *Rectus capitis anticus major* (Pl. XXXV. *b*) is continued, or arises by as many distinct tendons, from the five superior tendons of insertion of the preceding muscle ; these origins soon become fleshy, converge, and coalesce previous to their insertion into the base of the skull.

The *Rectus capitis anticus minor* (Pl. XXXV. *c*) is a strong fleshy compressed triangular muscle arising from the anterior part of the body of the first four cervical vertebræ. *Ins.* Base of occiput.

The *Rectus capitis lateralis* (Pl. XXXII. XXXV. *d*) arises from the upper transverse processes of the sixth to the second cervical vertebra inclusive. *Ins.* Side of the base of the skull.

C. Muscles of the Tail.

Levator caudæ.—Origin. From the posterior and superior extremity of the ischium. *Ins.* Into the spines of the caudal vertebræ.

Adductor caudæ superior.—This muscle is smaller than the preceding, with which it runs parallel; it rises below from the posterior extremity or tuber of the ischium, and is inserted into the transverse processes of the caudal vertebræ.

Adductor caudæ inferior.—Origin. From the tuber ischii, and the ligament connecting this with the posterior extremity of the pubis. *Ins.* Into the transverse processes of the caudal vertebræ.

Depressor caudæ.—Origin. From the under part of the middle line of pelvis. *Ins.* Into the inferior spines of the caudal vertebræ.

D. Muscles of the Abdomen.

Obliquus externus abdominis (Pl. XXXII. XXXV. *e*).—*Origin.* Fleshy, from the second and third ribs, and by a strong aponeurosis from the succeeding ribs near the attachment of the costal processes, and from those processes. *Ins.* The fleshy fibres are continued from this aponeurotic origin to nearly opposite the ends of the vertebral ribs; they run almost transversely, very slightly inclined towards the pubis, to within half an inch of the linea alba, and there terminate, by an almost straight, parallel line, in their aponeurosis of insertion. The fibres of this aponeurosis decussate those of the opposite side, and adhere to the tendinous intersections of the *rectus* beneath. The aponeurosis from the last rib passes to be inserted into a strong ligament extending between the free extremities of the *ossa pubis*, leaving the abdomen behind the last rib, defended only by the *internal oblique* and *transversalis*.

Obliquus internus abdominis (Pl. XXXV. *f*).—*Origin.* From the whole of the anterior and outer surface of the pubis; aponeurotic from the upper part, fleshy for half an inch from the lower or ventral extremity: the carneous fibres run longitudinally, and cannot be distinctly defined from the *intercostales* on their outer border, or from the *rectus abdominis* on their inner or mesial border, which forms the medium of the insertion of the internal oblique.

Rectus abdominis (Pl. XXXV. *g*).—I give this name to the mesial continuation of the preceding muscle, which arises by a strong, flat, triangular tendon (*g*) from the lower or

ventral extremity of the pubis and from the inter-pubic ligament: it soon becomes fleshy; the carneous portion is interrupted by three broad, oblique, but distinct aponeurotic intersections (g^*), and is finally inserted into the xiphoid and lateral processes of the sternum and the intervening fascia.

Transversalis abdominis.—A layer of loose, dark-coloured cellular tissue divides the internal oblique from the transverse abdominal, except at its origin from the pubis, and for half an inch anterior to that part.

The *transversalis* then proceeds to derive carneous fibres from the inner surface of the vertebral ribs near their lower third; they pass obliquely upwards and forwards, and terminate by a regular, slightly concave line midway between their origins and the extremities of the ribs; a strong aponeurosis passes thence to the linea alba, but becomes thin at the pubic region, where a mass of fat is interposed between it and the peritoneum.

Diaphragm (Pl. XXXVI. & LII. Vol. ii.).—This muscle presents more of its normal mammalian character in this than in any other known bird. It is perforated by vessels only, in consequence of the non-development of the abdominal air-cells. The origin corresponding to that of the lesser muscle in Mammalia is by two strong and distinct, short tendinous pillars (*a a*), from the sides of the body of the last costal vertebra; they are united by a strong tendon or fascia, forming the anterior boundary of the aortic passage. The tendinous pillars may be traced forward for some way in the central aponeurosis, expanding without crossing; they are then lost in that aponeurosis, which is perforated by the gastric arteries and veins; decussates and divides anteriorly (at *b*) to give passage to the gullet and the apex of the heart; the aponeurosis expands over the anterior part of the thoracic air-cells, and becomes, at its lateral circumference, the point of attachment of muscular fibres arising from the inner surface of the anterior ribs, and forming apparently a continuation of the *transversalis abdominis.*

Appendico-costales (Pl. XXXII. *h*).—*Origin.* From the posterior edge and extremity of the costal processes or appendages. *Ins.* They run down to be inserted severally into the rib posterior to that to which the process affording them origin is attached. These processes are supported by strong triangular aponeuroses continued from their anterior and upper margins, severally, to the rib anterior to them.

The muscles of the jaws have already been described in the account of the digestive organs[1]. The following are shown in Pl. XXXII.: α, *temporalis externus*; β, *temporalis internus*; γ, *biventer maxillæ*; the masseter has been removed, but is shown at η, Pl. XXXIV. fig. 1. The internal pterygoid muscle is shown in Pl. XXXV. at ε; the external pterygoid at ζ.

Some of the muscles of the tongue, which are described in the first part of this memoir[2], are delineated in Plate XXXIV. fig. 1.

The strong *orbicularis palpebrarum* has been divided and reflected forwards at δ, Pl. XXXII.; it is shown *in situ* at δ, fig. 1. Pl. XXXIV.

[1] Vol. ii. p. 263. [2] Ib., p. 264.

Muscles of the Anterior Extremity.

Serratus magnus anticus (Pl. XXXII. XXXIV. *i*).—This muscle consists of three portions; the first and anterior portion (Pl. XXXIV. fig. 2. *i*) arises by a short, strong aponeurosis from the last cervical rib, and is inserted into the lower edge of the anterior two-thirds of the scapula: the second and middle portion arises from the lower end of the second vertebral rib, near the attachment of the costal process, and from the anterior margin of the same rib, and is inserted into the lower edge of the posterior two-thirds of the scapula: the third, posterior and smallest portion (Pl. XXXII. *i*) rises from the costal process of the third rib, and ascends to be inserted into the posterior extremity of the scapula.

This muscle is a direct inspirator: by drawing down the scapula it depresses the sternum through the medium of the strong coracoideum, increases the angle between the vertebral and sternal ribs, and dilates the thoracic air-cells.

Levator scapulæ (Pl. XXXII. XXXIV. *k*).—This seems to be the most anterior portion of the series of muscles which constitute the *serratus magnus*. *Origin*. Two flat fleshy strips from the inferior transverse and costal processes of the last and penultimate cervical vertebræ. *Ins*. Into the inner and upper side of the middle third of the scapula. It depresses as well as draws forwards the scapula, and thus aids the *serratus* in the action of inspiration.

Serratus anticus minor.—*Origin*. From the outer part of the costal process of the sternum. *Ins*. Into the posterior part of the base of the coracoideum.

Trapezius (Pl. XXXIV. *l*).—This flattened oblong quadrilateral muscle arises from the fascia, extending upon the back from the spinous processes of the posterior cervical vertebræ, and is inserted into the conjoined extremities of the scapula and coracoideum.

There is no representative of the *rhomboidei*.

Latissimus dorsi (Pl. XXXIV. *m*).—This muscle consists, as usual in Birds, of two portions, both of which have their origin from a continuation of the fascia, attached to the spinous processes, which gives attachment to the trapezius: the fibres of the smaller and anterior strip converge to their insertion: the fibres of the posterior and broader strip are slightly twisted, the posterior edge being folded inwards as they also converge to join the preceding, and to be inserted with it into the posterior and inner side of the proximal extremity of the humerus.

Deltoides (Pl. XXXI. XXXIV. *n*).—This is a single long and narrow triangular muscle, of which the base is attached to the conjoined extremities of the scapula and coracoid, and to the capsule of the shoulder-joint; the apical insertion is into the upper and outer third of the humerus, which this muscle directly raises.

Infraspinatus (Pl. XXXII. *o'*).—A muscle which may be compared either to the *infraspinatus* or *teres major* comes off from the lower margin of the anterior two-thirds of the scapula, passes behind the shoulder-joint, where it is closely attached to the capsule, and is inserted into the inner and posterior part of the proximal end of the humerus.

Musculi pectorales.—The pectoral muscles, which present their feeblest condition and

lowest development in the *Apteryx*, are nevertheless similar in number and arrangement to those which in some birds of flight are known to outweigh all the other muscles of the body.

The *pectoralis major* (Pl. XXXI. XXXII. XXXIV. XXXV. *p*) is represented by two very thin triangular layers of muscular fibres, the anterior of which is three lines broad at its base, and is attached to the sternum immediately exterior to the perforation of that bone: the second, posterior, and somewhat narrower portion, rises immediately behind the preceding, from the osseous bridge separating the perforation from the notch; the two portions converge as they extend upwards and outwards to unite and be inserted into the anterior and internal surface of the proximal third of the humerus.

The *pectoralis medius seu secundus* (Pl. XXXII. XXXV. *q*) is a similar, thin, feeble, but broader triangular layer of carneous fibres, which arise anterior to the preceding, just below the coracoid socket of the sternum, and converge as they wind over the shoulder-joint to be inserted into the upper surface of the proximal extremity of the humerus, of which they thus become an elevator.

The *pectoralis minor seu tertius* (Pl. XXXII. XXXV. *r*) arises above and between the origins of the *pectoralis secundus* and the anterior strip of the *pectoralis major*, also partly from the coracoid process; its fibres converge to be inserted into the proximal end of the humerus, above and behind the *pectoralis major*.

Coraco-brachialis (Pl. XXXV. *s*).—This is represented by two small strips of muscular fibres which rise from the posterior part of the coracoideum, and are inserted, one directly below the other, into the proximal third of the humerus.

Obs.—The close adherence to the ornithic type of the muscular system of the anterior extremity in the *Apteryx* is more especially remarkable as regards the position and course of the *pectoralis medius*, since the physiological conditions of the circumstances attending that muscle are wanting in the *Apteryx*.

Here we have a true bird, exhibiting a remarkable modification of the whole ornithic structure, in reference to exclusively terrestrial life and nocturnal habits; and we learn, from this adherence to a typical organization, in a very rare exception, that the teleological conclusions respecting that typical construction, as it is manifested in the general rule, are in no ways affected by such an exception; because the modification of one part necessarily affects that of many others, perhaps of the whole body. If, for example, the fixation and structure of the lungs require a broad sternum and concomitant modifications of the coracoid and scapula for the mechanical part of the respiratory process, then it may be more convenient for the levator of the humerus to rise below that bone from the sternum, and act in the due direction by a modification of its course; although the locomotion of the bird may in no way be facilitated by the aggregation of muscular substance beneath the centre of gravity, nor the size of the levator be such as to render its particular position a matter of any consequence in regard to that centre.

A minute flexor (Pl. XXXIV. fig. 2. *t*), wanting the attachment to the scapula which exists in birds of flight, and arising solely from the humerus, glides along the front of that bone, chiefly as a delicate tendon to be attached to the inner part of the head of the ulna.

A single extensor (Pl. XXXIV. fig. 1. *v*), almost equally tendinous and delicate, arises from the scapula, and represents the 'long extensor' of Vicq. d'Azyr: it is inserted into the rudimental olecranon.

There is a tendinous trace of a flexor (*w*) and extensor (*x*) of the minute monodactyle manus: but the motions of the rudimental wing and its terminal hook would seem to be produced as much by the cutaneous muscles which converge to be inserted into the integument connected with it, as by the feeble representatives of the true wing-muscles above described.

Muscles of the Posterior Extremity.

The most superficial of the muscles on the outer side of the leg is that very broad one which combines the functions of the *tensor vaginæ* and *rectus femoris*, but which, in the opinion of both Cuvier[1] and Meckel[2], is the homologue of the *tensor vaginæ* and *glutæus maximus* (*seu externus*); since however it is exclusively inserted into the leg, I shall describe it with the other muscles moving that segment of the posterior extremity. The removal of this muscle, of the *sartorius*, and the *biceps cruris*, is requisite to bring into view the true *glutæi*.

Glutæus externus (Pl. XXXII. A).—The external *glutæus* (*glutæus medius* of Meckel) is smaller, as in most Mammalia, than the middle *glutæus*, but is relatively larger in the *Apteryx* than in birds of flight, in which it is described as the *pyriformis* by Cuvier[3]. This muscle, however, besides its origin from the outside of the pelvis, overlaps part of the *glutæus medius*, and has its insertion into the femur at some distance below the great trochanter, all of which are marked characteristics of the *glutæus magnus*. *Origin.* It takes its origin from the superior margin of the os innominatum, extends along an inch and a quarter of that margin, directly above the hip-joint, and is chiefly attached by distinct short tendinous threads, which run down upon the external surface of the muscle: it rises also by carneous fibres from the external surface of the os innominatum for three lines below the superior margin. *Insertion.* The fibres converge and pass into a tendinous sheet, beginning on the external surface of the muscle half-way down its course, which ends in a broad, flat, strong tendon, inserted into a rising on the outer side of the femur nearly an inch below the great trochanter. It abducts and raises the femur.

Glutæus medius (Pl. XXXII. B).—*Origin.* This is the large, triangular, strong and thick muscle, which has an origin of three inches' extent from the rounded anterior and superior margin of the ilium, and from the contiguous outer surface of the bone for an extent varying from an inch to eight lines. *Ins.* Its fibres converge to a strong, short, broad and flat tendon, implanted in the external depression of the great trochanter, having a bursa mucosa interposed between the tendon and the bony elevation anterior to the depression.

[1] Leçons d'Anat. Comp. ed. 1836, tom. i. p. 502.

[2] Vergleich. Anat. 1828, Th. iii. p. 361.

[3] *Loc. cit.* p. 503; it is here called 'pyramidal.'

Glutæus minimus (Pl. XXXII. c).—*Origin.* It rises below and internal to the preceding muscle from the anterior and inferior extremity, and from one inch and three-fourths of the inferior and outer margin of the ilium, and contiguous external surface, as far as the origin of the *glutæus medius*; also by some fleshy fibres from the outside of the last rib. *Ins.* These fibres slightly converge as they pass backwards to terminate in a broad flat tendon which bends over the outer surface of the femur, to be inserted into the elevation anterior to the attachment of the *glutæus magnus*.

A muscle (Pl. XXXII. D.) which may be regarded either as a distinct accessory to, or a strip of the preceding one, arises immediately behind it from half an inch of the outer and inferior part of the ilium; its fibres run nearly parallel with those of the *glutæus minimus*, and terminate in a thin flat tendon, which similarly bends round the outer part of the femur, to be inserted into the outer and under part of the trochanter immediately below the tendon of the *glutæus medius*. This muscle and the preceding portion, or *glutæus minimus*, are described by Prof. Mayer[1] under the names of *Glutæus quartus* and *Glutæus quintus*, in the Cassowary; one of them is absent in most birds.

Use.—All the preceding muscles combine to draw the femur forwards, and to abduct and rotate it inwards.

Iliacus internus.—This is a somewhat short thick muscle, of a parallelogrammic form, fleshy throughout; rising from the tuberosity of the innominatum in front of the acetabulum immediately below the *glutæus minimus*, and inserted at a point corresponding to the inner trochanter, into the inner side of the femur near the head of that bone, which it thus adducts and rotates outwards. This muscle is present both in the Ostrich and Bustard, but Meckel[2] says it is wanting in the Cassowary.

Pyramidalis.—The same kind of modification which affects the *iliacus internus*, viz. the displacement of its origin from the inner surface of the ilium to a situation nearly external, affects this muscle, which, from its insertion and triangular form, I regard as the analogue of the *pyramidalis*. It arises fleshy from the outer surface of the ischium for the extent of an inch, and converges to a broad flat tendon which is inserted into the *trochanter femoris* opposite, but close to the tendon of the *glutæus minimus*, which it opposes, abducting and rotating the femur outwards.

Adductor brevis femoris (Pl. XXXII. E).—A small, long and slender muscle arises from the innominatum immediately behind the acetabulum, passes over the back part of the great trochanter, becomes partially tendinous, and is inserted into the back part of the femur in common with the following muscle.

Adductor longus (Pl. XXXII. XXXV. F).—A long, broad and thin muscle, separated from the preceding by the ischiadic nerve and artery. The origin of this muscle extends one inch and a quarter from near the upper margin of the innominatum which is behind the acetabulum; it is joined by the preceding strip, and is inserted into the whole of the lower two-thirds of the back part of the femur.

[1] Analekten fur Vergleich. Anatomie: 4to. 1839, p. 12.

[2] Arch. fur Physiol. xiii. 261.

Adductor magnus (Pl. XXXV. G).—This broad and flat muscle has an extensive origin (two inches) from the outer edge of the ischium and the obturator fascia; its fibres slightly diverge as they pass downwards to be inserted into the back part of the lower half of the femur, and into the upper and back part of the tibia.

Obturator internus.—This arises from the inner side of the opposite margins of the pubis and ischium, where they form the posterior boundary of the *obturator foramen*, and from the corresponding part of the *obturator fascia*; the fleshy fibres converge in a slightly penniform manner to the strong round tendon which glides through the notch, separated from the rest of the foramen by a short, strong, transverse, unossified ligament, and is inserted into the posterior part of the base of the trochanter. In its length and size this muscle resembles the corresponding one in the Ostrich and other Struthious birds.

Gemellus.—This is represented by a single small fleshy strip arising from the margin of the *obturator foramen*, close to the emergence of the tendon of the *obturator internus*, with which it is joined, and co-inserted into the femur.

Quadratus.—I consider a broad fleshy muscle which arises from the pubis, below the *obturator foramen*, and which increases in breadth to be inserted into the femur internal and posterior to the obturator tendon, to be the true analogue of the *quadratus femoris*.

Tensor vaginæ and *Rectus femoris* (Pl. XXXI. H).—The largest and most remarkable of the muscles which act upon the bones of the leg is that already alluded to as the most superficial of those on the outer side of the thigh. It has a broad, thin, triangular form, and arises from the spines of the sacrum by a strong but short aponeurosis which soon becomes fleshy; the carneous fibres converge as they descend[1], and pass into a thin aponeurosis at the lower third of the thigh: this is closely attached to the muscles beneath (*vastus externus* and *cruræus*), then spreads over the outer and anterior part of the knee-joint, is inserted into the patella, and into the anterior process of the head of the tibia.

Owing to the great antero-posterior extent of the origin of this muscle, its anterior fibres are calculated to act as a flexor, its posterior ones as an extensor of the femur: all together combine to abduct the thigh and extend the leg, unless when this is in a state of extreme flexion, when a few of the posterior fibres glide behind the centre of motion of the knee-joint.

Sartorius (Pl. XXXI. XXXV. I).—The origin of this muscle is characterized by an unusual extension, like that of the preceding, with which it is posteriorly continuous: it comes off aponeurotic, from the anterior and superior margin or labrum of the ilium; the fibres soon become fleshy, and the muscle diminishes in breadth and increases in thickness as it descends: it is inserted by short and strong tendinous filaments obliquely

[1] They are not divided into a superficial and deep layer, as in the Ostrich, but form a simple stratum, as in the Cassowary. Meckel regards the rectus as entirely wanting in the Cassowary, supposing, with Cuvier, the present muscle to be the analogue of the *glutæus maximus* and *tensor vaginæ* united. He says that Professor Nitzsch observed a like absence of the *rectus femoris* in the Emeu. Cuvier calls that muscle *rectus anticus femoris*, which is described in this monograph as the '*pectineus*.'

into the anterior part of the tendon of the broad rectus, and into the anterior and inner part of the head of the tibia. Its insertion is partly covered by the internal head of the *gastrocnemius*.

It bends and adducts the thigh, and extends the leg.

The homologue of the *Biceps flexor cruris* (Pl. XXXI. XXXII. K) is a unicipital muscle, corresponding with the *rectus extensor* in the characteristic modification of its extended origin, in relation to the great antero-posterior development of the pelvic bones: it is exposed by the removal of the *rectus*. *Orig.* By a broad and thin aponeurotic tendon, which at first is confluent with that of the *rectus* but soon becomes distinct, from the posterior prolongation of the ilium: there is no second head from the femur. *Ins.* The fleshy fibres converge as they descend along the back and outer part of the thigh, and finally terminate in a strong round tendon, which glides through a loop (*x*) formed, as in the common Fowl, Ostrich, &c., by a ligament extended from the back of the outer condyle of the femur to the head of the tibia, and is inserted into the process on the outside of the fibula one inch from its proximal extremity. By means of the loop the weight of the hinder parts of the body is partially transferred, when the leg is bent, to the distal end of the femur; and the biceps is enabled, by the same beautiful and simple mechanism, to effect a more rapid and extensive inflection of the leg than it otherwise could have produced by the simple contraction of its fibres.

Semimembranosus (Pl. XXXII. XXXV. L).—*Origin.* From the side of the coccygeal vertebræ, and from the posterior end of the ischium; it crosses the superficial or internal side of the *semitendinosus*. *Ins.* Into the fascia covering the *gastrocnemius* and the inside of the tibia: through the medium of the fascia it acts upon the tendon (R*) of the internal *gastrocnemius*.

Semitendinosus (Pl. XXXII. XXXV. M).—This muscle arises from the posterior and outer part of the *sacrum* and the aponeurosis connecting it with the *ischium*: it is a flattened triangular muscle, which receives the square *accessorius* muscle (N) from the lower and posterior part of the femur. It gradually diminishes as it descends, and having passed the knee-joint, sends off at right angles a broad and square sheet of aponeurosis, which glides between the two origins of the *gastrocnemius internus*, and is inserted into the lower part of the angular ridge continued from the inside of the head of the tibia. The terminal tendon, continued from the apex of the muscle, then runs along the outer or fibular margin of the internal head of the *gastrocnemius*, and becomes confluent with the tendon of that muscle at R* Pl. XXXV.

Cruræus (Pl. XXXII. XXXV. O).—This is a simple but strong muscle: it commences at the upper and anterior part of the thigh by two extremities, of which the outer and upper one, representing the *vastus externus*, has its origin extended to the base of the trochanter; the inner and inferior comes off from the inner side of the femur, beneath the insertion of the *glutæus magnus*; the two portions blend into one muscle much earlier than in the Ostrich. *Ins.* By the ligamentum patellæ into the fore-part of the head of the tibia.

Gracilis (Pl. XXXV. P).—On the inner side of the *cruræus*, but more superficially, lies a narrow, compressed, long muscle, which rises by two heads, one from the anterior and upper part of the femur, the other from the os pubis; both soon become blended together and transmit a broad thin tendon to be inserted into the lower and lateral part of the patella with the *cruræus*.

Vastus internus (Pl. XXXV. Q).—Two other muscles succeed the preceding, and rise beneath it from the inner and anterior part of the femur; they have a similar insertion, and obviously represent the *vastus internus*. The fibres converge to a middle aponeurosis, which increases to a strong short tendon, inserted into the upper and anterior projection of the tibia.

Popliteus.—This small muscle is brought into view when the superficial muscles of the leg which are inserted into the foot are removed. Its carneous fibres extend from the fibula inwards and downwards to the tibia. It is of relatively smaller extent than in the Cassowary.

Gastrocnemius.—This complex and powerful muscle consists, as in other birds, of several distinct portions, the chief of which correspond with the external and internal origins of the same muscle in the Mammalia. The *gastrocnemius externus* (Pl. XXXI. XXXII. R) arises by a strong, narrow, rather flattened tendon (R*) from the ridge above the external condyle of the femur, which, about an inch below its origin, becomes firmly attached to the strong ligamentous loop attached by one end to the femur above the preceding tendon, and by the other to the outer ridge of the fibula. This trochlear loop, which is displayed by reflecting down the tendon of the *gastrocnemius* in Pl. XXXII., is lined by synovial membrane, and supports the tendon of the *biceps cruris*, which glides through it. The carneous fibres of the external *gastrocnemius* come off from the outer side of the tendon, and from the fascia covering the outer surface of the muscles of the leg: they are continued in a somewhat penniform arrangement two-thirds down the leg, upon the inner surface of the muscle, where they end in a strong subcompressed tendon. This joins its fellow-tendon, from the internal *gastrocnemius*, behind the ankle-joint, and both expand into a thick, strong ligamentous aponeurosis (Pl. XXXII. fig. 2. R), which extends over three-fourths of the posterior part of the tarso-metatarsal bone. The lateral margins of this fascia are bent down under the flexor tendons behind the joint, and become continuous with a strong ligamentous layer gliding upon the posterior surface of the distal condyles of the tibia, and attached to the tendons of the *peroneus* and *tibialis anticus*: the conjunction of the thickened tendons of the *gastrocnemii* with this deeper-seated layer of ligamento-tendinous substance constitutes a trochlear sheath (Pl. XXXV. R***) lined by synovial membrane, through which the flexor tendons of the toes glide. The synovial membrane of the ankle-joint is continued upwards half an inch above the articular surface of the bone, between it and the fibro-cartilaginous pulley. Below the joint the margins are inserted into the lateral ridges of the tarso-metatarsal bone, becoming gradually thinner as they descend, and ending below in a thin semilunar edge directed downwards.

The *gastrocnemius internus* (Pl. XXXV. R) has two powerful heads, one from the femur, the other from the tibia; the first (R)[1] arises fleshy from the internal condyle of the femur, expands as it descends, and receives additional fibres from the lower edge of the *accessorius semitendinosi*. About one-fifth down the tibia this muscular origin in the right leg terminated in a flattened tendon (R*), which became attached to the inner side of the tibial portion of the *gastrocnemius internus* (R**). In the left leg the tendon soon divided; one portion passed to the soleus, the other went to join the tibial portion of the *gastrocnemius internus*. The second head, which is separated from the preceding by the insertion of the *semitendinosus*, arises partly from the internal and anterior part of the strong fascia of the knee-joint by short tendinous fibres, which almost immediately become fleshy, and partly from a well-defined triangular surface (R**) on the inner and anterior aspect of the head of the tibia: the fleshy fibres converge, receive the tendinous slip from the femoral portion, and end on the inner side of the muscle in a strong flattened tendon, about two-thirds down the leg: this joins the tendon of the *gastrocnemius externus* (R *e*), and is inserted as described above.

Soleus[2] (Pl. XXXV. s).—This is a slender flattened muscle arising from the posterior part of the head of the tibia, the tendon of which joins that of the *gastrocnemius internus*, behind the tarsal joint.

The *Flexor perforans digitorum* (Pl. XXXI. XXXII. XXXV. 1) lies immediately anterior to the external *gastrocnemius*; it arises fleshy from the outer condyle of the femur, below the tendinous origin of that muscle, and terminates in a slender flat tendon half-way down the leg. Its tendon (1) glides behind the tarsal joint through the sheath of the *gastrocnemius*, expands beneath the metatarsus and bifurcates, sending its smallest division to the inner toe, and its larger one to blend with the tendon of the *peroneus medius* (12).

Flexor perforatus of the outer toe (Pl. XXXI. XXXII. XXXV. 2).—This arises by very short tendons from the proximal end of the fibula, and from the ligament forming the bicipital pulley; it continues to derive a thin stratum of fleshy fibres from the fascia covering the anterior surface of the muscles of the leg: the fleshy fibres terminate half-way down the leg in a flattened tendon, which, after entering the gastrocnemial sheath, pierces the tendon of the first *perforatus* of the middle toe, then runs forward to the outer toe, expands into a thick ligamentous substance beneath the proximal phalanx, and sends off two tendinous attachments on each side, one to the proximal, the other to the second phalanx, and is continued to be finally inserted into both sides of the third phalanx.

Flexor perforatus digitorum (Pl. XXXII. XXXV. 3, 4, 5, 6) is the strongest of the three; it arises fleshy from the posterior part of the distal extremity of the femur, above the external condyle (Pl. XXXII. 4), and also by a distinct flattened tendon (6), one inch in

[1] This is described as the *soleus* in the Cassowary, by Prof. Mayer, *loc. cit.* p. 15, but the origin of this muscle is not extended in other animals above the knee-joint.

[2] This is described as the *plantaris* in the Cassowary, by Prof. Mayer, *loc. cit.* p. 14, but the normal origin of that muscle should be sought for above the knee-joint.

length, from the proximal end of the tibia: this tendon moreover receives the long slender tendon sent off obliquely across the front of the knee-joint from the *pectineus* (T), by which its origin is extended to the pelvis. This accessory tendon perforates the inner fleshy surface of the muscle, and is finally lost about half-way down the carneous part. Before the *flexor perforatus* is joined by the tendon of the *pectineus*, it subdivides posteriorly into four muscular fasciculi. The anterior division receives principally the above tendon, and this division of the muscle becomes wholly tendinous two-thirds down the leg; its tendon (3) passes through the posterior part of the pulley of the *gastrocnemius*, and expands as it passes along the metatarsus: a thick ligamentous substance is developed in it opposite the joint of the proximal phalanx of the second toe, into the sides of which it is inserted, dividing for that purpose, and giving passage to the two other flexor tendons of that toe. The second portion of the present muscle terminates in a tendon (4) situated behind the preceding, which passes through a distinct sheath behind the tarsal joint, expands into a sesamoid fibro-cartilage beneath the corresponding expansion of the previous tendon, which it perforates, and then becomes itself the perforated tendon of the second phalanx of the second toe, in the sides of which it is inserted. The third portion of this muscle ends in a somewhat smaller tendon (5) than the preceding, which forms the second *perforatus flexor* of the third or middle toe. The fourth and most posterior portion soon becomes a distinct muscle; its fleshy fibres cease on the inner side, one-fourth down the leg, but on the outside they are continued three-fourths down the leg; its tendon (6) passes through the gastrocnemial pulley behind the ankle-joint, and divides to form a sheath for the *flexor perforatus* of the fourth toe; it is then joined by the tendon of the *peroneus* (7), which passes through a pulley across the external malleolus, and finally becomes the perforated tendon of the first phalanx of the middle or third toe.

Pectineus (Pl. XXXII. XXXV. T), (*Rectus anticus femoris* of Cuvier[1] and Meckel[2]).—This is a long, thin, narrow strip of muscle arising from the spine of the pubis, anterior to the acetabulum, and passing straight down the inner side of the thigh; it degenerates into a small round tendon near the knee, which tendon traverses a pulley, formed by an oblique perforation in the strong rotular tendon of the extensors of the leg, and thus passing across the knee-joint to the outer side of the leg, finally expands, and is lost in the *flexor perforatus digitorum* last described. It is this muscle which causes the toes to be bent when the knee is bent.

Peroneus longus (Pl. XXXII. XXXV. 7).—*Origin.* Tendinous from the head of the tibia, and by carneous fibres from the upper half of the anterior margin of the tibia; these fibres pass obliquely to a marginal tendon, which becomes stronger and of a rounded form where it leaves the muscle. The tendon gives off a broad, thin, aponeurotic sheath to be inserted into the capsule of the tarsal joint; it is then continued through a synovial pulley on the side of the outer malleolus, and is finally inserted or continued into the perforated tendon of the middle toe (6).

[1] Leçons d'Anat. Comp. ed. 1836, p. 523.

[2] Vergleich. Anat., Th. iii. p. 365.

Tibialis anticus (Pl. XXXII. XXXV. 8).—This muscle is overlapped and concealed by the peroneus; it arises partly in common with that muscle, and partly by separate short tendinous threads from the outer part of the head of the tibia; it gradually becomes narrower, and finally tendinous two-thirds of the way down the leg; its strong tendon glides through the oblique pulley[1] in front of the distal end of the tibia, expands as it passes over the ankle-joint, and is inserted into the anterior part of the proximal end of the tarso-metatarsal bone, sending off a small tendinous slip to the aponeurosis covering the extensor tendons of the toes, and a strong tendon (8′) which joins the fibular side of the tendon of the following muscle.

Extensor longus digitorum (Pl. XXXV. 9).—This lies between the *tibialis anticus* and the front and outer facet of the tibia, from which it derives an extensive origin; its tendon commences half-way down the leg, runs along the anterior part of the bone, first under the broad ligamentous band representing the anterior part of the annular ligament, then through a ligamentous pulley, and inclines to the inner or tibial side of the anterior surface of the metatarsal bone, where it expands and divides into three tendons. Of these the innermost is given off first, and subdivides into two tendons, one of which goes to be inserted into the base of the last phalanx of the second toe; the other portion is principally inserted into the middle toe, but also sends off a small tendon to the inner side of the proximal phalanx of the second toe. The second tendon is inserted by distinct portions into the second, third and last phalanges of the middle toe. The third tendon supplies the outer toe.

Extensor brevis digitorum (Pl. XXXV. 10).—A small extensor muscle arises from the insertion of the *tibialis anticus*, and sends its tendon to the outer side of that of the great *extensor digitorum*.

Extensor pollicis brevis (Pl. XXXV. 11).—An extensor of the small innermost toe arises from the upper and inner side of the tarso-metatarsal bone.

Peroneus medius, Cuv., *Accessorius flexoris digitorum*, Vicq. d'Azyr (Pl. XXXII. XXXV. 12).—This strong penniform muscle arises fleshy from nearly the whole of the outer surface of the fibula, also from the posterior part of the tibia and the interosseous space; the tendon of the biceps perforates its upper part in passing to its insertion. It ends in a strong flat tendon at the lower third of the leg, which tendon runs through a particular sheath at the back part of the tarsal pulley, becomes thickened and expanded as it advances forwards beneath the tarsus, joins the tendon of the *flexor perforatus* (1), and forms with it the expansion which finally divides into three strong perforating tendons, which bend the last joints of the three long toes.

In the outer, or fourth toe, both the *perforans* and *perforatus* tendons are confined by a double annular ligament; the exterior one being continued from the adjoining toe, the inner and stronger one from the sides of the proximal phalanx of the outer toe.

[1] This is ossified in the Bustard and most true *Grallæ*.

The second and third toes have two perforated tendons; one inserted into the sides of the first, and the other into the sides of the second phalanx.

On a review of the details of the Muscular System above recorded, it will be seen that the analogies of the muscles on the dorsal aspect of the spine with those of Man and the Mammalia, are, in consequence of their unusually strong and distinct development in the Apteryx, more clearly traceable than their condition in other birds perhaps admits of. The same character of the muscles of the hind-extremity has led, as I believe, to a more accurate determination of them than had been adopted by former Comparative Anatomists, among whom the honoured names of Cuvier and Meckel call for a more detailed statement of the grounds on which I have ventured to dissent from views, so sanctioned, than has been given in the descriptive part of the present monograph.

The chief modification of the skeleton of the hind limb of Birds, in respect of size and proportion, is manifested in its central segment; the ossa innominata being anomalously expanded in order to include, as it were, in their grasp the whole of the very long sacrum required for the support of the horizontal trunk upon a single pair of extremities. The principal modification of the muscles of the leg attached to the ossa innominata might be expected, therefore, to be found in their origins. In the attachment of the fibres of a superficial muscle to the aponeurosis, continued from the outer part of the thigh, over the knee-joint, to the head of the tibia, we recognize the corresponding insertion of the *tensor vaginæ femoris* of Man and Mammalia; and no Comparative Anatomist appears to have thought the anomalous development and extensive origin of this muscle, in Birds, to be any objection to the homology indicated by its insertion, which is the attachment that mainly governs the function of a muscle. Now besides the attachment to the femoral fascia, we find this broad superficial muscle, and especially its middle and posterior fibres, terminating in a strong tendon, implanted into the upper part of the patella, and receiving fibres from the *cruræus* and *vasti* muscles which it immediately covers, and with which it concurs in constituting a *quadriceps extensor* of the leg. Here, therefore, we perceive the normal insertion, the normal function, and the true relative position of the *rectus femoris*: and shall we reject these concordances on account of the modification of unusually extended origin? By parity of reason, we ought to reject the admitted homology of the *tensor vaginæ*; and not only of this, but also of the *sartorius* and *biceps cruris*, both of which have undergone equal or greater modifications of origin in the class of Birds. It is true that the *glutæus maximus* is the most superficial of the outer muscles of the thigh in Man and Mammalia, and that it has the most extensive origin and largest size in Man; but superior size and extensive origin are far from being the characters of the *glutæus externus* in the lower Mammalia, in which it much more frequently

manifests the proportions, as compared with the *glutæus medius*, which the muscle to which I have assigned the name of *glutæus externus* in the Apteryx, presents. But if the *rectus femoris* has undergone, as I believe, a similar modification of origin to that which characterizes the *tensor vaginæ*, *sartorius* and *biceps*, it would, by its extension along the spines of the sacrum, cover and mask the true *glutæus externus*, which arises from part of the outer surface as well as from the crista of the ilium ; and by the same modification of the *rectus*, that connection between the *tensor* and *glutæus*, which is present in some quadrupeds, would be severed ; while the more common close proximity of origin of the *rectus* and *tensor* is maintained. Already, in the Kangaroo, we find the origin of the *rectus femoris* extending from above the acetabulum higher up than usual upon the iliac bone. If, therefore, the great superficial muscle in question does not include the *rectus femoris* with the *tensor vaginæ*, then, with the evidence of the true *glutæus externus* in the muscle A Pl. XXXII. of the Apteryx, I should feel bound to regard it as an enormous development of the *tensor vaginæ* alone.

Meckel assigns as his reason for regarding the muscle which I have called *glutæus externus* to be the *glutæus medius*, that its origin and relations to the other levators and abductors of the thigh are absolutely the same as the *glutæus medius* in Mammals[1]. It is, he says, covered by the *glutæus maximus*, meaning H Pl. XXXI., or the great 'pyramidal' of Vicq. d'Azyr ; but we are not bound to admit, in the absence of proof, that the great pyramidal of Vicq. d'Azyr is the *glutæus maximus* ; and until this be satisfactorily established the argument is of no weight. Reasons have been already given for regarding the *glutæus externus* of Meckel as the combined *tensor vaginæ* and *rectus femoris*. The true *glutæus externus* is hidden in most birds, by the extraordinary extension of the origin of the *rectus extensor cruris* on one side, and of the *biceps flexor cruris* on the other ; but, though covered, the *glutæus externus* is the outermost of the three *glutæi* which are recognizable in the Apteryx. The more posterior position of its origin and its lower insertion, together with its inferiority of size as compared with the muscle which I have called *glutæus medius*, are characters which the *glutæus externus* of the Apteryx has in common with that muscle in most Mammalia, and especially in the genera *Macropus* and *Dipus*, which most resemble Struthious birds in the proportions and functions of their locomotive extremities.

To attempt to conceive the muscle Pl. XXXII. A. to be the homologue of the *pyriformis* involves so anomalous an inversion of position in respect of the pelvis, of relations to other muscles inserted into the proximal part of the femur, and of both origin and insertion, as can only be accounted for by the difficulty in which Cuvier, having recognized the true *glutæus medius*, found himself in respect to the homologue of the *glutæus externus*, having applied the name of that muscle to the expanded *tensor* and *rectus*, by which it is covered.

[1] *Loc. cit.* p. 352.

The remarkable concordance of the muscles of the rudimental wing in the Apteryx with those in ordinary birds of flight, has been already pointed out. Nor is the correspondence less remarkable in the muscles of the leg and foot, especially as manifested in the condition of the 'perching muscle' (*pectineus*), in which it could hardly have been anticipated. The strong flexors and extensors of the leg and toes are strictly adapted to the exigencies of a bird which obtains probably most of its nourishment from the earth by means of feet resembling those of the *Gallinacea*, and which owes its safety to the speed with which it runs by means of legs which have almost the proportions of those of the Struthious tribe; and which, finally, is reported to seek concealment and to incubate in subterraneous burrows.

Female Organs of the Apteryx australis.

The trunk of a specimen of this species, transmitted to me from New Zealand by the lamented botanist Mr. Cunningham, having proved to be that of a female, enables me to add to this anatomical monograph the description of the organs of generation in that sex. These consisted of two ovaria and one oviduct. The right ovarium (Pl. XXXVI. *a*), was, as usual in Birds, in an atrophied state, and situated in front of the corresponding suprarenal body, attached to that body and the adjoining trunk of the *vena cava*. It was a small, flattened, minutely granular body, measuring eight lines by five lines, and about one line in thickness.

The left ovarium (Pl. XXXVI. *b*) was in a state of full development, of the usual racemose structure, consisting principally of one enormous calyx (*b*), ripe for dehiscence, containing the vitellus of an ovum, which measured three inches in length by two inches in breadth, indicating an unusually large egg for the size of the bird. All the other calyces were comparatively small, and the greater number of minute size.

The oviduct commenced by the usual simple unfringed or entire slit-shaped aperture (*c*), two inches in its long diameter: the tube soon contracted to a diameter of half an inch, with longitudinally plicated walls, indicating its dilatability: it then expanded to an inch diameter, and after slightly contracting, suddenly enlarged, to form the uterine or shell-secreting part (*d*), which was nearly one inch and a half in diameter; here the muscular tunic is thicker, and the lining membrane presents a peculiar character, consisting of transverse, linear, sub-parallel streaks, sending off numerous short processes at right angles, both streaks and processes being of a white colour, relieved by the darker mucous membrane. A magnified portion of this structure is given at fig. 2. This structure occupied nearly two inches of the uterine dilatation, which reassumed the longitudinal plications about one inch before terminating in the uro-genital compartment of the cloaca. The terminal outlet (*e*) is of a narrow elliptical form, with a tumid margin covering a sphincteric arrangement of the muscular fibres.

DESCRIPTION OF THE PLATES.

(The figures are reduced one half the natural size.)

Plate XXXI. Side view of the superficial muscles.

Plate XXXII. Side view of the second layer of muscles.

Plate XXXIII. Side views of the deeper seated muscles of the back and neck.

Plate XXXIV. Side and front views of the second layer of muscles of the neck.

Plate XXXV. Front view of the muscles of the Apteryx.

PLATE XXXVI.

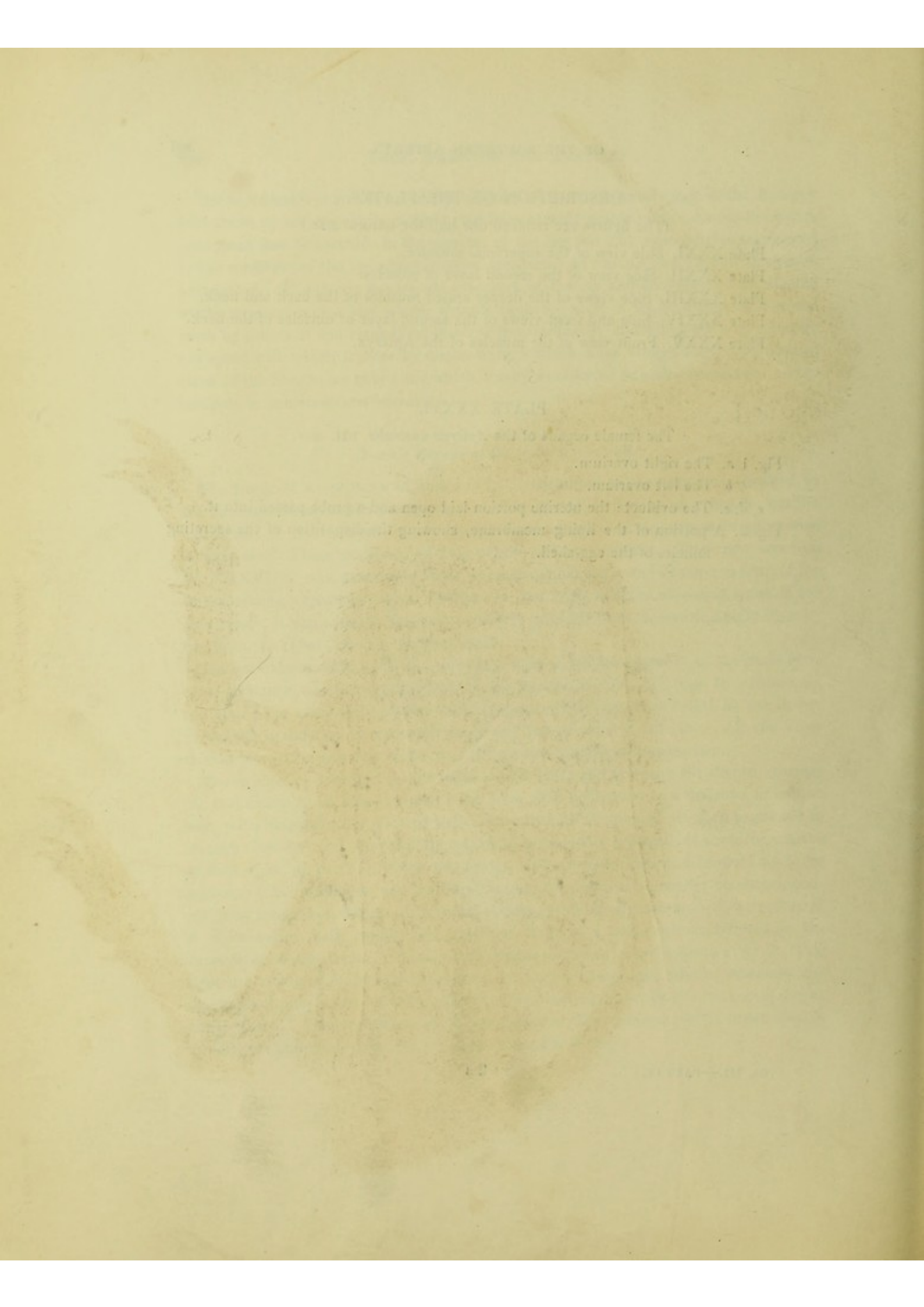
The female organs of the *Apteryx australis*, nat. size.

Fig. 1 *a*. The right ovarium.

b. The left ovarium.

c, *d*, *e*. The oviduct: the uterine portion laid open and a probe passed into it.

Fig. 2. A portion of the lining membrane, showing the disposition of the secreting follicles of the egg-shell.



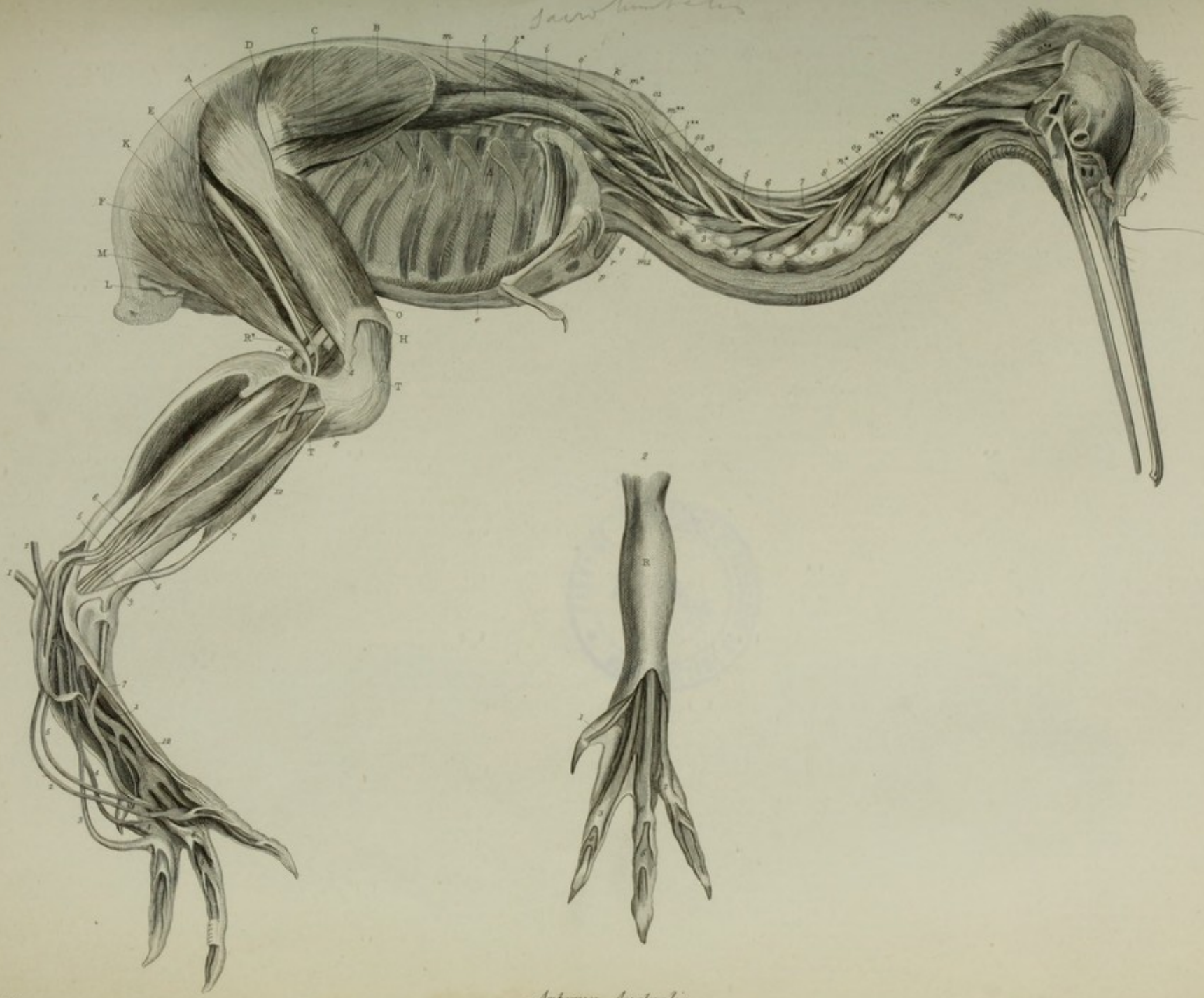
Trans. Zool. Soc. Vol. 3. Pl. 31. p. 310.

R.O. & W. Scharf. del.

Apteryx Australis.

Scale $\frac{1}{4}^{th}$ the natural size.

J. Basire. sc.

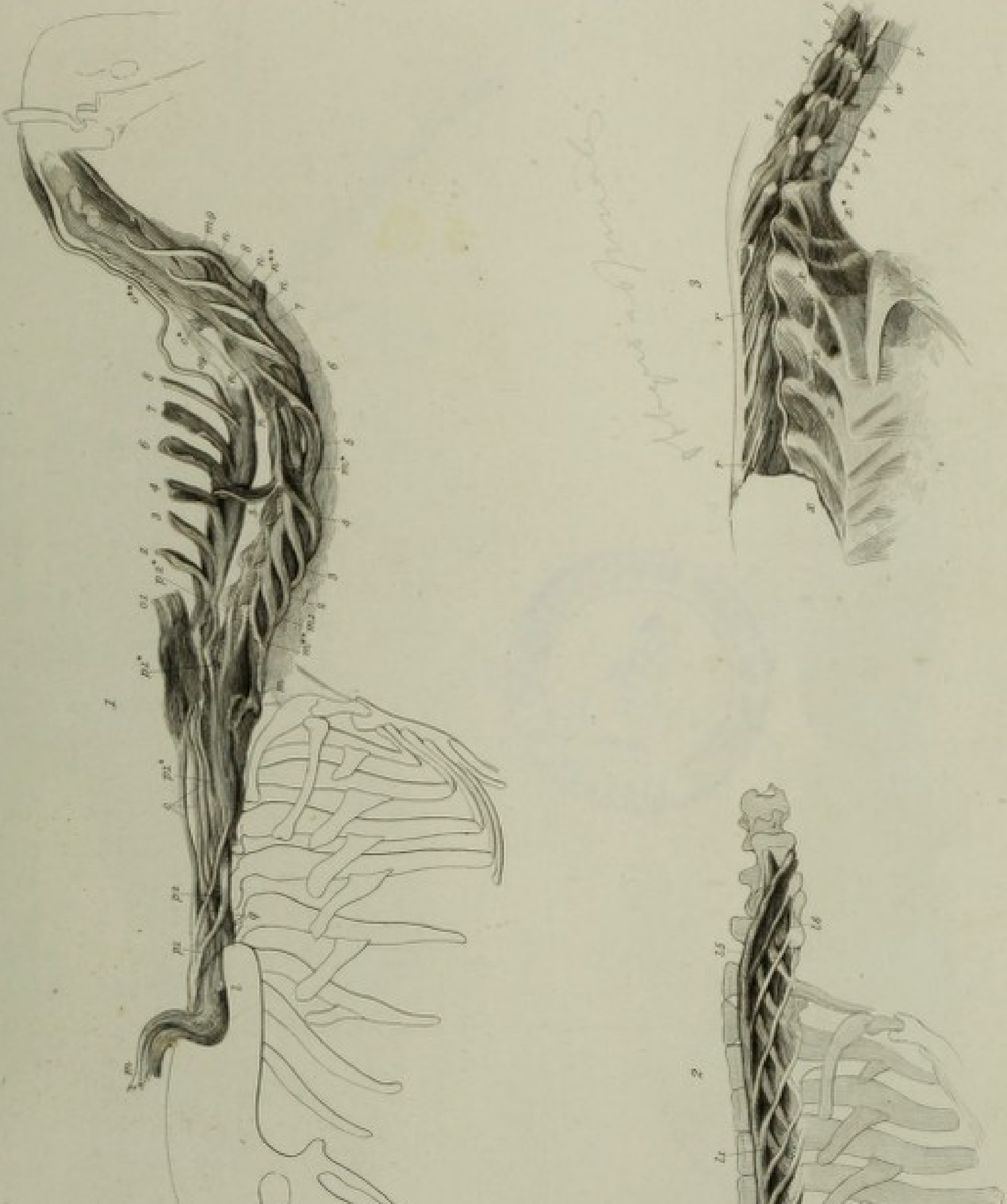


Apteryx Australis.

Scale ½ the natural size.

R.O. & W. Scharf del.

J. Basire sc.



Apteryx Australis.

R. O. & W. Scharf. del. — Scale 4ths the natural size. — J. Basire sc.

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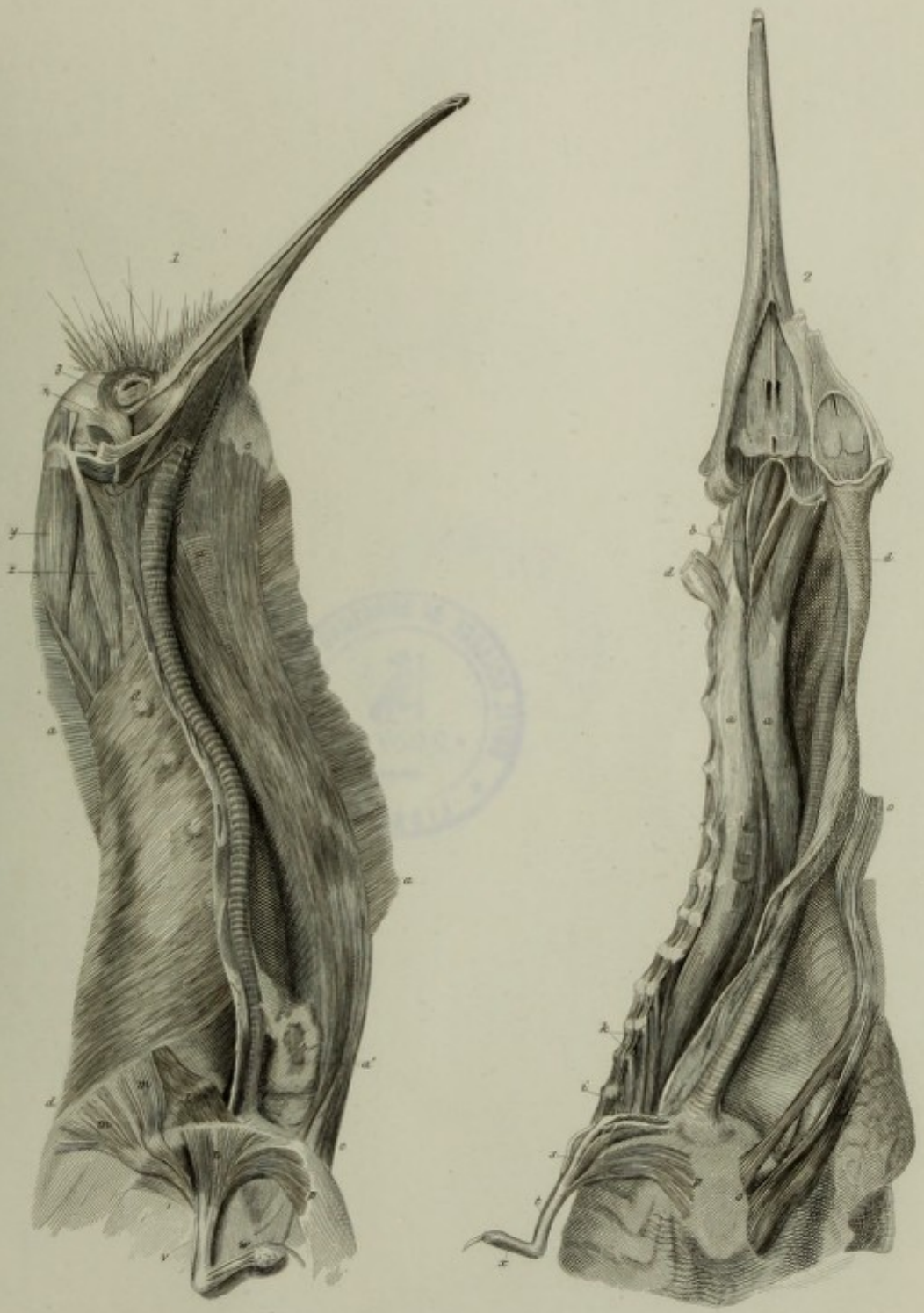


Apteryx Australis.

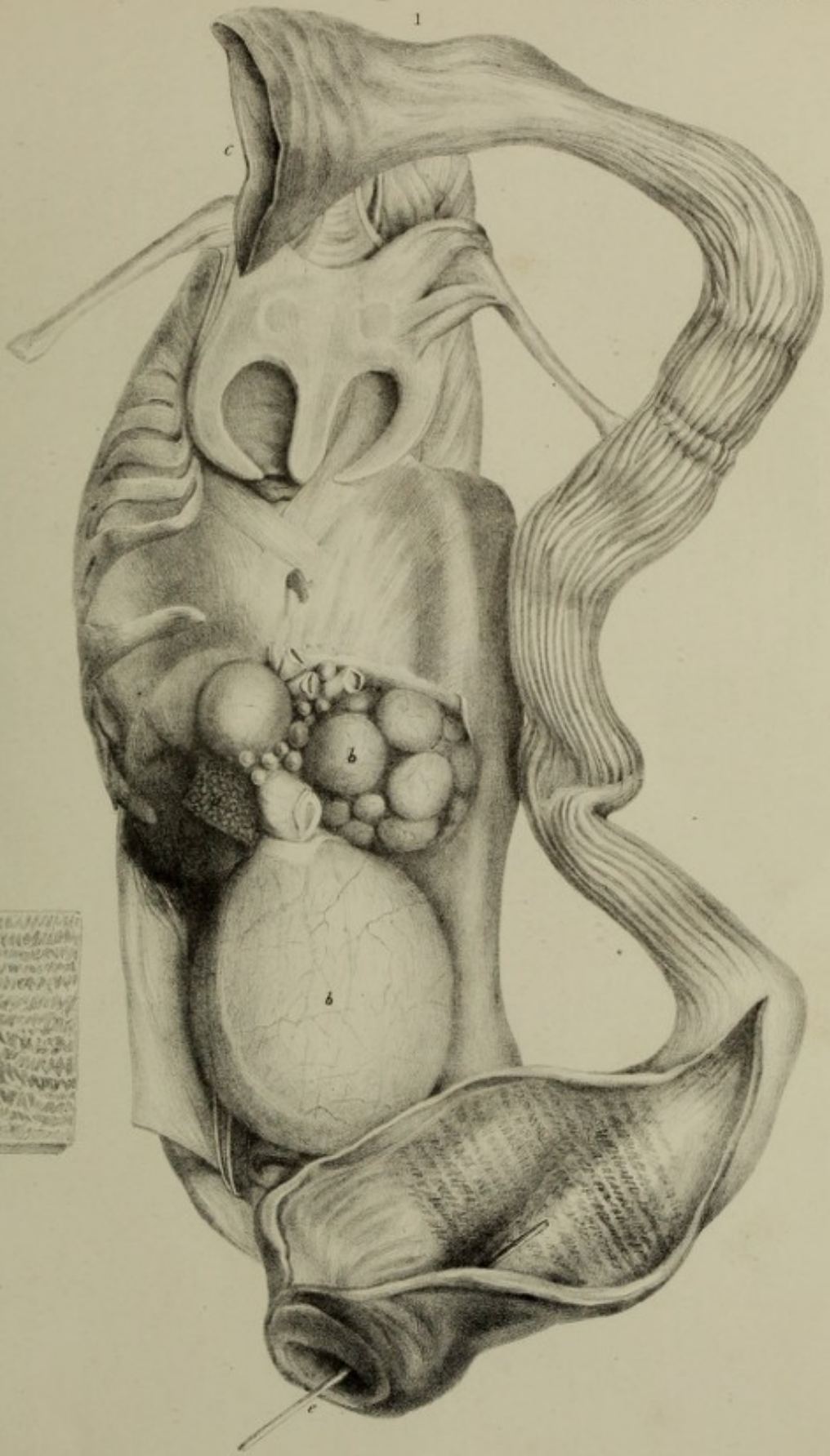
Scale $\frac{1}{4}$ the natural size.

R.O. & W. Scharf. lith.

J. Basire sc.

Apteryx Australis.

Trans. Zool. Soc. Vol. 3. Pl. 36. p. 310.



Erxleben, Zinc.

Day & Haghe, Lith.rs to the Queen.

Apteryx australis