IX. *On the Anatomy of the Great Anteater* (Myrmecophaga jubata, *Linn.*).

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

Read July 25, 1854.

THE energetic administration of the Zoological Society of London, besides adding to the means of instruction and instructive recreation for the millions who reside in or visit the metropolis, is not less operative in advancing the purely scientific aims of the Fellows of the Society.

Already the 'Transactions' and other publications of the Society contain the records of the organization of many rare animals, unknown, at least anatomically, before their exhibition in the Menagerie in the Regent's Park; and in addition to former Monographs, including those on the Giraffe, Phacochere, Walrus, and Rhinoceros, I have now the good fortune to be able to communicate the commencement of one on the Great Anteater of South America.

The subject of the present description was a full-grown female animal which was received at the Gardens in the Regent's Park, September 29, 1853, and there died, July 6, 1854. Contemporary notices of the peculiarities of its external form, modes of motion, particularly of its large, vertically fan-shaped, long-fringed tail, when the animal, coiled up for repose, covered itself with that portable blanket, preclude the necessity of premising much on these subjects; for information on which I may refer more particularly to the 'Literary Gazette,' No. 1916, for October 8, 1853, to Mr. Broderip's most interesting Paper in the No. of 'Fraser's Magazine' for February 1844, and to the excellent articles in the 'Household Words,' and the periodical entitled 'Excelsior.'

The weight of the entire animal at the time of its death was 62 lbs. avoirdupois. [Since communicating an account of the anatomy of this animal to the Scientific Meeting of the Zoological Society, July 25, 1854, a male Anteater of the same species (*Myrmecophaga jubata*), not quite fully grown, has also been examined by me, and the present memoir combines the results of both dissections.]

External Peculiarities and Dermal Muscles.

The following remarks on some external peculiarities, as observed in the recent animal, seemed to be worthy of recording.

The length of the naked sole of the fore foot, from the base of the middle claw to the back part of the carpal pad, is five inches. The distal half of the ungual phalanx of the first toe, or 'pollex,' projects from the common cutaneous sheath of the toes; it supports a slender curved claw one inch three lines long by three lines in greatest breadth. The end of the second phalanx, with the ungual phalanx of the second toe, 'index,' projects freely: the length of the exposed part of the claw is three inches, its basal diameter six

lines: this claw is curved, with its inner border and convex extremity trenchant; it can be bent so as to touch the carpal pad, but cannot be extended so as to bring the end of the claw in the line of the digit; its movements are limited to one plane. The ungual phalanx of the third digit, 'medius,' is free: the length of the claw following the convex curvature is four inches, its greatest basal breadth nine lines; its basal circumference two inches six lines; its under surface is flat, bounded by trenchant borders; its extremity is more pointed than that of the index; it can be bent so as to touch the carpal pad, but forms an obtuse angle downwards with the digit in a state of greatest extension. The second and ungual phalanges of the fourth digit are free; they are compressed, and terminate in a straight compressed pointed claw six lines in length; the joint of the last phalanx permits a slight extent of flexion and extension, and of free movement from side to side. A semilunar notch on the outside of the base of the liberated portion of the fourth digit indicates the extremity of the abortive fifth digit. This, with the metacarpal and proximal phalanx of the fourth, supports a convex callous pad at the outer and under part of the sole, two inches by one inch and a half in extent. The corium of this digital pad is developed into a number of large, low, obtuse papillæ, perforated or notched at the apex and covered by larger and more complex papillæ of the thickened cuticle. The carpal pad is smaller, of a kidney shape, one inch five lines in breadth. The part of the foot which receives the superincumbent weight in ordinary progression is the digital pad, and the outer side of the free portion of the compressed fourth digit.

The length of the sole of the hind-foot is five inches. The naked part begins about one inch in advance of the prominence of the calcaneum: the breadth of the sole at the base of the digits is two inches six lines, and there is a callosity at the inner margin one and a half inch behind the innermost digit, upon which the supplementary tarsal ossicle rests. Each of the five digits has the second as well as the ungual phalanges liberated, and each supports a curved, obtuse claw, about one inch in length, but somewhat longer on the middle digit and shorter on the outer digit. The three middle digits project the furthest, and their claws terminate at the same line: the outermost or fifth digit ends a little short of these, and the innermost digit is still shorter.

The integument of the Great Anteater has something of a pachydermal character; and although there is not any extensively diffused *panniculus carnosus*, there are some well-developed dermal muscles having attachments to parts of the endo-skeleton.

The corium between the rami of the lower jaw is one line in thickness, and increases as the skin approaches the sternum to a thickness of three lines, which is its average thickness over the back and sides of the trunk; it becomes rather thinner where it covers the abdomen, and upon the limbs.

The skin is connected to the subjacent muscles, by a thin layer of tough elastic cellular substance, along the under part of the neck; but, near the sternum, and over the fore part of the sternum, the lobules of an immense salivary gland, resembling fat-lobules at first sight, were found interposed. Pressure upon this glandular mass (Pl. XXXVII. fig. 1, *a*, *a'*)—the size, shape, and disposition of which will afterward be

noticed,—was followed by the escape of thick tenacious mucoid saliva from the mouth, where it was poured out of two apertures, situated one a little behind the other, and both within six lines of the anterior border of the lower lip. After squeezing out much of the muco-salivary fluid, which presented a nearly clear opaline appearance when collected in a moderate quantity, an injection of size and vermilion was thrown into both orifices, whereupon the course of the long ducts became indicated by their tumefaction, especially at the base of the neck, where they dilated into reservoirs (*ib. c, c*), before communicating, as at *b*, immediately with the glands. The body of the hyoid, the epihyals, and the bases of the ceratohyals formed a bilobed prominence (*ib. l, l*) just anterior to the chief mass of the great salivary gland, and twenty-two inches behind the opening of the mouth.

The ordinary course of dissection was then proceeded with. Before carrying the incision along the abdominal integuments, the nipples were searched for: only one pair was found. Each nipple is subcompressed, subquadrate, about half an inch in length, with from ten to twelve lacteal orifices; it is situated four inches behind the axilla, nearly opposite the lower border of the pectoralis major. The mammæ may be said to be post-pectoral in position. The common cloacal aperture is situated beneath the root of the tail, on a prominence of soft integument, in shape like the letter T with the cross slightly bent, and the stem directed forwards, and forming the fissure where the urogenital canal opens. The tumid sides of this fissure, representing the labia majora, have their hinder ends overlapped by the crescentic fold, bounding the anus behind, the horns of which fold are bent forward and terminate outside the labia: the soft vascular lining of the vulva is continued by a short narrow median strip directly into that of the rectum.

On reflecting the skin from the under part of the head, the attention was first directed to a feeble development of a panniculus carnosus in the form of thin transverse fasciculi (*ib. e, e*) about half an inch in breadth, and occurring at intervals of from two to three inches, where they underlie the rami of the slender elongated under-jaw, and of the breadth of an inch and a half where they lie below the base of the cranium; these muscular strips (*dermogulares*) have their attachments exclusively in the integument, and aid in accommodating its movements to the alternating expansion and contraction of the great gular dilatation (Pl. XXXIX. fig. 3, *p, q*) near the base of the tongue. The transverse fasciculi are crossed by a longitudinal strip of cutaneous muscle (*dermolabialis posticus*, Pl. XXXVII. fig. 1, *f*) on each side of the under part of the head and neck; the strip emerges from beneath the fore part of the great subpectoral gland, *a*, is here very thin, and about six lines in breadth; it diminishes in breadth and increases in thickness as it extends forwards, assuming near the mouth the character of a muscle independent of the skin (Pl. XXXIX. fig. 1, *t*); where, passing beneath the tendon of the *retractor anguli oris, ib. f*, it is inserted into, or blends with, the fibres of an accessory portion of the *orbicularis oris* (*ib. r*). A shorter longitudinal muscular strip (*dermolabialis anticus*, Pl. XXXVII. fig. 1, *f''*) arises from the integument below the

fore part of the preceding muscle, becomes free as it advances (Pl. XXXIX. fig. 1, *s*), and is inserted into the proper *orbicularis oris* (*ib. q*).

Between the integument of the abdomen and the abdominal 'panniculus,' there is a layer of tough elastic cellular tissue like a fascia. On reflecting this, a broad layer of muscular fibres (*dermo-abdominalis*) is exposed, which covers the proper abdominal muscles. The flattened and slightly separated fasciculi of this dermal muscle arise from the fascia covering the anterior and inferior part of the sternum and contiguous sternal ribs; also from a median raphé of the subcutaneous fascia, attached to the linea alba, and extending two-thirds of the way towards the pubis. The anterior two-thirds of the above muscular sheet are joined by a broad layer of similar flattened fasciculi coming off from a fascia covering the side of the thorax, and the muscle so formed passes obliquely downwards and outwards, converging to form a thick fleshy band, about two inches broad, which is continued along the inner and upper part of the thigh, and becomes slightly twisted prior to its attachment to the aponeurosis covering the knee-joint. The posterior portion of the dermo-abdominalis consists of thinner and more scattered flattened fasciculi which pass outwards and downwards, and, as they diverge from the median line, are lost in the subcutaneous fascia covering the tendinous expansion of the *obliquus externus abdominis*. Between the dermo-abdominalis and the proper abdominal muscles there is a moderately thick layer of elastic cellular tissue.

Reserving the details of the muscular system in general for a subsequent communication, I proceed next to the visceral anatomy of the Great Anteater.

Thoracic and Abdominal Cavities, and general disposition of their Viscera.

On opening the abdomen, the liver is seen arching across the upper part of the abdominal cavity from the right to the left hypochondrium. The suspensory ligament enters a cleft to the left of the median plane, near the left end of the middle or cystic division, but not extending to within two inches of the anterior border of that division. To the right of the ligament is a wide subcircular notch, through which the fundus of the gall-bladder projects. Below the cystic lobe appears a prominent portion of the stomach, opposite the right side of the ensiform cartilage. The right lobe of the liver occupies the right hypochondrium, and between it and the stomach is seen a short convolution of the duodenum with the head of the pancreas. The spleen, a long and narrow organ, appears below the left half of the liver, between it and the stomach, and then bends downward and to the right, overlapping the middle constriction of the stomach. A short epiploon, without fat, extends from the spleen over the left division of the stomach which is seen projecting below the spleen. The epiploon is reflected back to a line a little behind the greater curvature of the stomach. The convolutions of the alimentary canal occupy the rest of the exposed part of the abdominal cavity. A thin layer of fat was interposed between the peritoneum and the soft walls of the abdomen.

One common duplicature of peritoneum, continued from the middle of the back part of the abdomen, and eighteen inches in extent where it is broadest, at the junction of the ileum with the colon, supports the whole intestinal canal, as in most reptiles,—mesentery, mesocolon and mesorectum being one and the same fold: the shorter diameter of this fold is from eight to ten inches. The mesenteric part is puckered to support the convolutions of the small intestines. A mesenteric gland of a dark colour is continued along the base-line of these plicæ for the extent of sixteen inches, beginning at the duodenal end of the pancreas and ending with the ileum. Parallel with this, on what may be regarded as the base-line of the mesocolon, are a number of detached glands of the same dark colour, and flattened, like the long mesenteric gland, but of a subcircular form, and from three lines to twelve lines in diameter. The mesenteric artery forms one series of arches, with their convexity at from six to twelve lines distance from the gut. The mesocolic vessels form also one series of arches, which are close to the gut.

The duodenum, arching round the head of the pancreas, is suspended on the beginning of the mesentery, where it is from two to three inches broad; and it is continued into the jejunum without being tied by a contraction of the mesentery to the back of the abdomen, as in most Mammalia. The right lobe of the liver is suspended to the dome of the diaphragm by a right coronary ligament, and a duplicature of peritoneum connects the extremity of that hepatic lobe to the upper part of the right kidney. There is also a left coronary ligament: a fold of peritoneum two inches broad connects the left lobe of the liver with the stomach at the fore part of the cardia; and a more posterior fold connects the left lobe of the liver to the left suprarenal body and left kidney. The peritoneum passes over the under surface (sternal aspect) of the kidneys, and over the same part of the right suprarenal body: it affords a more entire covering to the left suprarenal body. The peritoneal folds called 'broad ligaments' begin to be reflected from the front of the lower ends of the kidneys, converging to sustain the ovaria and enclose the ovarian ligaments, fallopian tubes, uterus, and ureters. The urinary bladder was empty and corrugated: the urachal fold, reflected from the middle of its fore part to near the fundus, expands as it extends to the lower part of the linea alba, terminating above at the obliterated umbilicus which is situated six inches above the symphysis pubis. A flat glandular body about the size of an almond was situated in the urachal fold: it might be the debris of part of an umbilical sac. Two narrow ureteral folds of peritoneum diverge from the back part of the urinary bladder to the broad ligaments.

The length of the female from the muzzle to the vent was four feet seven inches; the length of the head was fourteen inches; that of the tail thirty-three inches. The total length of the intestinal canal was thirty-four feet; the small intestines measuring thirty feet in length. The ileum dilates rapidly into the colon, which commences without any cæcal projection. The greatest circumference of the duodenum is two and a half inches:

the calibre of the intestinal canal gradually contracts to a circumference of one inch nine lines at the part which would be called jejunum in Man, and it recovers a circumference of three inches near the end of the ileum. The colon, within three inches of the ileum, has a circumference of nine and a half inches; and has decreased to a circumference of six inches, where it forms the rectum, about nine inches from the anus.

The inner surface of the duodenum and jejunum is smooth, offering no villi to the naked eye. A few irregular very narrow longitudinal folds of the lining membrane, not parallel to, but following one another, begin to appear in the ileum: these are succeeded by a longer longitudinal fold, or two, which are soon followed by one extending continuously through the ileum, along the side of the gut opposite the attachment of the mesentery: this fold is from two to three lines in breadth, is narrowest where the canal has been most distended, but is not obliterated by the utmost dilatation of the gut: it is a permanent single longitudinal production of the vascular lining membrane, and forms the chief characteristic of the lower half of the small intestines in the *Myrmecophaga jubata*. In this part of the canal there are patches of glandulæ agminatæ from one to two inches long, and with intervals of about one foot.

The transition of the ileum into the colon is effected by a rapid increase of diameter, viz. from one inch to two and a half inches; by a slight thickening of the muscular coat; by the appearance of a few transverse ridges or very low folds of the mucous membrane at the beginning of the colon, and not extending round the circumference of the gut: but the boundary of the ileum is not defined by any ileo-colic valve nor by any appreciable alteration in the vascularity or other structure of the mucous membrane in the two divisions of the intestinal canal.

The inner surface of the colon is smooth, finely reticulate, with a few very narrow transverse folds, from one inch to half an inch apart, subsiding for the most part before reaching the attached line of the gut; these folds are not obliterated when the canal is fully distended; they commence about eighteen inches from the ileum, gradually become shorter and narrower, and disappear about a foot from the rectum.

The longitudinal folds of the rectum extend to the margin of the anus, where a little dark pigment is developed under the epithelium. The soft epithelial-covered integument extends from the fore part of the anus to the vulva, which is distant about half an inch. The longitudinal muscular fasciculi of the rectum and rectal end of the cloaca are strongly marked, and are from one line to one line and a half in breadth.

In the thorax, a mediastinum, increasing in breadth from two to three inches as it passes backward from the aortic arch, completely divides that cavity into a right and left compartment; the heart and pericardium projecting equally into both. A peculiar subcompartment of the right pleural cavity is formed by a duplicature of pleura extending from the right division of the mediastinum and from the lower part of the pericardium around the inferior cava, into which compartment the lobulus azygos from the right lung projects.

The structure of the thoracic and abdominal viscera will form the subject of a succeeding part of the present memoir.

Salivary Glands.

The glandular mass representing the submaxillary salivary glands in Man (Pl. XXXVII. fig. 1, *a*, *a'*), is a bilobed body, sixteen inches in length, two inches in greatest thickness at the posterior part which forms the isthmus or junction of the two lobes or glands. From this confluent base they diverge, extending outwards and forwards, and form, each, a flattened triangular mass, from four to five inches in breadth and two inches thick posteriorly, and becoming thinner towards the outer and anterior border, where the apex is prolonged into a slender process. The isthmus, or base of the combined glands, overlies the anterior half of the thorax; the base of each lateral lobe is notched by the prominence of the shoulder-joint (*s*, *s*), round which its outer border extends; the contracting anterior prolongations of the gland pass forwards along the sides of the neck, external to the sterno-maxillares (*w*, *w*), and terminate a little in advance of the angle of the jaw, at *a'*.

The two packets of ducts (*ib. b*, *b*, figs. 1 & 2), which indicate the essential doubleness of the gland, emerge from the inner and posterior part of the lateral lobes, five or six inches in a straight line from the posterior border of the isthmus, and nine or ten inches from the anterior attenuated extremity of the gland. After a short course, the ducts dilate and form a small reservoir, *ib. e*, on each side; they are here so closely covered and connected by elastic cellular tissue as to seem a single reservoir; they maintain however their distinctness, and continue, contracted, from each dilatation, as three closely united attenuated ducts, which at length unite into one long and slender duct. The dilated portion is surrounded by a compressor muscle (*constrictor salivaris*, *ib.* fig. 3, *k*).

The gland is conglomerate, the primary lobes being for the most part oblong, subcompressed, from about three to nine lines in diameter. The closely united ducts (*d*, *d*), after quitting the reservoir, are continued forwards covered by the extraordinarily extended *mylohyoideus* (*g*, *h*, *i*, *j*), and, after their union, the common duct terminates, as above described, at the symphysis of the lower jaw (Pl. XXXIX. fig. 3, *d*).

The parotid gland (*ib.* fig. 1, *x*) is small in proportion to the animal: it is situated in front and below the root of the ear, is of a triangular form, two inches four lines in length, one inch two lines in breadth, with the duct continued from the outer side of the anterior apex of the gland, which apex terminates at the posterior end of the origin of the masseter muscle. The duct (*ib. y*) extends forwards along the outside of the masseter near its origin, passes along the buccinator near its upper border and beneath the tendons of three of the retractors of the mouth, then dips under the orbicularis oris (*q*, *q*), and terminates near the opening of the mouth. The length of the duct is eleven inches, its diameter scarcely half a line. This is perhaps the longest duct, in proportion to the size of the gland, in the animal kingdom. The depressor auris (*w*),

which arises from the angle of the jaw, perforates the parotid gland. A chain of lymphatic glands is continued backward from beneath the parotid on the side of the neck.

The representative of the sublingual gland forms a thin layer, divided for the most part into narrow elongated lobes or groups of follicles (Pl. XXXIX. fig. 2, *fa*), attached to and spread over the inferior buccal membrane for an extent of twelve inches: the greatest breadth of this layer is two and a half inches, and is opposite the angle of the jaw.

There is a small elongated labial gland (*ib.* fig. 2, *z*), lying upon the fore part of the buccinator, near its lower border, and sending its secretion into the side of the fore part of the mouth; apparently to lubricate that contracted aperture during the frequent and rapid protrusive and retractile movements of the tongue. The buccal glands form a very extensive but extremely thin stratum of muco-glandular follicles, closely attached to the thin membrane of the mouth; they are chiefly developed at the lower and lateral parts, and along the middle of the upper surface of that part of the mouth which is prolonged backward, below the similarly prolonged nasal canal, beyond the bony palate. These glands terminate by innumerable very minute orifices upon the smooth inner surface of the buccal membrane, which they serve to lubricate. They are continuous with the better-marked series of follicles extending along the sides of the under surface of the mouth, beneath the lower jaw, which represent the 'sublinguales.' But the glands that pour out the abundant viscid secretion which lubricates the tongue and is mainly subservient to its peculiar prehensile function in the Great Anteater, are those conjoined or interblended pair that answer to the submaxillary salivary glands in other animals; which glands are most modified and developed, for a like function, in other species of *Myrmecophaga*, in the Armadillos (*Dasypus*), and in the Echidna.

In the little scansorial *Myrmecophaga didactyla*, the homologues of the submaxillary glands (Pl. XL. fig. 3, *c*, *c*) are subcervical and blended together, as in the larger species; and a slender process (*d*) is continued from them to the labial gland, *a*. The duct (*e*) commences by three tubes continued on each side from the main body of the gland; and these tubes dilate into a small reservoir, provided with a compressor muscle, before the long and slender single duct is continued, covered by the mylohyoideus, to the symphysis of the jaw. The parotid gland is of very small relative size; and this striking difference in the proportions of the two chief salivary glands indicates the difference in their functions and in the quality of their respective secretions. The labial glands (*a*) are relatively larger in the *Myrmecophaga didactyla* than in the *Myrmecophaga jubata*; and there is a superadded aggregate of mucous follicles (*b*) behind the eyeball, in the shallow orbit of the smaller species, the secretion of which enters near the angle of the mouth.

In the Armadillos (*Dasypus*), the submaxillary glands are subcervical in position, and, though large, are relatively less than in the true Anteaters (*Myrmecophaga*); they are also disunited, but come into contact at their lower extremities. Figure 1 of Pl. XL. represents these glands, *in situ*, of the natural size, in the specimen of the *Dasypus sexcinctus* described by me in the Proceedings of the Zoological Society for July 1832,

p. 130. The salivary bladder (*e*) is relatively larger than in the Great Anteater, and is a simple pyriform sacculus receiving the secretion of the great gland by three or four short ducts, entering obliquely at its fundus: the apex of the bladder is continued into the long and slender duct which terminates in the mouth just behind the symphysis mandibulæ. Figure 2 of Pl. XL. shows a further dissection of the right submaxillary salivary gland and bladder in another species of Armadillo (*Dasypus Peba*[1]). The saliva which these reservoirs contain is very tenacious, the serous part being probably absorbed during its detention. Thus prepared and accumulated, it is expelled at the extremity of the mouth, in order to lubricate the tongue, which is thus, as in the Anteaters, made subservient to the catching of insects[2].

In the Spiny Anteater of Australia (*Echidna*), the homologues of the submaxillaries are as largely developed as in the hairy Anteaters of America, and are subpectoral and subcervical in position; but they are not blended together. The primary lobes are fewer and larger than in the *Myrmecophagæ*, and the secretion is carried from each gland by a single relatively very wide duct. When the duct has reached the interspace of the lower jaw, it dilates and then divides into eight or ten undulating branches, which subdivide and ultimately terminate by numerous orifices upon the membranous floor of the mouth. This unique modification of a salivary apparatus is figured and described in my Article *Monotremata* of the 'Cyclopædia of Anatomy and Physiology,' 8vo, vol. iii. 1847, p. 388, fig. 188.

Muscles of the Mandibular and Hyoid arches, and of the Tongue.

Mylohyoideus.—The muscle answering to the mylohyoideus is of unusual extent, and is divisible into different portions: the first of these is a thin layer of transverse fibres (Pl. XXXVII. fig. 1, *g*), extending from the symphysis menti about five inches backwards: the fibres pass from the under and outer side of one mandibular ramus to the opposite ramus, and are attached along the middle line of their central surface to the long and thin tendon of the geniohyoideus: the posterior transverse fibres overlap the anterior termination of the second division (*h*) of the mylohyoideus. The transverse fibres of this division arise externally, or laterally, from the inner side of each mandibular ramus, and are attached mesially and centrally to a continuation of the tendon of the geniohyoideus, which may be seen shining through the fibres of the mylo-

[1] Proceedings of the Zoological Society, 1832, p. 130.

[2] The preparations exemplifying the above interesting modifications of the salivary apparatus are preserved in the Physiological Series of the Museum of the Royal College of Surgeons, Nos. 772 L and M, and are described in the first volume of my Catalogue of that Series, p. 228, 4to, 1831. Prof. Rapp, in his excellent work, 'Über die Edentaten,' 4to, 1843, has given a figure of this structure, in the *Dasypus peba*, and refers to a description of it in an Inaugural Thesis by Winker, "Dissertatio sistens observationes anatomicas de Tatu novemcincto. Præs. Rapp. Tubingen, 1824." This Thesis I have never seen, nor, as yet, been able to obtain: I became aware of its existence only through the reference in the work above quoted.

hyoideus, and which looks like a raphé of the muscle. This portion, which represents the normal mylohyoideus (*h*), extends backward as far as the ascending ramus of the jaw. A third portion (*ib.* *i*, and Pl. XXXIX. fig. 1, *i*) arises fleshy from the inner side of the ascending ramus of the jaw, whence its fasciculi radiate towards the middle line, in a somewhat twisted course, the anterior ones passing beneath the second or normal part of the mylohyoideus. The fourth portion, *j*, at its anterior part arises from the angle of the jaw, then from the base of the cranium, and afterward from a strong fascia extended thence backwards, between the postcranial prolongations of the nose and mouth (Pl. XXXIX. fig. 2, *j*); the posterior and longest fasciculi come off more outwardly and radiate to spread over and blend with the gular fasciculi of the sternoglossi, passing outward and downward, and then bending inward to envelope that part of the hyoid apparatus. All the fibres of the fourth portion terminate in a median raphé, which is less marked than in the anterior portion. The fibres of the posterior division of the mylohyoideus, especially those which are attached superiorly to the under surface of the posteriorly prolonged nasal canal, form a kind of muscular sheath for the basal part of the muscles of the tongue (*ib.* fig. 1, *j*).

Constrictor salivaris.—This is a flat subquadrate muscle (Pl. XXXVII. fig. 3, *k*), which arises fleshy from the inner border of the base of the ceratohyal, *m*, passes downward and forward beneath the *ceratohyoideus*, *n*, expands on emerging, bends over the salivary reservoir (figs. 1 & 2, *c*), and is inserted into the tendon marked * in fig. 2: it also blends with the back part of the *mylohyoideus*. The *constrictor salivaris* is crossed by the ectocarotid (fig. 3, *o*), and by the large lingual nerve, *u*, which, winding round the ceratohyal, *m*, curves over the ectocarotid and the constrictor, passing forward beneath it and the ceratohyoideus muscle, to accompany the sternoglossi to the base of the tongue.

Ceratohyoideus.—This muscle (Pl. XXXVII. figs. 2 & 3, *n*) arises from the ceratohyal, *m*, about an inch from its upper end, whence its origin is continued for an extent of one inch and a half: its fibres converge and form a fasciculus six lines in breadth, which is inserted into the commissural tendon (*, fig. 2), and is connected with a strip, *x*, from the sternomaxillaris muscle. The ceratohyal (Pl. XXXIX. fig. 2, *m*), after giving attachment to the foregoing two muscles and to the anterior constrictor of the pharynx, extends freely forward in front of the scalenus, and mesiad of the sternomastoid muscle, its extremity being attached to the *stylohyoideus* muscle, *v*.

Stylohyoideus.—In most mammals, the hyoid arch, by the length of the ossified part of the stylohyal and the extent of the ossification of the ceratohyal, is almost restricted to hinge- or swing-movements forward and backward upon the proximal joints of the stylohyals as a fixed point; so that the basihyal with its immediate appendages—usually the tongue—cannot be very far protruded or retracted. In the *Myrmecophaga jubata* the usual place of the stylohyal bone is occupied by a long and slender muscle, the *stylohyoideus* (Pl. XXXIX. fig. 2, *v*), which arises from the petromastoid, and after a course of five inches is inserted into the ceratohyal, here the first bone of the hyoid

arch. Supposing the *stylohyoideus* to contract one-third of its length, it would protract the hyoid arch to the same extent: in which act it combines with the *geniohyoideus*. The retraction of the hyoid arch is provided for by the *sternothyroidei* (Pl. XXXVIII. fig. 1, *p*) and their apparent continuations the *thyrohyoidei*. There is no direct sterno-hyoid muscle: the homologue of this seems to be the sternal portion of the *sterno-glossus* (*ib. g*).

Geniohyoideus.—This muscle arises by a single tendon from the symphysis of the jaw. It is one line in breadth, flat, runs back beneath the raphé of the anterior mylohyoideus; slightly expands beneath the raphé of the middle mylohyoideus, then again contracts and again expands, and at about ten inches from its origin becomes diffused into fleshy fibres, which gradually acquire a breadth of six lines, continue back in close connexion with the *mylohyoideus* to the commissural tendon (*, fig. 2) and there expand, the lateral borders being attached thereto. Here a mid-line of separation appears, and the muscle bifurcates into two flat fasciculi (Pl. XXXVII. figs. 1 & 2, *l*, *l*) each six lines broad, which are inserted into the angles of the basihyal.

The *Sternothyroidei* (Pl. XXXVIII. fig. 2, *p*, *p*) come off from the inner and lateral parts of the sixth, seventh and eighth sternal bones, and from the seventh and eighth sternal ribs near their articulations therewith. The interthoracic extent of these muscles is six inches. At about two inches from the origin is the point of a tendinous angular intersection (*), somewhat more marked than in the *sternoglossus*; the angle is turned forward on the opposite side of the muscle. These intersections vary somewhat in the two muscles, the left *sternothyroideus* presenting two within the chest, the right one three. Behind the manubrium the left muscle sends off a small fasciculus of fibres to the right one, and the right reciprocally to the left. Where the decussation takes place there is a tendinous intersection at the fore part, which does not extend to the back part of the muscle. In advance of the interchange of fasciculi the sternothyroidei diverge, increase in thickness, and decrease in breadth just before they emerge from the chest; beyond which cavity they are fleshy throughout their extent (*ib.* fig. 1, *p*, *p*), and are inserted into the lower and fore part of the thyroid cartilage (*ib. q*).

Cricothyroidei.—These muscles (Pl. XXXVIII. fig. 1, *r*, *r*) cover the whole of the cricoid cartilage, beneath and external to the *sternothyroidei*, and are inserted into the lower and lateral borders and productions of the thyroid cartilage.

The *Thyrohyoidei* (Pl. XXXVIII. fig. 2, *s*, *s*) arise from the lateral and anterior parts of the thyroid cartilage, above the preceding, and are inserted into the median two-thirds of the thyrohyal or posterior horn of the hyoid.

The *Intercornualis* (Pl. XXXIX. fig. 2, *q*) is a straightened mass of fibres passing obliquely from the thyrohyal forwards and inwards to the epihyal.

A ligament connects the mesial end of the ceratohyal with the anterior and outer end of the thyrohyal. A shorter and thicker ligament ties the posterior and outer end of the thyrohyal to the thyroid cartilage.

Sternoglossus.—This remarkable muscle arises fleshy from the lateral border of the dilated xiphoid and last sternal bone, and from its junction with the last two true ribs. The origin (Pl. XXXVIII. fig. 2, *e*) is at first triangular, but soon assumes a flattened shape, six lines broad by two lines thick, the muscle gradually diminishing in breadth, as it extends forwards, without losing thickness. Linear tendinous intersections (*ib. f, f*) mark the part of the muscle within the chest; the first occurs about two inches and a half from the origin, and is bent with the angle turned forward; the second, about two inches in advance, crosses the muscle obliquely; the third, at about the same interval, sends a slight angle forward; the fourth is an angular intersection, with the point turned backward on one side and forward on the other side of the muscle. From this point the sternoglossus passes forward, emerging from beneath the manubrium sterni as a simple fleshy muscle (Pl. XXXVIII. figs. 1 & 2, *g*), five lines broad and from two to three lines thick. Opposite the hyoid it is perforated by a lingual artery: between four and five inches in advance it is perforated by the lingual nerve (*ib.* fig. 1, *u, u*); and here it begins to give off, or its inferior stratum is resolved into, flattened fasciculi of fibres which decussate or combine with those of the opposite muscle, *h, h*. About six inches in advance of the basihyal these fasciculi spread over a dilated membranous portion of the buccal cavity, at the lower part of which the base of the tongue is situated: and here they converge and blend with corresponding flattened fasciculi, *o'*, *o'*, sent off from the lower part of the *genioglossi*, as these pass backward to the base of the tongue. The main continuation of the sternoglossus, which is concealed by the subgular fasciculi, forms a rounded slender muscle (*i, i*, fig. 2), which raises the buccal membrane so as to form the back part of the frænum linguæ, and penetrates, or forms, the back part of the base of the tongue, and a great proportion of its substance.

Genioglossus.—This muscle (Pl. XXXVIII. *m, n, o*) has a complex origin, by a middle portion, from the short symphysis mandibulæ, *m*, and by a flattened penniform series of fibres, from the lower border of the mandibular rami for the extent of four inches behind the symphysis, *n, n*. The symphysial origin is round and slender, and belongs more directly to the proper tongue-muscle: the ramal origins seem to be the more special fixed point of the subgular fasciculi. The fibres of the ramal origin, *n, n*, pass obliquely backward and inward, converging to a middle raphé, to which the symphysial origin closely adheres. The two origins of the muscle are blended into one for about three inches beyond the point of attachment, in which extent the muscle forms a moderately thick depressed mass along the middle of the under part of the mouth. It then begins to expand, and to detach from its under surface those subgular fasciculi, *o'*, *o'*, which diverge and unite with the corresponding dismemberments, *h, h*, of the sternoglossi. The main part of the *genioglossus* enters, as a single muscle (*ib.* fig. 2, *o*), the fore part of the base of the tongue, carrying into the floor of the mouth a fold of buccal membrane forming the fore part of the frænum linguæ. Between the

genio- and sterno-glossi, the fifth pair of nerves (Pl. XXXIX. fig. 2, *o*), which have arched almost transversely beneath the lower part of the gular pouch, converge to penetrate the tongue at the base of the frænum.

Epihyoglossi.—Beneath the insertions of the geniohyoidei (Pl. XXXVIII. fig. 1, *l*, *l*), a pair of more slender muscles (*ib. k*, *k*) come off from the median ends of the epihyals. These muscles, after a brief course, expand into a thin layer, resolve themselves into separate fasciculi, and combine an inch in advance of their origin to form a layer about eight lines in breadth below the middle line of the postlingual part of the mouth; which layer (*k*) slightly diminishes in size as it approaches the commissure of the sterno-glossi (*h*), and, with them, penetrates the back part of the frænum linguæ. The antero-posterior diameter of the base of the tongue, where it rises freely from the buccal membrane (Pl. XXXVIII. fig. 2, *o*, *p*, *i*), is three and a half inches. The convergence of the *sterno-* and *genio-glossi*, with the connecting frænal fold, forms a triangle, from the apex of which the tongue, *b*, assumes its vermiform shape, gradually diminishing from a breadth of eight lines to the obtuse apex which is one line in breadth, the length of this free part of the tongue being eighteen inches.

The tongue is covered by a smooth shining epithelium, which begins to present a softer, more vascular or mucous character fourteen inches from the apex; but the only papillæ anywhere present are two fossulate ones, 'papillæ vallatæ' (Pl. XXXIX. fig. 3, *f*), forming a pair, two lines apart, situated on the dorsum of the tongue about two inches in advance of the termination of the frænum. A linear groove, commencing two inches from the base of the tongue, extends along the dorsum to within four inches of the apex.

The muscular substance of the free part of the tongue is formed by the lingual portions of the *sternoglossi*, by the *genioglossus*, and by the proper 'linguales' muscles.

The buccal membrane (Pl. XXXIX. fig. 3, *p*, *q*) is smooth, perforated at its lateral and inferior parts, and also superiorly beyond the bony palate, by innumerable very minute orifices, from a quarter of a line to one line apart, by which the secretion of the thin glandular stratum before described enters the mouth.

Four inches in advance of the angle of the jaw, near the lower border of the ramus, a longitudinal ridge or low fold of the buccal membrane begins to rise, increasing in depth and assuming a callous hardness as it extends forwards and upwards: this ridge (Pl. XXXIX. fig. 3, *r*) is about two lines in breadth, and bends down so as to leave a groove between it and the lower membrane of the mouth. It is possible that the Termites may be crushed by the action of the tongue against these two callous ridges, which seem to occupy the place of teeth on each side the mouth.

The cavity of the mouth quickly expands as it passes backward and acquires its greatest breadth opposite the base of the skull and of the tongue (*ib.* fig. 3, *p*, *q*), having there a diameter of from four to five inches. The thin membrane, over which the diverging fasciculi of the sternoglossi and hyoglossi spread, is capable of considerable dilatation, and may serve, therefore, as a temporary receptacle for the Termites, where

they may be blended with the more alkaline and solvent salivary secretion of the parotids after being pounded by the tongue against the callous ridges, before they are finally swallowed: the singular backward extension of the fauces and nasal passages appears to relate in part to the presence and function of this receptacle.

The buccal cavity gradually contracts beyond the receptacle to the hyoid bone, immediately in advance of which, nineteen inches from the aperture of the mouth, are situated the tonsils (Pl. XXXVIII. fig. 2, *t*, *t*; Pl. XXXIX. fig. 3, *t*), each tonsil being an oval patch of a thin layer of muco-glandular substance with a finely reticulate surface, measuring one inch by nine lines. Behind the tonsils, and between them and the basihyals, a pouch of the gular membrane (*ib. s*) descends between the epihyals; it is one inch and a half in depth, by one inch in width.

One inch behind the prehyoid pouch, the extremity of the epiglottis, *v* (bisected in fig. 2, Pl. XXXVIII.), is seen projecting into the cavity of the mouth; it is broad and trilobed, the middle lobe subquadrate and curved downwards and backwards. A *hyo-epiglottideus* muscle extends from the back of the basihyal to the fore part of the base of the epiglottis: some fibres from this muscle appear to spread upon the prehyoid pouch.

The thyroid cartilage (Pl. XXXVIII. fig. 1, *q*) is ossified. The cricoid (*ib.* fig. 2, *y*) is cartilaginous. The arytenoids (*ib.* fig. 2, *w*, *w*) are low obtuse cartilages.

The *chordæ vocales* (Pl. XXXIX. fig. 3, *x*, *x*) extend from the middle of the lower and front part of the thyroid forwards to the arytenoid cartilages, *w*, the fold containing them expanding as they advance. There is a shallow fossa beneath this fold and a deeper one above it, or between it and the folds continuing from the epiglottis, *v*, to the arytenoids. There is a small fibrocartilage supporting an obtuse prominence from near the hinder end of the epiglottidean fold. The posterior interspace of the first tracheal cartilage is half an inch wide, but at the third ring the posterior extremities come into contact.

The posterior margin of the soft palate terminates by a low angular projection like the rudiment of a uvula (*ib. u*) opposite the base of the epiglottis. From the sides of this uvula the membrane arches backward, and gradually subsides upon the beginning of the œsophagus.

The whole length of the nasal passage (Pl. XXXIX. fig. 3, *c*, *e*) is twenty-two inches. The first inch is surrounded by the cartilaginous part of the nose: the next thirteen inches is enclosed by bone: the last eight inches of the canal has musculo-membranous walls, and is an enormously-developed homologue of the 'palatum molle' in Man.

Constrictores pharyngis.—The canal of the posterior nares is continued far back beyond the base of the skull (*ib.* fig. 3, *e*, *e*), and the homologues of the 'constrictor pharyngis' act upon this canal before they embrace the proper pharynx. They consist of several distinct muscles. The most anterior one (*ceratopharyngeus*, Pl. XXXIX. fig. 2, *f*) comes off from an extent of more than an inch of the middle part of the cerato-

hyal, *m*. It is a thin broad layer, the fasciculi of which diverge to spread upon the sides of the postcranial continuation of the nasal passage interlacing with the constrictor fibres which spread over the back part of that passage. The second muscle (*epipharyngeus*, *ib. g*) has a thicker origin, of ten lines in extent, from the back part of the inner end of the ceratohyal, and from the joint between this and the epihyal. The fasciculi diverge and spread over the sides of the posterior part of the soft nasal canal, partly overlapping the preceding muscle anteriorly, and being themselves slightly overlapped by the next portion behind. The third constrictor (*hyopharyngeus*, *ib. h*) has an origin three lines in extent from the thyrohyal and contiguous part of the basihyal: the fibres diverge upon the sides of the end of the nasal canal and the beginning of the pharynx; the anterior fibres overlapping and then blending with the posterior fibres of the preceding muscle. The fourth constrictor (*thyropharyngeus*, *ib. i*) comes off from the outer margin of the thyroid cartilage, having an origin of nine lines in extent. The fibres pass transversely round the pharynx, partially overlapping the preceding muscle, and slightly expanding at the back of the pharynx. The posterior continuation of this portion, which might be regarded as a fifth muscle (*cricopharyngeus*, *ib. i'*) arises from the posterior and outer prolongation of the cricoid, behind the three upper rings of the trachea.

Retractor pharyngis (Pl. XXXIX. fig. 2, *k*, *k*).—A slender longitudinal muscle, arising from a fascia connected with the origin of the scalenus, runs along the outer side of a long slender gland, and then passes forwards to the outer side of the cricopharyngeus, where it bends backwards, slightly expands, and appears to blend with the contiguous fibres of the crico- and thyro-pharyngei. The breadth of the free part of this retractor pharyngis is from one to two lines.

In the dissection of the neck of the Great Anteater, three pairs of long and slender muscles are met with, which relate to the movements of the head.

Sternocervicalis.—This muscle arises from the upper and outer angle of the manubrium sterni, close to the inner (mesial) side of the *sternomaxillaris*, by a thin tendon four lines broad, which soon becomes fleshy, and the slender muscle (Pls. XXXVII. fig. 2, and XXXIX. *y*) gradually contracts to be inserted into the side of the middle cervical vertebra.

The *Sternomastoideus* (*ib. z*) arises from the outer angle of the manubrium sterni, by a tendon two lines broad, which gradually expands, is flattened, and at one inch nine lines from its origin becomes a fleshy flat muscle six lines broad; this gradually increases in thickness to a rounded form, then contracts, and forms a tendon at about eleven inches from its origin, which contracts to its insertion into the paroccipital representative of the mastoid protuberance.

Sternomaxillaris.—This muscle arises from the inner side, near the upper and outer angle, of the manubrium sterni, and manubrial fascia, centrad of the clavicular fascia, and of the origins of *sternomastoideus* and *sternocervicalis* (Pl. XXXVIII. fig. 1, *w*, *w*); its origin is by a flat, very short tendon, five lines broad: an aponeurosis passes from one

tendon to that of the fellow muscle. The fleshy part forms a long slender band six lines in breadth, which passes forward, and about four inches from its origin sends off a slender fleshy strip (Pl. XXXVII. fig. 2, *x*) to the ceratohyoideus, *n*, and the central tendon, *. It then advances as a slender round fleshy muscle, which degenerates into a subcompressed tendon about half an inch in length, opposite the *compressor salivaris*. Resuming its fleshy structure, it forms an anterior subcompressed belly, ten inches in length and from four to five lines in diameter (Pl. XXXIX. fig. 1, *w*). This gradually contracts and terminates in a slender tendon three inches long, which expands to be inserted into the outer and under part of the maxillary ramus, six inches in advance of the angle of the jaw.

To the action of the pair of muscles, so inserted, is mainly due that characteristic movement of the head of the Great Anteater when it composes itself to sleep, and draws its head downward and backward between the fore-limbs, in contact with the chest. The mouth is small, and susceptible of so slight an opening as not to require for that action so remarkable a modification of what appears to be a dismemberment of the homologue of the sternocleidomastoideus muscle.

The proper muscles of the jaws consist of the *temporalis*, the *masseter*, and the *pterygoidei*.

The *temporalis* (Pl. XXXIX. fig. 2, *a*) arises from a low ridge extending from the stunted zygomatic process of the squamosal upwards and slightly forwards,—the boundary rather of a large and ill-defined orbit than of a temporal fossa, which is in no wise marked off from the orbit: some fibres are derived from the temporal fascia; but the muscle is not above an inch in breadth, and its greatest length does not exceed an inch and a half; it is inserted into the external ridge, an inch in advance of the condyle, which feebly represents a coronoid process.

The *masseter* (Pl. XXXIX. figs. 1 & 2, *b*) has an extent of origin of three inches three lines from the malar process of the maxillary, from the short and free malar, and from a very strong fascia continued thence over the temporal muscle to the zygomatic process of the squamosal. The maxillary origin has the appearance of a distinct tendon, *b'*, expanding into an aponeurosis, which spreads over nearly the upper half of the outside of the muscle. The carneous fibres from the maxillary tendon pass vertically downward: the more posterior fibres proceed more obliquely downward and backward as they approach the angle of the jaw, into which the most posterior ones are inserted. The extent of the insertion from this point forward is four inches two lines. The action of this muscle is to close the mouth and protract the mandible.

The *pterygoideus internus* arises, chiefly fleshy, from a longitudinal channel on the under part of the pterygoid bone, which is bounded mesially by a low ridge, to which a short aponeurotic origin of the muscle is attached: the muscle gains in thickness and depth as it passes forward and outward to be inserted into the concavity on the inner side of the ascending articular part of the jaw.

The external *pterygoideus*—a narrower and smaller muscle—is not clearly distinct from the foregoing; it arises fleshy from the outer part of the tuberosity of the pterygoid bone, and the fibres pass more directly forward to their insertion, where they blend with those of the preceding muscle: this external part of the pterygoideus is more directly a retractor of the jaw: the other fibres would antagonize the masseteric ones in rotatory horizontal movements of the jaw.

Muscles of the Nose, Ear, and Lips.

The back part of the upper maxillary bone, which slopes downward and a little outward, to form the malar process, affords an aponeurotic origin to four muscles of the nose and lips. The *levator nasi* (Pl. XXXIX. fig. 1, *c*) is the superior of these; it becomes distinct an inch in advance of the common origin, its fleshy fibres converging to a small tendon two inches nine lines from that origin: the tendon, which is four inches in length, is inserted into the upper part of the nose, which it raises.

The *retractor anguli oris* (*ib. d*) is the second muscle: it comes off from the lower and outer part of the preceding, about an inch in advance of their common origin, and is aponeurotic on its upper border for two and a half inches. The aponeurosis, which forms the tendon of insertion, begins at the lower border of the muscle near where the first aponeurosis terminates. The whole length of the fleshy part of this muscle is four inches nine lines: its greatest breadth, where distinct, is three lines: the length of the slender tendon is two inches; it passes over the *orbicularis oris*, *q*, to be inserted into the angle of the mouth.

The *retractor alæ nasi* (*ib. e*) is the third muscle: it is sent off below and from the inner side of the preceding; has a fleshy belly three inches four lines in length, and a very slender tendon four inches three lines in length, which passes over the *orbicularis oris*, to be inserted into the skin of the back part of the nostril.

The *retractor labii inferioris* (*ib. f*) is the fourth muscle: it forms the lower and outer part of the common origin, covers that of the preceding muscle, has a fleshy portion five inches six lines in length, and a tendinous one two inches four lines in length. This tendon seems to penetrate the orbicularis oris, to the fibres of which it gives attachment both along its upper and lower borders. It is inserted into the lip below the angle of the small mouth.

The *retractor labii superioris* (*ib. m*) forms a fifth muscle, which has a more distinct origin from the malar process of the maxillary, than the preceding four, for the extent of one inch. Its fleshy part is three inches three lines in length; its very slender tendon is five inches in length, and is inserted into the upper lip, and to the lower part of the nostril, of both of which parts it is a retractor. Near its insertion it is connected with muscular fibres descending from the skin of the nose to the circular lip, where they are connected with the cutaneous muscles affecting that part.

The *orbicularis oris* (*ib. q*) arises from the outer side near the fore part of the long

maxillary: it is a thin muscular layer, eight lines in breadth, inserted into the tendon of the retractor anguli oris, and partly continuous with a thicker layer of the same sphincter which passes round, beneath the mouth, closely connected with the skin of the lip, to the same tendon of the opposite side. A small oblique tendon is developed near where the fibres of the longitudinal muscle (*dermolabialis anticus*, *s*) blend with and are lost in the *orbicularis oris*.

The *accessorius ad orbicularem oris* (*ib. r*) arises from the maxillary behind the muscle it assists, and contracts as it descends and blends its fibres with the true orbicularis: it receives the insertion of the *dermolabialis posticus*.

The *buccinator* (*ib. u*) is of unusual longitudinal extent, and consists of a thin layer of flattened fasciculi of vertical fibres arising from an aponeurosis attached to the toothless border of the upper jaw, and inserted at the outside of the similar border of the lower jaw.

A small mass of labial glands, two inches in longitudinal extent and from two to three lines in breadth, rests upon the under and fore part of the buccinator and dips under the *orbicularis oris*.

The *levator auriculæ* (*ib. v*, *v'*) has an extent of origin from the epicranial fascia of nearly four inches. The most anterior fasciculus, *v*, comes off behind the eye and is a protractor: the posterior fasciculus, *v'*, arises from the occiput and is a retractor: these with the intermediate fasciculi acting in succession would rotate the ear. Beneath the posterior fasciculus is a deeper-seated retractor of the ear inserted into the inferior and outer part of the auricular cartilage.

The *depressor auriculæ* (*ib. w*) is a roundish, slender muscle, which arises from the angle of the jaw, penetrates the parotid gland, and is inserted into the lower part of the cartilage of the ear.

Cuvier and Duvernoy long ago pointed out that the protraction and retraction of the tongue of the Anteaters and Echidna were not due to any peculiar conformation of the hyoid bone and muscles, but to another mechanism answering the same end. Those distinguished anatomists seem, however, not to have noticed to what an extent the base of the tongue is removed from the basihyal, nor to have recognized the share which the genioglossus takes in the formation of the tongue itself. "The hyoid in the *Myrmecophagæ* (the species is not noted) is placed very far back, and as a consequence, the base of the tongue is placed equally far back, although it is not, so to speak, attached to the hyoid bone. It seems to be composed exclusively of the sternoglossi and of an annular muscle[1]."

The gular fasciculi of the genioglossus are recognized as 'geniobuccales,' and are described as "diverging upon the sides of the base of the tongue, beyond which they

[1] "L'os hyoïde étoit placé très en arrière; il en résulte que la base de la langue est également très en arrière, quoique celle-ci ne tienne pas, pour ainsi dire, à l'os hyoïde."—"Elle ne semble composée que des *sternoglosses* et d'un muscle *annulaire*."—Leçons d'Anatomie Comparée, tom. iii. 1799, p. 265.

form a tendinous sheath enveloping the sternoglossi, with which they are continued to the sternum[1]:" in this description will be recognized what I have described as gular fasciculi, or dismemberments of the sternoglossi and genioglossi respectively. For the absence of any styloglossi, Duvernoy accounts by the remark, "that the base of the tongue is much further back than the stylohyal[2]." But this is not the case in the Great Anteater.

In the posthumous edition of Cuvier's 'Leçons d'Anatomie Comparée,' t. iv. 1836, p. 558, Prof. Duvernoy intimates, that the brief notice respecting the anatomy of the tongue in the Anteaters, inserted in the first edition, was an extract from a Memoir on that subject, which he read to the 'Société de la Faculté de Médecine de Paris' in 1804, and which was afterwards inserted entire in the 'Mémoires de la Société d'Histoire Naturelle de Strasbourg,' tom. i. 1830.

On referring to the latter volume, I find that the interesting remarks of the venerable anatomist were based upon dissections of the *Myrmecophaga tamandua*, Cuv., the *Myrmecophaga didactyla*, and the *Echidna Hystrix*: the Great Anteater (*Myrmecophaga jubata*) seems not to have come under the scalpel of either Cuvier or Duvernoy. Whatever discrepancy, therefore, may be found between the descriptions in the present Memoir and those in the 'Strasbourg Transactions,' may be set down, either to a different interpretation of the structures observed, or to the specific modifications of the *Myrmecophaga jubata*. I have not, at least, had the opportunity of testing by actual dissection the degree of concordance between the *Myrmecophaga tamandua* and the large species which would seem to have been now anatomized for the first time.

DESCRIPTION OF THE PLATES.

PLATE XXXVII.

Salivary and Lingual Structures.

Fig. 1. Superficial view of the submaxillary salivary glands, and muscles of the tongue and jaw, beneath the head and neck: half the natural size.

Fig. 2. Further dissection of the submaxillary gland and duct, and contiguous muscles: half the natural size.

Fig. 3. Muscles of the salivary reservoir and contiguous muscles: natural size.

[*The following letters indicate the same parts in each figure.*]

a, *a*. Main body of the confluent submaxillary (here subcervical and subpectoral) salivary glands: *a'*, their slender anterior continuation.

b, *b*. Ducts, prior to their dilatation.

c. Dilated portion of the ducts, or salivary reservoir, surrounded by a muscle.

[1] *Ibid.* p. 264.

[2] "... que la base de la langue est plus en arrière que l'os styloïde."

d. Long and slender portion of the ducts leading to the mouth, covered by the mylohyoideus muscle.
e, *e*. Submandibular transverse fasciculi of panniculus carnosus (Dermogulares).
f. Dermolabialis posticus.
f'. Dermolabialis anticus.
g. Anterior
h. Middle
i. Twisted or radiated
j. Posterior
} portions of the Mylohyoideus.
k. (fig. 3, *c*. fig. 1) Constrictor salivaris.
l. Geniohyoideus.
m. Ceratohyal.
n. Ceratohyoideus.
o. Carotid artery.
p. Sternothyroidei.
q. Thyroid cartilage.
r. Cricoid cartilage.
s. Prominence of shoulder-joint.
t. Trachea.
u. Lingual nerve.
v. Stylohyoideus.
w. Sternomaxillaris. *, (fig. 1) its middle tendon. *w''*, its tendon of insertion.
x. (fig. 2) Its strip to the tendon *.
y. Sternocervicalis.
z. Sternomastoideus.

PLATE XXXVIII.

Muscles of the Tongue.

Fig. 1. Inferior superficial view of muscles of the tongue: half the natural size.
a. Mouth.
b. Tongue.
c. Rami of lower jaw.
d. Ducts of submaxillary gland.
e. Origin (fig. 2)
f. Tendinous intersections (*ib*.)
g. Extrathoracic part
h. Gular fasciculi
i. Proper lingual part (fig. 2)
} of the Sternoglossus.
k. Epihyoglossi.

l. Geniohyoidei (insertions of).
m. Symphysial origin
n. Ramal origin
o. Lingual or proper part
o'. Gular fasciculi
} of the Genioglossus.
p. Sternothyroidei.
q. Thyroid cartilage.
r. Cricothyroidei.
s. Thyrohyoidei.
t. Thyrohyoidei antici, seu minores.
u. Lingual nerve.
v. Lingual artery.
w. Sternomaxillaris.
y. Sternocervicalis.
z. Sternomastoideus.

Fig. 2. Proper muscles of the tongue: half the natural size.

a. Mouth.
b. Tongue.
c. Rami of the lower jaw.
d. Termination of the duct of submaxillary gland.
e. Origin
f. Tendinous intersections
g. Extrathoracic part
h. Gular fasciculi (fig. 1)
i. Proper lingual part, or continuation,
} of the Sternoglossus.
k.
l.
} fig. 1.
m. Symphysial origin
n, *n*. Ramal origin
o. Proper lingual part
o'. Gular fasciculi (fig. 1)
} of the Genioglossus.
p. Frænal fold of the gular membrane at the base of the tongue.
q. Membrane of the mouth forming the gular dilatation.
r. Roof of the mouth.
s. Subgular or prehyoid pouch.
t. Tonsils.
u. Uvula.
v. Divided epiglottis.
w. Arytenoid cartilage.
x. Chordæ vocales.
y. Cricoid.
z. Trachea.

PLATE XXXIX.

Fig. 1. The parotid salivary gland and duct, and the superficial muscles of the jaws, tongue, mouth, nose, and ear.

a. Fascia covering the temporalis muscle.
b. Masseter; *b'*, its maxillary origin.
c. Levator nasi.
d. Retractor anguli oris.
e. Retractor alæ nasi.
f. Retractor labii inferioris.
m. Retractor labii superioris.
q. Orbicularis oris.
r. Orbicularis accessorius.
s. Dermolabialis anticus.
t. Dermolabialis posticus.
u. Buccinator.
v. Levator auriculæ, anterior (protractor) portion; *v'*, occipital (retractor) portion.
w. Depressor auriculæ.
x. Parotid gland.
y, *y*. Its duct.
z. Labial gland.

[*The other letters signify the same parts as in the previous plates.*]

Fig. 2. Muscles of the head, tongue, and neck.

a. Temporalis.
b. Masseter; *b'*, its maxillary origin.
d. Duct of submaxillary gland.
e. Soft part of nasal canal behind the skull.
fa. Fauces or dilated part of mouth behind the skull.
f. Ceratopharyngeus.
g. Epipharyngeus.
h. Hyopharyngeus.
i. Thyropharyngeus.
i'. Cricopharyngeus.
j. Posterior part of mylohyoideus.
k. Retractor pharyngis.
l. Insertion of geniohyoideus.
m. Ceratohyal.
n. Ramal origin of genioglossus.
o. Gular fasciculi of ditto, blending with those of
p. Sternoglossus.
q. Intercornualis.

r. Cricothyroideus.
s. Thyrohyoideus.
tr. Trapezius.
t. Atlanto-acromialis.
u. Atlantoscapularis.
w'. Axioscapularis.
v. Stylohyoideus.
w. Sternomaxillaris.
x. Parotid gland.
y. Sternocervicalis.
z. Sternomastoideus.

Fig. 3. The oral and nasal canals, pharynx, larynx, and beginning of the œsophagus and trachea, vertically and longitudinally divided.

a. Opening of the mouth.
b. Tongue.
c. Style passed through the external nostril into the cranial part of the nasal canal *c–c*.
e–e. Postcranial part of the nasal canal.
i, *i*. Sternoglossi.
a, *p*. Prelingual part of the mouth: the faucial fasciculi of the genioglossus are seen through the thin membrane of the dilated part of the mouth.
q, *s*. Postlingual part of the mouth.
s. Prehyoid pouch.
t. Tonsil.
u. Uvular part of soft palate.
v. Epiglottis.
w. Arytenoid cartilage.
x. Chorda vocalis.
y. Cricoid cartilage.
z. Trachea.

PLATE XL.

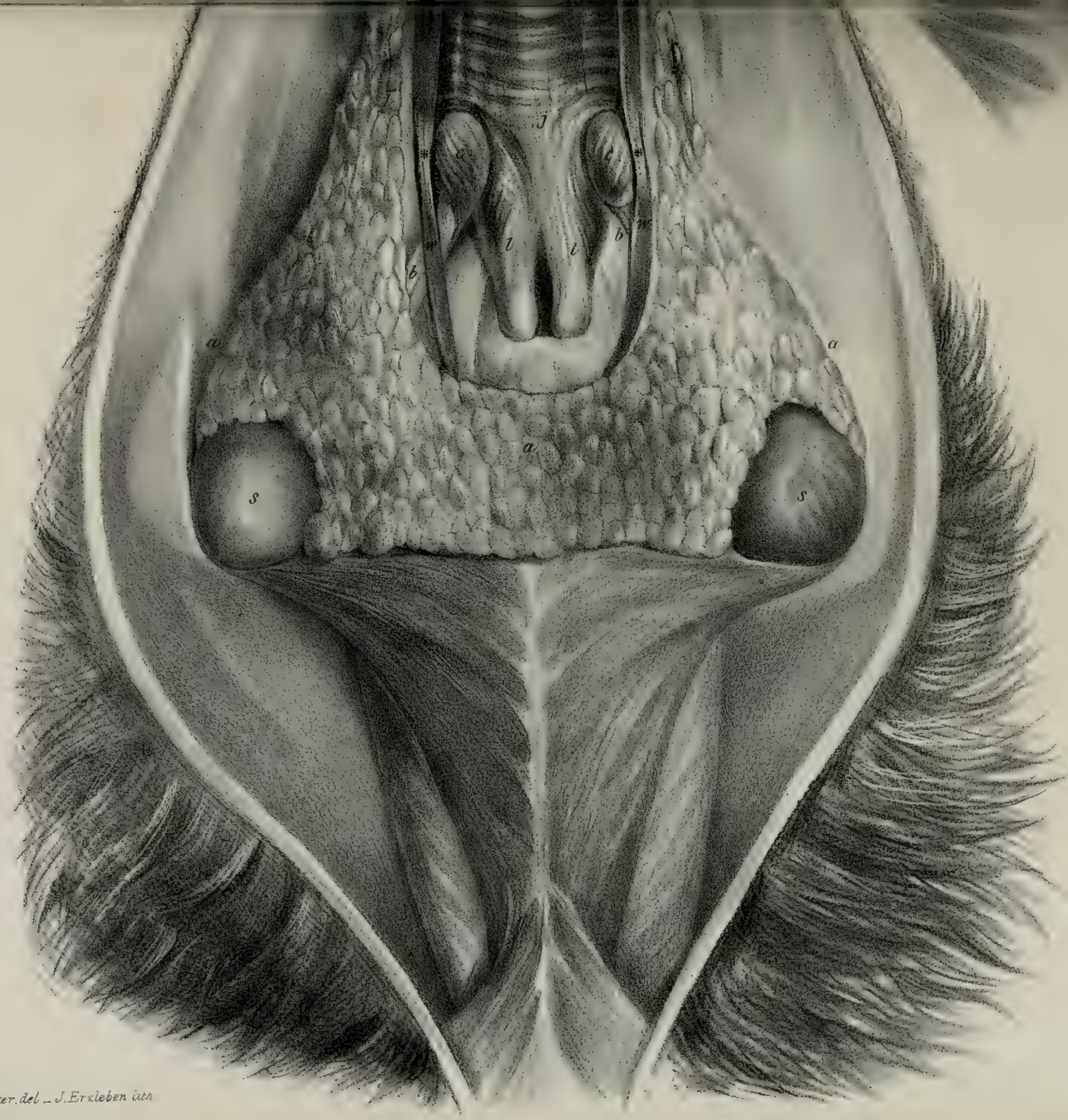
Fig. 1. Head and fore part of body of the Weasel-headed Armadillo (*Dasypus sexcinctus*), dissected to show the submaxillary glands and reservoir.

Fig. 2. Lower jaw, larynx, submaxillary gland and reservoir of the *Dasypus Peba*.

Fig. 3. Salivary structures of the Small Anteater (*Myrmecophaga didactyla*). All the figures are of the natural size: the letters indicate the same parts in each.

a. Labial gland.
b. Postorbital gland.
c. Submaxillary (subcervical) gland.
d. (fig. 1) Slender anterior prolongation of ditto.

d. (fig. 3) Ducts leading from submaxillary gland into
e. Salivary bladder or reservoir.
f. Duct continued from ditto.
g. Dermal muscular fasciculi, adapted to compress the salivary reservoirs.
h. Sternomaxillares.
i. Mylohyoidei.
k. Hyoglossi.
l. Lingual nerve.
m. Larynx.
n. Trachea.
o. Thyroid gland.
p. Pectorales muscles.
q. Parotid.



E. Carter. del. – J. Erxleben lith.

Day & Son, Lith.rs to the Queen

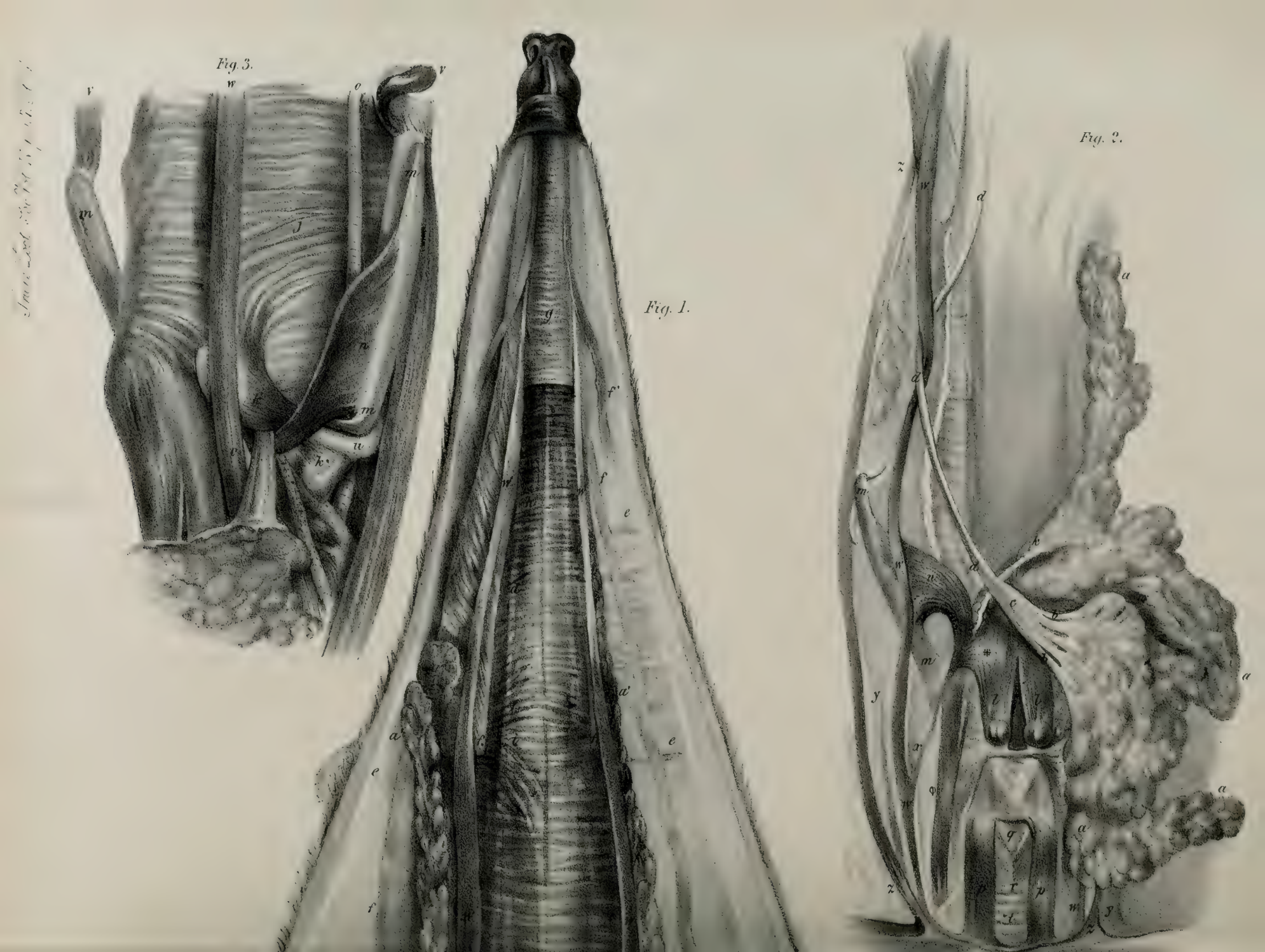


Fig. 3.
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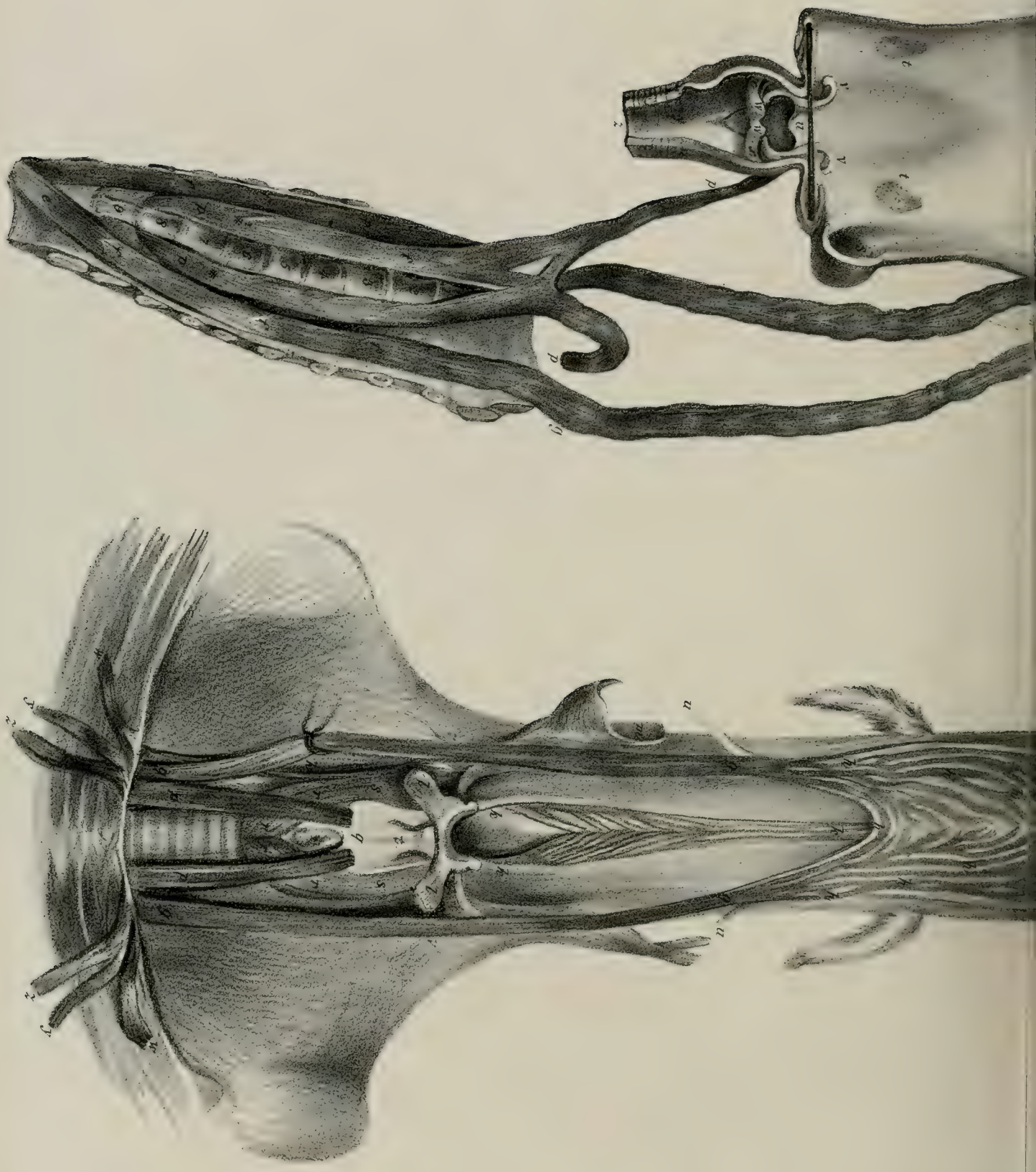


E.V. Carter, del. — J. Erxleben, lith.

Fig. 2.

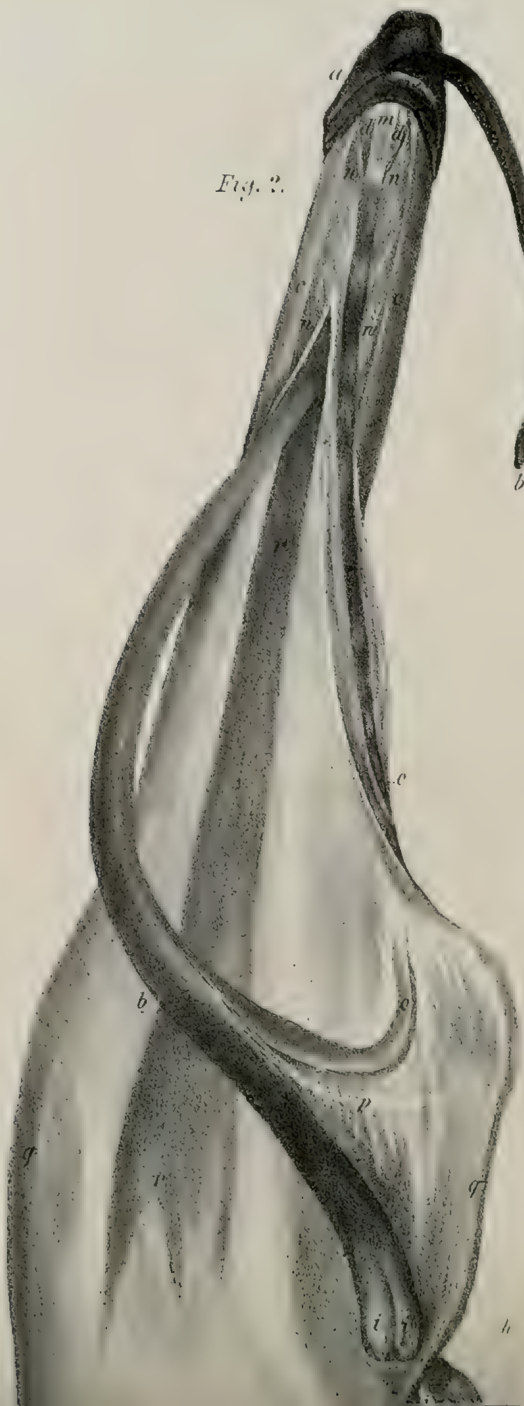
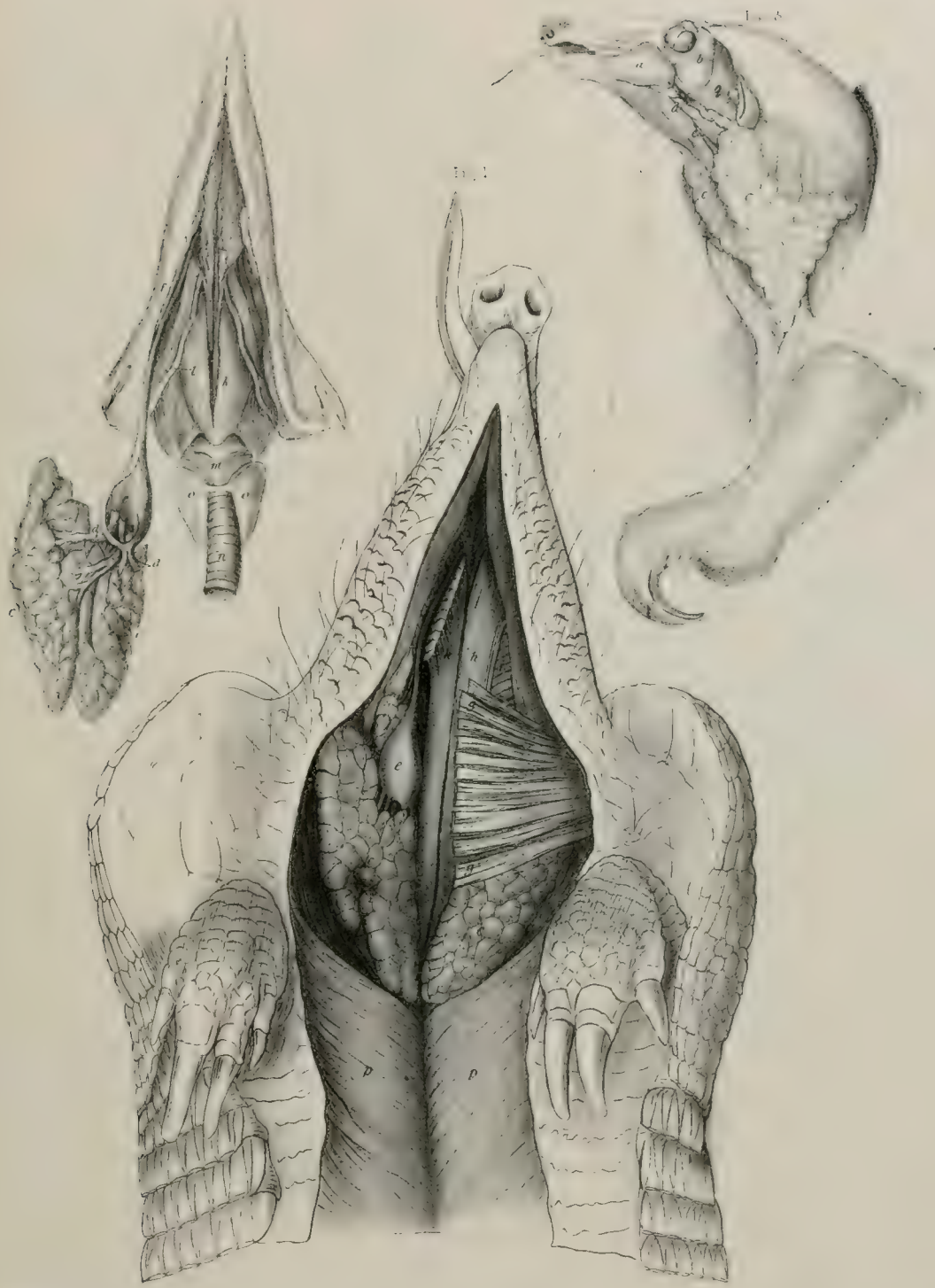


Fig. 1.

Day & Son, Lithrs to the Queen.

Fig. 2.

Fig 3.



SALIVARY GLANDS

1 & 2 Armadillo. — 3. Ant-eater.

X. *On* Dinornis (Part VI.): *containing a Description of the Bones of the Leg of* Dinornis (Palapteryx) struthioides *and of* Dinornis gracilis, *Owen.*

By Professor Owen, *F.R.S., V.P.Z.S., &c.*

Read November 14, 1854.

In my memoir of 1843[1], I described two femora of birds from tertiary deposits in New Zealand, agreeing in size with that bone in the Ostrich, and referred them to a species called *Dinornis struthioides*; one of these specimens however consisted only of the shaft; the other and more perfect specimen, figured in pl. 21. fig. 3, was mutilated at both its extremities. I have since received, through the kindness of the Rev. Mr. Colenso, M.A.[2], and the Rev. William Cotton, M.A., three entire specimens of femora, ranging between 11 and 12 inches in length, and the shaft of a fourth femur of the *Din. struthioides*, confirming very satisfactorily that species, and completing our knowledge of the anatomical characters of the bone.

The head (Pl. XLI. fig. 2) is rather more than a hemisphere, more prominent than in the Ostrich, and with a smaller proportion cut off, as it were, from the upper and outer part, and roughened for the attachment of the strong 'ligamentum rotundum.' From the upper part of the base of the head, an almost flat, slightly concave, surface ascends, expanding, as it rises, to the broad semicircular ridge which crowns the great trochanter. In the Ostrich that process does not rise above the level of the head of the bone. In the *Din. struthioides* the upper trochanterian platform is broader proportionally than in the *Din. casuarinus*[3]. The anterior surface of the trochanter is also extensive through the continuation outwards of the great process: it is slightly concave, sculptured by muscular impressions with intervening ridges, and by a defined oval rough tract between the head and the base of the trochanter. The outer convex expanded surface of the trochanter is more strongly marked by the insertions of powerful tendons, surrounding an irregular smooth tract near the centre of the surface. The back part of the upper end of the femur in two of the specimens presents two or three small holes leading into the superficial cancelli, by which it is possible a little air may have been admitted to these cavities; but this is a very feeble representation of the wide orifice and canal at the same part of the Ostrich's femur which conducts directly to the large air-cavity in the body of that bone.

[1] Zool. Trans. vol. iii. pp. 247, 249, pl. 21. fig. 3.

[2] The specimen contributed by this gentleman is cited in the table of admeasurements, Zool. Trans. vol. iii. p. 329.

[3] *Ibid.* pl. 46. fig. 2.

The shaft of the entire femur of the *Din. struthioides* repeats the characters described and figured in the memoir above cited. The fore part of the external condyle begins to rise from the level of the shaft, about one-third from the distal end of the bone, and bends outwards, forwards and downwards, increasing in breadth and convexity, and forming the outer boundary of the characteristic broad rotular surface. The convex fore part of the inner condyle forming the inner boundary of that surface is shorter, and rises more abruptly. The deep oval fossa, above the vertical broad groove for the fibula, behind the outer condyle, is well-marked. The orifice of the medullary artery is at the middle of the back part of the shaft of the femur in two of the specimens.

With regard to the metatarsus of the *Dinornis struthioides*, the same satisfactory confirmation of the species has been received, as in the case of the femur, by the addition of three specimens repeating the characters of the original bone described at p. 240, and figured in pl. 27. fig. 2. of my memoir of 1843. One of these specimens, kindly sent to me by J. R. Gowen, Esq., F.G.S., Sec. H.S., was discovered in the tertiary deposits at Waikawaite, Middle Island of New Zealand, and has the two extremities more entire than in the original specimen figured. The middle of the distal trochlea is impressed by a shallow groove running its whole length, and becoming more shallow as it approaches the contracted back part of the trochlea, which terminates abruptly, projecting beyond the level of the back part of the distal end of the bone.

A second of the additional specimens of the metatarsus of the *Din. struthioides* was obtained by the Rev. Wm. Cotton, M.A., at Tarawaite, in the North Island of New Zealand: a third specimen (Pl. XLI. fig. 4) was discovered by Governor Sir George Grey, C.B., in a cave in the district which lies between the river Waikate and Mount Tongariro, in the North Island.

From the same cave Sir George Grey likewise obtained and very liberally transmitted to me, with a most valuable collection of other bones of *Dinornis* and *Palapteryx*, an entire tibia (Pl. XLII. fig. 2) agreeing with the portion of shaft, which, from the dimensions given in vol. iii. p. 329, I was induced to refer to the *Dinornis struthioides*, differing in its size and proportions from all the tibiæ previously described and referred to other species, but presenting similar relations of size to the femur and metatarsus of the *Din. struthioides*, which the previously described tibiæ have presented to the other bones of the leg of the respective species to which those tibiæ have been referred.

I conclude, therefore, that in the tibia transmitted with the metatarsus of the *Din. struthioides* by Sir George Grey, I possess the bone, which I have been so long desirous to obtain in order to complete the leg of the *Din. struthioides*. Like the metatarsus above-cited, it is from the left side, and they appear to have belonged to the same individual bird.

	in.	lin.
The length of this bone is	22	0
The breadth of the proximal extremity . .	5	6
The breadth of the distal extremity	3	2
The circumference of the middle of the shaft .	5	0
The fibular ridge extends down	10	0

This ridge begins, as in the tibiæ of other species of *Dinornis*, below the expanded end of the tibia near the middle of its back part, inclining to its outer side.

In its slender proportions, and the relative positions of the procnemial (*p*) and ectocnemial (*e*) ridges, the tibia of the *Dinornis struthioides* agrees with that of the *D. dromioides*.

Description of the Bones of the Leg of the Dinornis gracilis.

The advantage of additional specimens, as confirming, by the repetition of the same characters, a species previously defined, is still greater in respect of the ground which they afford for the discrimination of a distinct but nearly allied species. Notwithstanding the well-marked differences observable between the femur of the *Dinornis struthioides* (Pl. XLI. fig. 2) and the *Dinornis gracilis* (*ibid.* fig. 1), I might have deemed them due to differences of sex or individuals, had I not had evidence of the fixity of the specific characters of the *Dinornis struthioides* by the successive arrivals of additional specimens of its bones. Attending the hoped-for confirmation from such arrivals, it appeared to be most prudent to refrain from announcing a new species of the rapidly increasing family of the great wingless birds of New Zealand until further evidence might be obtained by corresponding differences in the tibiæ and metatarsi of the two species.

Having had the good fortune at length to receive, through the kind contributions of the Rev. Richard Taylor, M.A., of Wanganui, and of W. E. Cormack, Esq., these additional illustrations of the *Din. gracilis*, I no longer delay communicating descriptions and figures of them to the learned Society, in whose Transactions my former Memoirs have appeared and have been so liberally illustrated.

Femur.

The bone (Pl. XLI. fig. 1) was obtained at the Bay of Opito, East Coast of the North Island, from beneath a sandy deposit, about three feet below the surface, by Mr. Cormack.

The following are the chief dimensions of this bone:—

	in.	lin.
Length	11	0
Breadth of proximal end in the axis of the neck .	3	8
Breadth transverse of distal end	4	0
Circumference of middle of shaft	4	8

A small portion of the upper ridge of the great trochanter has been broken off: when entire, the femur of the *Din. gracilis* presents the average length of that of the *Din. struthioides*; but it is more slender in proportion, the head is smaller, and is supported by a better marked constriction or neck, especially at its under part. The upper platform of the trochanter is narrower, the anterior border of the trochanter not being extended so far forwards and outwards. The angle between the upper and fore surfaces of the trochanter is a right one, and they meet at a sharp ridge. The rough oval surface between the head of the femur and the base of the trochanter is smaller than that of the *Din. struthioides*. The outer irregular surface of the trochanter is of much less breadth in the *Din. gracilis*. The muscular impressions at the sides of the shaft meet and form a longitudinal ridge along the back part of the middle third of the shaft: they are separated by a tract of half an inch in the *Dinornis struthioides*, and terminate below in two tuberosities. The corresponding ridge formed by the meeting of the vasti muscles along the fore part of the shaft is shorter in *Din. gracilis* than in *Din. struthioides*.

The most marked distinction, however, is presented by the distal extremity of the bone, which is not only relatively less expanded in the *Din. gracilis*, but the rotular groove is narrower, and is bounded laterally by condyloid eminences of more nearly equal length; the external one not rising so high up, nor describing the sigmoid curve in descending, as in the *Din. struthioides*. The rotular groove in the *Din. gracilis* is impressed by a transversely oval rough depression, at its upper part, with sharp lateral borders, which depression does not appear in any of the femora of the *Din. struthioides*. The popliteal space is triangular and better defined in the *Din. gracilis*; the fibular groove is shorter and less angular, and the rough deep pit above it is smaller. The tibial surface on the inner condyle is relatively smaller.

Tibia.

The same character is repeated on the proximal end of this bone, where the surface applied to the inner condyle is absolutely smaller than in the *Din. struthioides*, although the entire bone, as shown in the subjoined admeasurements, is longer in the *Din. gracilis*: it is also, as the name of the species implies, more slender in proportion to its length.

This bone (Pl. XLII. fig. 1) was obtained from beneath a sandy deposit, about two feet below the surface, at a locality between Wanganui and Turakina, North Island of New Zealand, by the Rev. Mr. Taylor.

	D. gracilis. in.	lin.
The entire length of the bone is	23	6
The transverse breadth of its proximal end . .	5	0
The transverse breadth of its distal end . . .	2	10
The circumference of the middle of the shaft . .	4	6
The fibular ridge extends down the shaft . . .	9	6

But this ridge commences nearly three inches below the back part of the proximal end of the bone, nearer the outer side than in the *D. struthioides*: it is interrupted by an oblique smooth tract at the point indicated in the admeasurement, where the medullary artery penetrates the bone; it then reappears about an inch and a half below the interruption, and soon gradually subsides. This second lower part of a fibular ridge is better marked than in the *Din. struthioides*. The relative size and position of the procnemial, *p*, and ectocnemial, *e*, ridges are much the same as in the tibia of the *Din. struthioides* and *Din. dromioides*.

Metatarsus (Pl. XLI. fig. 3).

The difference between the *Din. struthioides* and the *Din. gracilis* is more obvious at first glance in a comparison of their metatarsi than in that of the above-described bones; especially to an eye accustomed to the comparison of the metatarsi of the different species. The superior length and slenderness of that bone in the *Din. gracilis* would at once prevent its being confounded with the metatarsus of the *Din. struthioides*.

The following are the chief dimensions of the bone in question: those of the extremities being approximative by reason of their worn margins:—

	D. gracilis. in.	lin.
Length of the tarso-metatarsus	13	0
Circumference at the middle of the shaft . . .	4	3
Transverse breadth of proximal end	3	4
Transverse breadth of the distal end	4	3
Breadth of the middle of the shaft	1	7
Thickness or antero-posterior diameter of ditto .	1	2

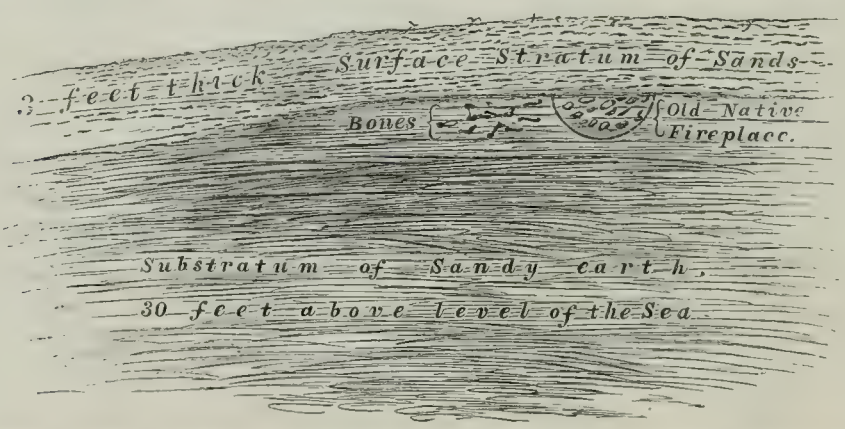
The depressed surface for the back toe is better marked than in the *Din. struthioides*.

Subjoined is the "Note on the locality" affording the femur of the *Dinornis gracilis*, kindly contributed by W. E. Cormack, Esq.; with a sketch of the section of the strata, of which a woodcut is here given.

"The bone "(Pl. XLI. fig. 1)" of the *Dinornis* now presented to Professor Owen was found in the north part of the North Island of New Zealand, in the month of January 1849. Its *locality* was in a small bay called 'Opito,' at the east extremity of the projecting land between Mercury Bay and Wangapoua, on the east coast, in about the latitude of 36° 40′ S., and fifty miles east from Auckland. The bay is about a mile in length, northerly and southerly, by about half a mile in depth, with high bluff heads or rocky cliffs projecting at each extremity; the semicircular sandy beach inside forming the bay. An irregular strip of low land lies inside of the beach, in some parts fertile, in other parts consisting of downs, and is overlooked in the rear by round hills of from 100 to 300 feet in height. The hills are composed of yellow-white and red burnt earth; very barren, producing stunted fern, and a solitary bush or scrubby tree here and there.

Towards the north end of the bay a small brook discharges itself, from a swamp at the foot of the hills in the rear: and at the mouth of the brook a short range of downs runs along the beach to the southward, presenting a line of earthy cliffs, wasting away and forming the shore as they fall down by the washing of the sea at the foot. These cliffs are about from twenty-five to thirty feet in height, and nearly perpendicular. The upper stratum of the cliffs is formed of sand, and is about three feet in thickness, producing the usual arenaceous shrubs, grasses, &c. Underneath, the line of demarcation being very distinct, is a thick stratum or bed of sandy earth, sand predominating: out of this substratum, about fifty or sixty yards south of the mouth of the brook, the *Moa's* bones were exposed, projecting, in consequence of a late falling away of that part of the cliff in which they were imbedded: they lay a foot or more beneath the upper surface of the substratum. At the same spot there was a '*kapura maori*,' or *native cooking fireplace*, dug into the surface of the substratum, and full of stones that had been once heated (to convey the heat to the food laid upon them),—and left, just as similar cooking-places are left at the present day by the natives;—about two feet from which lay the bones. Close to the fireplace, and similarly imbedded, were bones of smaller birds, and of fishes similar to those found at present in the sea adjacent; all, including those of the *Moa*, having been evidently the remains of the food cooked here at a former period and eaten, as my native attendant remarked, by the then native inhabitants. A part of a leg bone, about two feet in length, apparently belonging to the same leg as this femur[1],—the bone having been broken near the middle (probably in order to be placed more conveniently over the fireplace), was also found close to the femur.

"The antiquity of these remains can only be arrived at by inference. How long it is since the superficial stratum of sand now exhibited at the top of the cliffs overlooking



the sea, was formed by water and winds, is a matter of induction for the geologist. The sea is now undoing, and claiming the privilege of, former lacustrine or marine

[1] It accords with the size of the tibia of the *Dinornis gracilis*.—R. O.

deposits. It would not be difficult to compute, with some shadow of approximation, the time required for the inroad of the ocean into strata of the nature of those described, supposing them to have extended from the summit of the cliffs to the ocean half a mile distant, along a line between the two heads or extremities of the bay: but that period would be conjectural only; for there are rocks, islets, and islands succeeding each other—mile beyond mile,—extending into the surrounding ocean, all of which are, by marine inroad, vestiges only of former rock-formations. Man and the *Moa*, however, were coeval at man's cooking fireplace upon this substratum.

"The mother ocean is altering, in some places very rapidly, the configuration of the coast of New Zealand. It is consuming some parts, and forming others by deposits; and again removing former deposits. In a general view, many parts of the east coast of the North Island are being disintegrated, not to reappear above water for many ages; while on the west coast, downs are not only being formed, stretching into the sea, but superimposing themselves—inland—in some places.

"These shiftings of the outline of the earth's crust are not limited to the sea-coast: for in the interior are many partial and violent settlings of the earth, evidently from earthquakes; submerging, in some instances many feet under the surface of fresh-water lakes, land with the natives' houses, fences, &c. upon it. This has happened in regard to the lake situated some miles from the east bank of the River Waipa, and south-eastwardly from the ruins of the famous sacked Pa (town) called 'Matakitaki.'

"W. E. Cormack,
6, Percy Street, 22nd October, 1850."

"*To Professor Owen,*
Royal College of Surgeons, London."

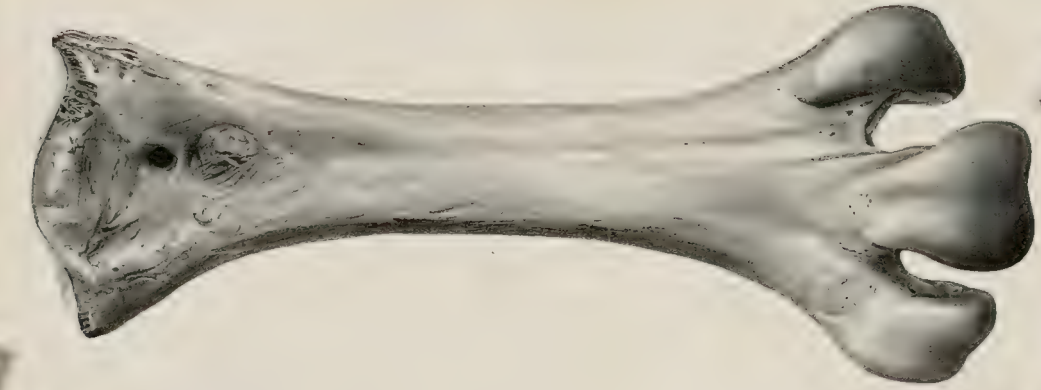
DESCRIPTION OF THE PLATES.

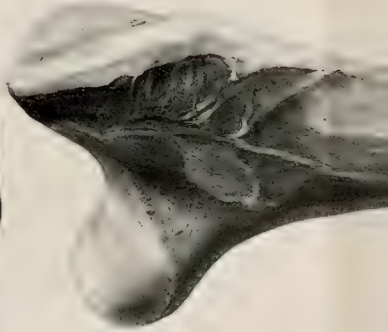
PLATE XLI.

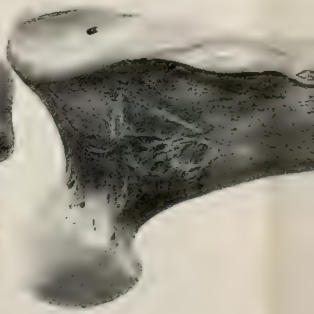
Fig. 1. Front view of the femur of the *Dinornis gracilis.*
Fig. 2. Front view of the femur of the *Dinornis struthioides.*
Fig. 3. Front view of the metatarsus of the *Dinornis gracilis.*
Fig. 4. Front view of the metatarsus of the *Dinornis struthioides.*

PLATE XLII.

Fig. 1. Front view of the tibia of the *Dinornis gracilis.*
Fig. 2. Front view of the tibia of the *Dinornis struthioides.*
p. Procnemial ridge. *e.* Ectocnemial ridge.
All the figures are of the natural size.







Figs. 1 & 3. Dinornis gracilis. — Figs. 2 & 4. Dinornis struthioides.


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Fig. 1. Dinornis gracilis. Fig. 2. Dinornis struthioides.

XI *On* Dinornis (Part VII.): *containing a Description of the Bones of the Leg and Foot of* Dinornis elephantopus, *Owen.* *By* Professor Owen, *F.R.S., V.P.Z.S., &c.*

Read April 8, 1856.

Mr. Walter Mantell having, on his recent return from New Zealand, provisionally deposited his very extensive collection of remains of Dinornithic and other Birds in the British Museum, I have gladly acceded to the wishes of that successful and enterprising collector, and of my friend the able Keeper of the Geological Department of the Museum, to devote the leisure at my command to the examination of this interesting and valuable collection[1].

I had advanced as far as the determination of the bones of the leg, and their classification according to their species, when the distinctive characters of one series of these bones irresistibly brought a conviction that they belonged to a species of *Dinornis* that had not previously come under my notice,—a species which, for the massive strength of the limbs, and the general proportions of breadth or bulk to height of body, must have been the most extraordinary of all the previously restored wingless birds of New Zealand, and unmatched, probably, by any known recent or extinct member of the class of Birds.

On a former occasion, I was so much struck by the form and proportions of the metatarsal bone referred to the species called *Dinornis crassus*, and described in the Memoir read to the Zoological Society, June 23, 1846, and figured in pl. 48, figs. 4 & 5, vol. iii. of the 'Zoological Transactions,' that I alluded to it as "representing the pachydermal type and proportions in the feathered class[2];" and the bone unquestionably indicated, at that period, "the strongest and most robust of birds." But by the side of the metatarsus of the species which I have now to describe, and for which I propose the name of *elephantopus*, the metatarsus of *Dinornis crassus* shrinks to moderate if not slender dimensions. But the peculiarities of the elephant-footed Dinornis stand out still more conspicuously when the bones of its lower limbs are contrasted with those of *Dinornis giganteus*.

I propose, in the present Memoir, to combine with the account of the leg- and foot-bones of *Dinornis elephantopus*, that of the bones of the lower limb of *Dinornis crassus* which had not previously been described, and to bring out their characteristics by comparison with the bones of other species, especially those of *Dinornis robustus*.

[1] Since the communication of the present Memoir, this collection has been purchased by the Trustees of the British Museum, and the entire skeleton of *Dinornis elephantopus* has been recomposed and articulated, and is now exhibited in the Gallery of Fossil Remains.

[2] *Ib.* p. 325.

Femur of Dinornis elephantopus.

Commencing with the femur, I shall premise the following Table of admeasurements of that bone in the three above-named species of *Dinornis*.

Dimensions of the Femur in

	D. robustus.		*D. elephantopus.*		*D. crassus.*	
	in.	lines.	in.	lines.	in.	lines.
Length	14	2	13	0	11	10
Transverse breadth of proximal end	6	0	5	10	4	5
Fore-and-aft breadth of ditto	5	0	4	5	3	9
Transverse breadth of distal end	6	0	5	11	4	7
Fore-and-aft breadth of ditto	4	3	3	9	3	5
Circumference (least) of shaft	7	10	7	9	6	0

The above comparative dimensions bring out the characteristic proportions of the femur of *Dinornis elephantopus* (Pl. XLIII. fig. 1), as shown by its greater thickness and strength. Compared with the femur of *Din. robustus*, this character is remarkably exemplified in the articular extremities (Pl. XLIII. figs. 2 & 3). Had these parts alone of *Din. elephantopus* been preserved and submitted to me, I should have scarcely ventured upon a conclusion as to their specific distinction from *D. giganteus*, or its representative on the Middle Island, *D. robustus*, the correspondence of configuration being so close and the difference of size so slight.

The articular surface is continued from the head upon the upper part of the neck (Pl. XLIII. fig. 2), expanding as it approaches the great trochanter, along the summit of which it is terminated by a ridge. In both species the surface for attachment of the ligamentum teres is formed, as it were, by a portion of the inner and back part of the hemispheric head, having been cut off obliquely with a slight excavation. The corresponding ligamentous surface in the head of the femur of *Din. crassus* is relatively smaller, less depressed and less defined. The upper and fore part of the trochanter is less produced relatively to the breadth of the supra-trochanterian articular surface in *Dinornis elephantopus*. In this species the subcircular rough surface for the attachment of the *iliacus internus* muscle (fig. 1, *i*) is relatively nearer to the head of the bone than in *Dinornis robustus*: the rugged and thick fore part of the great trochanter descends lower upon the shaft; indeed the shortness of the entire bone seems to depend chiefly on the shaft being relatively shorter in *Din. elephantopus* than in *D. giganteus* or *robustus*. The intermuscular ridge continued from the trochanterian one down the fore part of the shaft bifurcates sooner in *Din. elephantopus*. The depression behind the trochanterian ridge is less deep in *Din. elephantopus*.

The oblique rotular channel is relatively as wide and deep as in *Din. robustus*, but the inner boundary formed by the fore part of the inner condyle is shorter in *Din. elephantopus*. At the back part of the shaft of the femur the medullo-arterial foramen

is relatively nearer the proximal end of the bone: the two tuberosities below this are closer together: the two sides (fig. 3, *s* & *t*) of the fibular groove (fig. 3, *r*) are at a more open angle, and the groove is less deep in *Dinornis elephantopus*, the outer side, *t*, being less produced, as compared with *Din. robustus*. The antero-posterior breadth of the outer and inner condyles is equal in *Din. elephantopus*, as it is in *Din. robustus*; but in *Din. crassus* that dimension of the outer condyle exceeds the same dimension in the inner one, and the fibular groove is more open or shallow than in *Din. elephantopus*.

The generic modifications of the femur are, however, very closely preserved in each species, being strictly of the type ascribed to the genus *Dinornis* in my original Memoir in the 'Zoological Transactions,' vol. iii. p. 247.

Tibia of Dinornis elephantopus.

Dimensions of the Tibia in

	D. robustus.			*D. elephantopus.*			*D. crassus.*		
	feet.	in.	lines.	feet.	in.	lines.	feet.	in.	lines.
Length	2	8	3	2	0	0	1	7	6[1]
				1	9	6[1]	1	6	6
Transverse breadth of proximal end	0	7	6	0	7	5[1]	0	6	2
				0	7	0			
Fore-and-aft breadth of ditto	0	4	9	0	4	6[1]	0	3	6
				0	4	3			
Least circumference of shaft	0	6	9	0	6	5	0	4	10
Transverse breadth of distal end	0	4	4	0	4	2	0	3	3
				0	4	0			

The characters of the upper end of the tibia of *Dinornis elephantopus* (Pl. XLIII. fig. 5) closely accord with those of the *Din. robustus*, and the difference of size, as exemplified in the foregoing Table, is so slight, that, had this extremity only of the bone reached me, I should most probably have referred it to *Din. robustus*. The almost flat articular surface for the inner condyle of the femur is somewhat less in its shorter diameter: the epicnemial ridge, *k*, is less extended transversely: the ectocnemial ridge, *e*, curves more strongly outward: but there are individual varieties in all these characters in the tibiæ before me. All, however, differ in the earlier subsidence of the ridge continued downward from the procnemial plate, *p*, which ridge is continued in *Dinornis robustus* uninterruptedly to that above the inner division of the distal trochlea. The space between the ecto- and pro-cnemial plates in *Dinornis crassus* is relatively greater than in either of the above larger species: the ridge continued from the procnemial plate is interrupted as in *Din. elephantopus*. The concave fore part of the tibia between the ectocnemial, *e*, and procnemial, *p*, ridges is impressed by irregular vascular grooves. The fibular ridge is interrupted by a smooth tract, in or near which

[1] The extremes of size in a series of several bones are here given.

is the orifice of the canal for the obliquely descending medullary artery, in all the species of *Dinornis*. The upper division of the ridge is shorter in *Dinornis elephantopus* than in *Din. robustus*, and relatively shorter than in *Din. crassus*. The surface between the fibular ridge and the inner border of the shaft, at the back part, is concave transversely in *Din. elephantopus*, not merely flat as in *Din. robustus* and *Din. crassus;* and, as it descends, it continues longer a flat surface before it changes gradually to a convex one. The oblong rough insertional surface above the inner condyle is relatively shorter and better defined in *Din. elephantopus* than in *Din. robustus*. On the characteristic fore part of the lower end of the tibia, that bone in *Din. elephantopus* repeats all the modifications ascribed to the genus *Dinornis* in my Memoir on the *Gastornis*, or large fossil bird from the Paris eocene[1].

The tendinal canal inclines obliquely inward, parallel with the inner border of the expanding end, near which it is placed (Pl. XLIII. fig. 4,*f*) : the bony bridge spans across it from a flattened tubercle developed from the lower part of the outer pier. The outlet of the canal is as wide as in *Din. robustus* ; its aspect is obliquely forward and downward. External to the tubercle is an oblique rough depression, relatively narrower and better defined than in *Dinornis robustus*. The inner condyle, *a*, is relatively narrower and more produced forward than in *Din. robustus*, resembling more the proportions of that part in *Din. crassus*. The general form and oblique direction of the wide distal trochlear articulation of the tibia are closely repeated in all the species ; the concavity being rather more sharply defined behind in *Din. elephantopus* than in *Din. robustus*. The depression on the entocondyloid surface is less deep in *Din. elephantopus* than in the *Din. robustus*.

The above specific differences, as well as all that I have noticed in the tibiæ of other species of *Dinornis*, are so inferior in degree to those which I have found in closely allied genera, and even in different species of the same genus, of other large land- and wading-birds, as *e. g.* in species of *Ciconia*, and in the existing Struthious genera, as to leave a strong impression on my mind of the generic affinity of the species of wingless birds of New Zealand which I have referred to *Dinornis* and *Palapteryx*, and which species have been divided, with a more liberal imposition of terms, by Dr. Reichenbach, into the nominal genera *Anomalopteryx, Movia, Emeus, Syornis*, &c. ; no other facts or characters being assigned for that multiplication of generic names than those which are to be found in the pages or plates of the Memoirs in the Zoological Transactions.

Fibula of Dinornis elephantopus.

The fibula of *Dinornis elephantopus* remains, as in other *Dinornithes*, and as in the existing Struthious genera, permanently distinct from the tibia. As a general rule in Birds, the fibula soon becomes anchylosed to the tibia. In the species now defined, it is a straight styliform bone, 14 inches 6 lines in length (Pl. XLIII. fig. 6). The head is

[1] Quarterly Journal of the Geological Society, 1856, vol. xii. p. 210. pl. 3. fig. 2.

subcompressed and produced, as if slightly bent, backward. The upper articular surface is convex from before backward, almost flat transversely. The head of the bone is flattened on the inner side; almost flat, but a little convex, on the outer side: the fore-and-aft dimension of this end of the bone is 2 inches 9 lines; the transverse diameter is 1 inch 3 lines. Below the head the bone assumes a trihedral form with the sides convex, gradually tapering and blending into a shape, elliptic in transverse section, and ending in a point about 9 inches above the ankle-joint. The outer surface of the shaft of the fibula is impressed by two oblong rough surfaces for the insertion of muscles, the upper one 2 inches 9 lines in length. The inner part, which is ridge-like, dividing the fore from the back surface of the bone, presents a rough surface, r, r', with a median interruption, for the ligamentous attachment of the bone to the fibular ridge of the tibia.

Metatarsus of Dinornis elephantopus.

Comparative dimensions of the Metatarse of

	D. giganteus[1].		*D. robustus*[2].		*D. elephantopus*[3].		*D. crassus*.	
	in.	lines.	in.	lines.	in.	lines.	in.	lines.
Length	18	6	15	9	9	3	8	8
Transverse breadth of proximal end	4	3	4	6	4	5	3	3
Ditto ditto distal end	5	4	5	3	5	4	3	9
Least ditto of shaft	2	3	2	0	2	5	1	9
Fore-and-aft breadth of proximal end	3	2	3	2	2	10	2	5
Circumference of ditto	12	0	12	9	12	0	9	3
Least circumference of shaft	6	3	5	3	6	6	4	6
Breadth of middle trochlea	1	10	2	3	2	2	1	8
Length, following the curve	5	9	5	4	5	3	4	0

I had, hitherto, regarded the metatarse of *Dinornis crassus*, described and figured in the 'Zoological Transactions,' vol. iii. pl. 48. figs. 4 & 5, as presenting the most extraordinary form and proportions of all the restored species of huge wingless birds of New Zealand; but it is strikingly surpassed in robustness and in great relative breadth and thickness by the same bone of the present species (Pl. XLIV. fig. 1), which chiefly on that account I have proposed to name *elephantopus*. Only in the great Maccaws and Penguins do the proportions of the metatarsus resemble those in this most robust-legged of birds; but the Parrot-tribe present those peculiar modifications of the distal trochleæ, with the strong articulation for the back toe, which relate to the Scansorial modifications of the bird's foot; and the Penguins associate with their broad and short metatarsus a characteristic retention of much of the primitive separation of the three constituent bones. In *Dinornis elephantopus* these elements have become as completely coalesced as in any other species, and the general characters of both proximal and distal ends accord with those in previously described species. On a more special

[1] Trans. Zool. Soc. vol. iii. pl. 27. fig. 1. [2] *Ib.* vol. iv. pl. 1. [3] *Ib.* vol. iv. pl. 46.

comparison of the metatarse of *Dinornis elephantopus* with that of its nearest congener the *Dinornis crassus*, the following differences present themselves. The entocondyloid depression (fig. 2, *e*) is deeper, its fore-and-aft diameter is greater, and its transverse diameter less, than in the ectocondyloid one, *c*; but the breadth of the entocondyloid depression is relatively greater and its depth somewhat less in *Dinornis elephantopus* than in *Dinornis crassus*.

The transverse convexity dividing the two condyloid depressions is relatively broader in *Dinornis elephantopus*; and the rough surface external to the anterior intercondyloid prominence is more strongly marked.

The two calcaneal ridges present an equal prominence in *Dinornis elephantopus*: the ectocalcaneal one, *c e*, is the most prominent in *Dinornis crassus*.

The anterior surface of the metatarsus differs chiefly in the proportions indicated in the "Table of admeasurements," p. 153, from that in *Dinornis crassus*: like most of the metatarsi of that species, one or more vascular foramina occur above the subcircular rough surface of insertion of the *flexor pedis*, which occupies the lower part of the shallow depression on the upper and fore part of the shaft.

Along the lower half of the shaft the median longitudinal and progressively widening prominence, due to the middle of the coalesced metatarsal bones, is rather more marked than in *Dinornis crassus*.

The inner side of the shaft is marked at its upper half by the oblique rough tract indicative of the insertion of the powerful aponeurosis of the gastrocnemic muscles. At the back surface the upper part of the mesometatarse is relatively less prominent than in *Dinornis crassus*.

The two vascular foramina occupy corresponding relative positions. All other notable differences are those of size and proportion.

From the metatarsus of *Dinornis robustus* that of the *Dinornis elephantopus* differs, most strikingly, in its proportions of length to breadth, being little more than half the length, but of nearly equal breadth; the distal trochleæ, however, being relatively less expanded than in *Dinornis robustus*.

The anterior vascular perforation is less than in *Dinornis robustus*: the insertional roughness for the *tibialis anticus* below the foramen is of equal size. The upper half of the fore part of the metatarsus is longitudinally channeled in *Din. robustus*, not in *Din. elephantopus*. The corresponding part of the back part of the shaft is much more prominent in *Dinornis robustus*. The characteristics of the metatarsus of *Dinornis elephantopus* are more strongly manifested in the comparison with that of *Dinornis giganteus*[1], of which bone it has only half the length, other dimensions being equal or even greater in *Din. elephantopus*.

Of the depression, – which is very faint in *Dinornis robustus*,—for the ligamentous

[1] Trans. Zool. Soc. vol. iii. pl. 27. fig. 1.

attachment of the rudimental back toe, there is no trace in the metatarse of *Dinornis elephantopus*.

The form of the articular pulleys for the three toes is shown in Pl. XLIV. fig. 3.

Toe-phalanges of Dinornis elephantopus.

The bones of the foot I shall compare with those of *Dinornis robustus*[1], to which they make the nearest approach in size.

Equalling, or nearly equalling, the phalanges of that bird in breadth and thickness, they differ chiefly in shortness, but in a less degree than the metatarsi differ.

These proportional characters of the species are best given and easiest appreciated in the plates (compare the above-cited Plate I. with Pl. XLIV.). A few minor differences, however, may be noticed: the outer portion of the proximal end of the first phalanx of the inner toe, I, II., is broader in proportion to its fore-and-aft diameter in *Dinornis elephantopus*. The inner portion of the proximal end of the first phalanx of the outer toe, I, IV., presents the like difference: the general form of that articular surface, fig. 3, II. & IV., is less triangular and more oval in both the specified phalanges of *Dinornis elephantopus*; the under side being indented as usual in the proximal phalanges of the inner and outer toes.

The modifications in the other phalanges, besides those of size and proportion, are not greater or other than might be expected in different species of the same genus.

Of the very remarkable species of *Dinornis* based upon the powerfully developed limbs, the bones of which are described in the foregoing pages, Mr. Mantell's collection includes five right and eight left femora, three right and four left tibiæ, nine right and fourteen left fibulæ, three right and eight left metatarsi; together with a considerable collection of toe-bones, from which, probably, other entire feet might be reconstructed in addition to the one of the left foot here exhibited, figured in Plate XLIV.[2]

There are also two femora and two metatarsi of an immature bird, apparently, by their proportions, from one individual of *Dinornis elephantopus*, Pl. XLV. fig. 1; to which may also belong the proximal end of a tibia, wanting the articular epiphysis.

The femora, as in other birds, retain the two articular ends, which are simply rougher than in the adult, having been covered by a thicker cartilage; but are not developed upon distinct osseous pieces, as in land mammals.

The proximal epiphysis is wanting in both the immature metatarsi, the left of which is figured in Pl. XLV. fig. 1, so that they exhibit the separate expanded ends of the three constituent bones, as shown in fig. 1, *a*; which bones terminate in the three prominent trochleæ below. The length of the femur of this young bird is 11 inches, that of the metatarse $7\frac{1}{2}$ inches. They already present the characteristic robustness of the adult bird.

[1] See Trans. Zool. Soc. vol. iv. pl. 1.

[2] The bones of the entire right foot of apparently the same individual bird have been determined and restored since the above was written.

The first evidence of the *Dinornis crassus* reached me from a turbary deposit at Waikawaite, in the Middle Island; it formed part of the collection there made by Mr. Earl. I have never received any evidence of this species of *Dinornis* from the North Island.

In like manner the bones of the much larger bird, which I have called *Palapteryx robustus* and *Dinornis robustus*, and which I was formerly inclined to regard as not only specifically but generically distinct from *Dinornis giganteus*, appear to be peculiar to the Middle Island; or at least have not, hitherto, been found in any locality of the North Island.

The richer series of illustrations of both *Dinornis robustus* and *Din. crassus* in the collection of Mr. Walter Mantell are from localities in the Middle Island; and the abundant illustrations of *Dinornis elephantopus* are exclusively from one locality in that island: they were obtained at Ruamoa, three miles south of Oamaru Point, or that called the "First Rocky Head" in the New Admiralty Map. This fact might give rise to the idea that the original range or locality of *Dinornis elephantopus* had been a restricted one; unless, at the period when the species flourished, the geographical extent of the Middle Island of New Zealand was widely different from what it now is. Yet Mr. W. Mantell has obtained strong, if not unequivocal, evidence that *Dinornis elephantopus* and *Din. crassus* existed contemporaneously with Maori natives in that island. The bones described in the foregoing pages are in a recent and most perfect condition. They retain the usual proportion of animal matter, and have undergone no mineral change.

They were discovered under circumstances closely resembling those described in a previous Memoir, Zool. Trans. vol. iv. p. 146, under which the femur of *Dinornis gracilis* was found in the North Island, by Mr. Cormack. Remains of native ovens, with the baking stones, were not far from the chief collection of bones of *Dinornis elephantopus*, discovered by Mr. W. Mantell, in the Middle Island. Both were covered by drifted sand from three to seven feet in thickness. Some of the bones have been scorched by fire.

From the sum of our present information respecting the localities of the several species of *Dinornithidæ*, we may infer that most, if not all, of the species of the North Island were distinct from those of the South Island.

To birds that could neither fly, nor, probably, swim well or far, the channel called Cook's Straits would prove an effectual bar to any migration from one island to another. With each successive addition of materials for the history of this most remarkable family of birds, I feel, nevertheless, impressed with the conviction of how little comparatively we still know respecting them, and how much more is likely, through the enlightened cooperation of active, resolute and accomplished explorers, such as Mr. Walter Mantell, to be, hereafter, contributed towards a complete history of the New Zealand wingless birds.

DESCRIPTION OF THE PLATES.

PLATE XLIII.

(All the figures are of the natural size.)

Fig. 1. Front view of the left femur of *Dinornis elephantopus*.
Fig. 2. Upper view of the head of the same bone.
Fig. 3. Under view of the condyles of the same bone.
Fig. 4. Front view of the left tibia of *Dinornis elephantopus*.
Fig. 5. Upper articular end of the same bone.
k. epicnemial ridge; *p*. procnemial plate; *e*. ectocnemial process; *a*. inner condyle; *b*. outer condyle; *f*. tendinal groove and bridge.
Fig. 6. Left fibula of *Dinornis elephantopus*: the side which is applied to the tibia is shown.

PLATE XLIV.

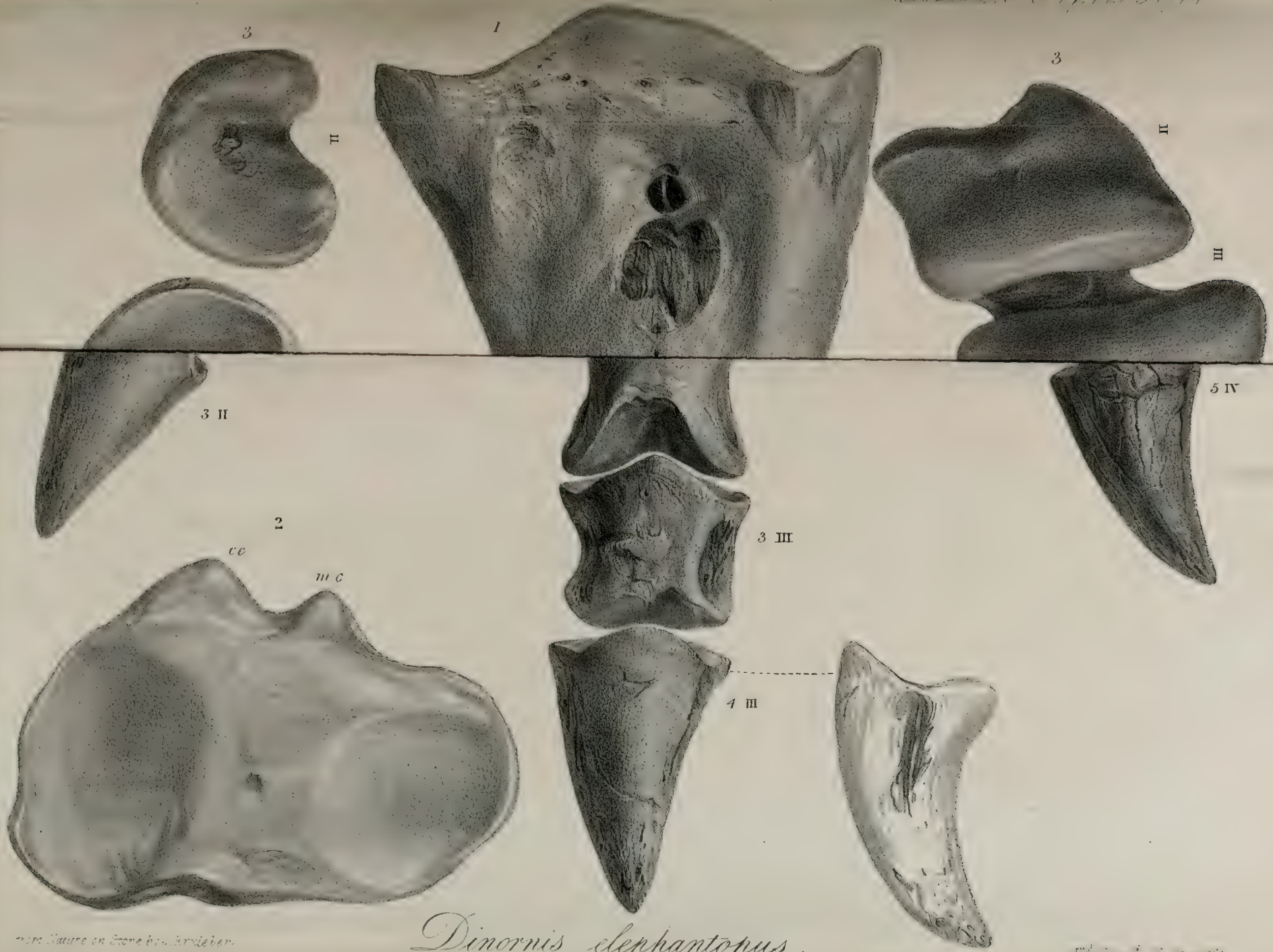
(All the figures are of the natural size.)

Fig. 1. The bones of the left foot of *Dinornis elephantopus*: II., III. & IV. indicate the distal trochleæ of the metatarsus; II. 1, 2, 3, the three phalanges of the inner toe; III. 1, 2, 3 & 4, the four phalanges of the middle toe; IV. 1, 2, 3, 4 & 5, the five phalanges of the outer toe.
Fig. 2. The proximal articular surface of the metatarsus: *e*. the internal, *c*. the external, articular cavity; *e c*. the ectocalcaneal, *m c*. the mesocalcaneal, process.
Fig. 3. The distal trochleæ of the metatarsus: II. that of the inner toe; III. that of the middle toe; IV. that of the outer toe.
Fig. 4. The proximal articular surfaces of the proximal phalanges of the three toes.
Fig. 5. Side view of the ungual phalanx of the middle toe.

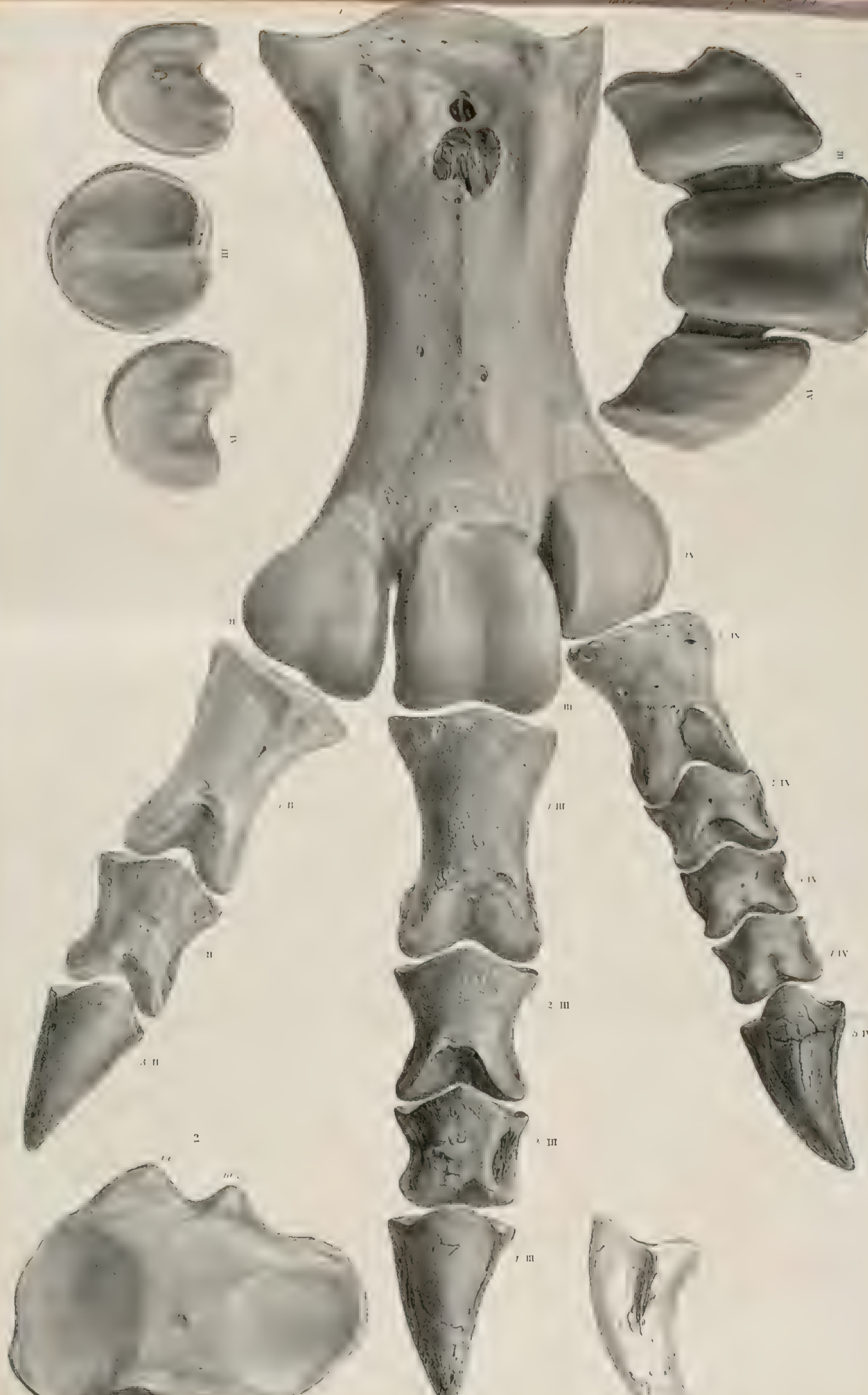
PLATE XLV.

Fig. 1. Front view of the left metatarsus of an immature *Dinornis elephantopus*: *a*. its proximal end uncovered by the tarsal epiphysis.
Fig. 2. Back view of the left metatarsus of an immature *Dinornis crassus*.

Dinornis Sephantopus.

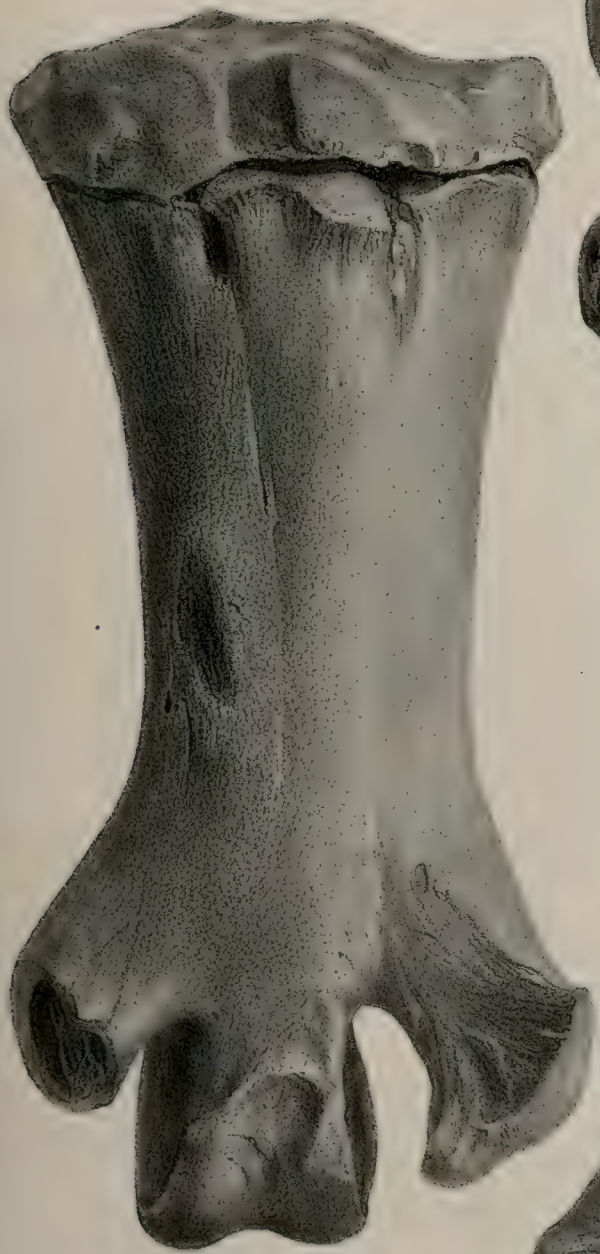


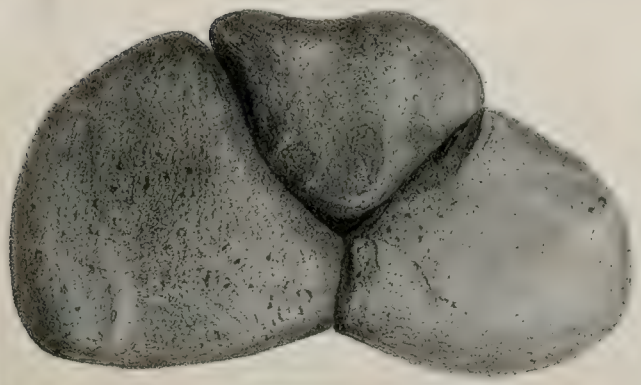
Dinornis elephantopus.



Dinornis elephantopus.

Fig. 2.





a

Fig 1.

From Nature on Stone by J. Erxleben

Fig. 1. Dinornis elephantopus, jun. — 2. Dinornis crassus jun.

XII. *On* Dinornis (Part VIII.) : *containing a Description of the Skeleton of the* Dinornis elephantopus, *Owen.* *By* Professor Owen, *F.R.S., V.P.Z.S.*, &c.

Read April 8, 1856.

In attempting the reconstruction of the entire skeleton of the *Dinornis elephantopus*, after the structure of the leg and foot had yielded the grounds for determining the species, my first step was the classification of the vertebræ.

Of these bones several hundreds had been collected by Mr. Commissioner Mantell at the spot where the bones of the leg had been found (*ante*, p. 156).

Upon comparison, the several vertebræ of obviously the same individual or species of *Dinornis*, presented good distinctive characters; and many series, of greater or less extent, were formed in the progress of the work; such series belonging, respectively, to the same individual skeleton of a different species of *Dinornis*.

Not to dwell needlessly on the different steps of this work of arrangement, in which I was efficiently aided by Mr. Flower, the experienced Articulator, I may proceed to state, that, after classifying the pelvises according to their size and probable species, one of these, which in general size and in the proportions of acetabulum accorded with the femur of *Dinornis elephantopus*, was found to present a well-marked anterior articular surface both on the centrum and on the fore part of the peculiarly long and strong square-shaped spine; the articular surface on the spine being unusually rugged.

Among the vertebræ previously classed as the 'last dorsal,' was found the one that had articulated with the above pelvis; and that dorsal vertebra terminated a series of seven dorsals, progressively decreasing as they advanced forwards, and indubitably belonging to the same individual bird.

The last dorsal vertebra of the *Dinornis* is characterized by a pair of tuberous processes (hypapophyses) from the under part of the centrum, close to the hind border: in the present skeleton of the *Dinornis elephantopus*, they are an inch apart: this vertebra is also characterized by the height of its spine, which is subquadrate; slightly expanded above; smooth at the sides, but rough at the fore and back parts. The height of this spine is four inches. There is a rudimentary tubercle at the middle of the under surface of the centrum near the anterior border. The articular surface at that end is concave transversely, convex vertically. The parapophysis is a large surface with slightly raised borders near the fore part of the centrum. The diapophysis is short and thick: at its under part is the pneumatic orifice. The proximal end of the rib is strongly bifurcated

to articulate with the two processes; it supported an appendage, but does not join the sternum. The above-described vertebra is the seventh dorsal, or the last free vertebra that supports moveable ribs (Pl. XLVI. D 7).

The sixth dorsal (*ib.* D 6) is narrower and with a spine somewhat shorter than the seventh. The posterior hypapophyses are nearer together: the anterior one is more developed: the spine, besides being shorter, is more compressed; but the diapophysis is longer, and the base of the neural arch is of greater fore-and-aft extent. The rib is stronger and longer; it supported an appendage, but is equally free from junction with the sternum. At the under part of the base of the diapophysis is the large pneumatic opening.

The fifth dorsal (*ib.* D 5) presents a corresponding decrease in transverse and vertical diameter, without any loss of fore-and-aft extent. The posterior hypapophyses have coalesced into a single process: the anterior hypapophysis is a strong ridge, with the fore part a little in advance of the anterior articular surface of the centrum. The shorter and more compressed spine has a somewhat greater fore-and-aft breadth than in the sixth vertebra: its height is not quite three inches.

In the fourth vertebra (*ib.* D 4) the anterior and posterior hypapophyses have coalesced into a single ridge, with a tuberosity on each side of its fore part; the ridge appearing to be a downward continuation or termination of the sides of the compressed centrum. The diapophysis is thicker but shorter than in the foregoing vertebræ: the spine, though shorter and somewhat thinner, has a greater fore-and-aft diameter; it is truncate a-top, like the rest.

The ribs of this and the succeeding vertebra, the fifth, are the largest; they each support a lamelliform appendage articulated to a well-marked surface at the back part, below the middle of the rib. The appendage is three inches in length and one in breadth; ascending obliquely and overlapping the succeeding rib. The sternal portion of the rib of the fourth dorsal joins the sternum.

The third dorsal vertebra (*ib.* D 3) much resembles the fourth; but with a slight diminution of size and a somewhat lower position of the parapophysis: this is associated with a rather longer and more bent-down neck of the rib. The sternal part of this rib joins the sternum.

In the second dorsal vertebra (*ib.* D 2) the inferior ridge is divided by a notch into an anterior and posterior hypapophysis; but the diminished size of the vertebra, the lower parapophysis, with a smaller articular surface for the rib, and shorter diapophysis, distinguish it from a fifth dorsal. The spine is somewhat shorter, and inclines more forward than that of the third dorsal.

In the first dorsal (*ib.* D 1), the hypapophysis is a ridge projecting from rather more than the anterior half of the centrum: the parapophysis has a smaller cup for the head of the rib than in the second dorsal: the diapophysis is proportionately diminished in size: the neural spine is smaller in every dimension, and slopes more forward. There

is a small pneumatic foramen below and in front of the diapophysis. The rib, about four inches in length, terminates in a point, and has no sternal portion, nor any appendage.

Besides the seven pairs of ribs from the seven dorsals, there are two pairs from the anterior sacrals, progressively diminishing in size, and the last terminating freely in a point. The first of these sacral ribs was moveably articulated to the first sacral vertebra: the second is anchylosed to the second sacral vertebra.

Thus the *Dinornis elephantopus* had nine pairs of long, conspicuous ribs: the first floating; the second to the fourth pairs inclusive composed of pleurapophysis and hæmapophysis, the latter articulating with the expanded hæmal spine or sternum. The next three pairs had hæmapophyses, or 'sternal ribs' which did not reach the sternum: the eighth and ninth pairs, simple and pointed like the first pair, belong to the first two of the vertebræ that have coalesced to form the long sacrum.

Of the cervical vertebræ there are fifteen, each having its individual character, and with trochlear articular surfaces so clearly or definitely sculptured on the ends of the centrum as to permit of no mistake in the co-adaptation of the vertebræ, successively, from the last or fifteenth, *ib.* C 15, up to the atlas, *ib.* C 1. The size of the articular cup on the fore part of the atlas determined the cranium belonging to the present skeleton of *Dinornis elephantopus*.

In the last cervical, *ib.* C 15, the hypapophysis is a ridge from the front half of the centrum; which centrum is longer, but of less fore-and-aft extent than that of the first dorsal. The short rib is anchylosed to both parapophysis and diapophysis; it is an inch and a half in length, pointed and directed backwards. The spine is smaller in all its dimensions than in the first dorsal.

In the fourteenth cervical, *ib.* C 14, the hypapophysis is a thick sub-bilobed ridge from near the fore part of the centrum, but is extended transversely, not from before backwards. The rib is merely a bar uniting the ends of the two transverse processes: the spine is rather more than an inch long, nearly an inch broad, half an inch from before backwards, and bifurcated, with the two divisions on the same transverse line.

The thirteenth cervical, *ib.* C 13, has a pair of anterior hypapophyses with their tuberous ends approaching and almost meeting each other, so as to complete a hæmal canal. The median cleft of the short spine almost divides it into two processes. The canal circumscribed by the met-, di- and pleur-apophyses, on each side of the vertebra, is large enough to admit the fore-finger. The centrum appears to be larger than in the succeeding vertebræ, because it does not lose in fore-and-aft extent while decreasing in other dimensions.

In the twelfth cervical, *ib.* C 12, the anterior hypapophyses are wider apart: the transverse pair of spines are also more apart, and are shorter than in the thirteenth vertebra.

In the eleventh cervical, *ib.* C 11, the hypapophyses are shorter and wider apart: the neural spine is now a pair of tuberosities.

The under surface of the tenth cervical, *ib.* C 10, is widely grooved, with the hypapophysial tubercles deepening the fore part of the sides of the groove. Slightly converging ridges from the upper part of the posterior zygapophyses represent the neural spine.

These ridges converge as they advance upon the neural arch, in the ninth, eighth, seventh, sixth, and fifth cervicals, in which a low tuberosity on the fore part of each ridge represents the divided neural spine. The under surface of the centrum becomes flatter in the above vertebræ: the hypapophyses are represented by a tubercle on the lower part of each parapophysis.

In the fourth cervical, *ib.* C 4, the pair of tubercles representing the neural spine are longer: in the third cervical they are closer together: in the second they have coalesced to form a single spine, with a deep fossa at its back part: in the atlas, *ib.* 1, the neural spine is obsolete.

The hypapophysis in the third cervical is a single median ridge, as it is also in the axis, or second vertebra: in the atlas it is absent. The hind surface of the body of the atlas is convex, a little hollowed above to receive the odontoid process: the lateral 'vertebral' canals are defined each by a slender vertical bar of bone. The under surface is produced into a pair of short tubercles at its hind margin and at its front margin; and they project respectively backwards and forwards, not downwards as hypapophyses. The deep anterior cup, which receives the single occipital condyle, is notched at the middle of its upper part. The neural arch expands beyond the breadth of the centrum, and developes only the posterior pair of zygapophyses.

The pelvis of the *Dinornis elephantopus* (Pl. XLVI. S 63, 64) is one foot nine inches in length, contrasting extraordinarily with the size of the skull.

Six of the anterior sacral vertebræ have parapophyses with the ribs confluent with them, save in the first: beyond the second vertebra the ribs simply abut against the ilium, with which they are confluent.

The ischium, 63, and pubis, 64, which coalesce with the ilium to form the acetabulum, do not again unite with each other: the notch at the under and fore part of the ischium opens into the long interspace between the two posteriorly extended bones. This part of the pubis, 64, is straight and styliform, $8\frac{1}{2}$ inches in length; slightly expanded, to a breadth of 14 lines, near the end; flattened externally, convex internally, so as to offer a subtrihedral transverse section. The ischium, 63, with an upper and lower notch, having smooth and thick rounded borders, near the acetabulum, expands gradually, and is flattened, into a plate of about three inches of vertical depth, with a truncate termination.

Nine caudal vertebræ, of a transversely subquadrate form, with a contracted neural canal, surmounted by a low transversely extended arch supporting a pair of tubercles, represent the basis of the short tail of the Dinornis.

The last of these vertebræ is as small and simple as in other large birds devoid of the power of flight; showing nothing of that characteristic modification of the terminal

coalesced coccygeals in birds of flight, for the support of the rectrices, or steering quill-feathers of the tail.

The cranium is six inches eight lines in length; three inches nine lines across the broadest part, behind the orbits. The post-orbital process is broad, compressed, and descends nearly to the zygomatic arch. The upper mandible is slightly deflected, conical, obtusely pointed, with the external nostrils terminating at the distance of about an inch from the apex of the premaxillary. The upper part of the median nasal process of this bone, together with the nasals, has been broken away. The minor characters of the cranium and of the lower mandible accord generically with those of the *Dinornis*, described in the present volume of the 'Transactions of the Zoological Society,' pp. 60–65. The chief peculiarity of the skull in the present species is its small size, as contrasted with the pelvis and hind limbs.

The characters of the bones of the leg and foot of the *Dinornis elephantopus* have been described in a preceding memoir, and need not here be repeated.

The keel-less sternum, in its shortness, breadth, and subquadrate form; in the two wide and deep posterior notches; in the unusually small and shallow coracoid fossæ; and in the reduction of the articular pits on the costal borders to three on each side, closely conforms to the type of that instructive bone, in the *Palapteryx* (*Dinornis*), described in the fourth volume of the 'Transactions of the Zoological Society,' pp. 194, 195.

I have refrained from entering into closer descriptive details of the skeleton of the *Dinornis elephantopus*, because only the plates can convey an adequate idea of its extraordinary proportions to those who have not seen the original itself.

The specimen, as now articulated, stands in the first compartment of the Palæontological Gallery of the British Museum. The articulated hind-limbs of the *Dinornis* (*robustus*) are placed on each side, as in Pl. XLVII., to illustrate the characteristic proportions of the two extinct species.

The drawings from which the plates have been engraved were taken from two successful photographic views, corrected, as to the relative size of the parts, from the skeleton itself: I am much indebted for the care and skill which Mr. Erxleben has bestowed on this complex subject.

The bones which have served for the reconstruction of the skeleton of the *Dinornis elephantopus* were selected from the large collection obtained by Mr. Commissioner Mantell, in the Middle Island of New Zealand, at the locality (Ruamoa, Middle Island of New Zealand) and under the circumstances described in the preceding memoir.

DESCRIPTION OF THE PLATES.

PLATE XLVI.

Side view of the skeleton of the *Dinornis elephantopus*; with a scale of English feet and inches, showing the degree of reduction of the figure, and the natural height of the skeleton, in the ordinary attitude of the bird, viz. five feet six inches.

PLATE XLVII.

Fig. 1. Front view of the same skeleton.
Fig. 2. Front view of the right leg and foot of the *Dinornis robustus*.
Fig. 3. Front view of the left leg and foot of the *Dinornis robustus*.


BRITISH MUSEUM
NATURAL HISTORY

XIII. *Osteological Contributions to the Natural History of the Chimpanzees* (Troglodytes) *and Orangs* (Pithecus).—No. VI. *Characters of the Skull of the Male* Pithecus Morio, *with Remarks on the Varieties of the Male* Pithecus Satyrus. *By* Professor Owen, *F.R.S., F.Z.S. &c.*

Read December 9, 1856.

At the Meeting of the Zoological Society for scientific business, held on the evening of October 25, 1836, I communicated a description of the skull of an adult Orang-utan, which, on account of its small size, but more especially from the proportions of the teeth, I was led to regard as appertaining to a species distinct from either of the varieties of the then known larger species of Orang-utan (*Pithecus Satyrus*), indicated by the names *Pithecus Wurmbii* and *Pithecus Abelii*.

For the smaller species of Orang—with canine teeth relatively less in proportion to the incisors than in the female of the *Pith. Satyrus*, with the molar teeth relatively larger in proportion to the size of the skull, whilst the superior incisors were nearly as large, and the inferior incisors quite as large, as those of the males of the great *Pith. Satyrus*,—I proposed the name of *Pithecus Morio*.

No record of the sex of the individual from which the skull in question had been derived was obtainable. My own belief was that it belonged to a female Orang; and in a letter on the subject, printed in the 'Revue Zoologique,' 1839, p. 38, in reply to a paper by M. Dumortier[1], I particularly compared the skull on which the *Pithecus Morio* had been founded with the skull of the adult female of the *Pith. Satyrus* (var. *Wurmbii*), and showed that the canine teeth of the *Pith. Morio* were relatively smaller, the molars relatively larger, the cranium being absolutely less, with the occiput rounded and convex instead of being flattened, and with the temporal ridges wider apart.

Various have been the subsequent comments of naturalists on the new species, and the evidence on which it was proposed. Mr. Blyth, in his "Remarks on the different species of Orang-utan[2]," states that he "inclines to infer that Mr. Owen's specimen is the skull of a male animal, chiefly from the greater depth of the alveoli" (p. 3), as compared with the skull of a known aged female *Pith. Morio* which died at Calcutta, and the skin and skull of which are preserved in the Museum of the Asiatic Society. Mr. Blyth gives figures of a side- and of a front-view of the skull of the above old female *Pith. Morio* (*op. cit.* pls. 7 & 8). The comparison of these figures with mine, published in the 2nd volume of the Zoological Society's Transactions, confirmed me in

[1] "Notice sur les Modifications du Crâne de l'Ourang-outang," Bulletins de l'Académie Royale de Bruxelles tom. v. 1838.

[2] Journal of the Asiatic Society of Bengal. I quote from a private copy, without date, of the Memoir.

the belief that the Plates 33 and 34 in that volume were of the skull of a female Orang. The small development of the canine teeth, corresponding with that in the skull of ascertained sex, figured by Mr. Blyth, outweighed the difference in the depth of the alveoli of the lower incisors and canines, which I knew to be a variable character in the same sex of the larger species of Orang.

But prior to the publication of Mr. Blyth's paper, the original indication of the second, smaller, and more Anthropoid species of Orang-utan in Borneo had attracted the notice of other able naturalists; some either tacitly ignored the specific distinction, adding the name *Pithecus Morio* to the synonyms of *Pith. Satyrus*, or formally combated my conclusion, as *e. g.* M. Dumortier, in a paper containing many excellent observations on the phases of dentition in the great Orang[1]. Other observers, as *e. g.* Sir James Brooke[2] and Mr. Blyth[3], adopted the species, and gave confirmatory evidence of the constancy of its distinctive characters from the larger Orangs (*Pith. Wurmbii*, *Pith. Abelii*, or *Pith. Satyrus*). Nevertheless, excepting a brief notice by Mr. Blyth of "a nearly grown living male of what he considered to be *Pithecus Morio*, which had no 'cheek callosities,' and had not developed its hindmost molares" (p. 5), I still remained in ignorance of the sex of the first-described specimen of my small species, and felt an increasing desire for the means of comparing the skull and dentition of a known adult male *Pith. Morio* with those characters in the adult male *Pith. Satyrus*. This interesting additional evidence has at length been afforded me by the enterprising explorer of the less-known parts of Borneo, Mr. A. R. Wallace, who has recorded the chief results of his observations on the Orangs in their native wilds in two interesting papers "On the Orang-utan or Mias of Borneo," dated Sarawak, Dec. 1855, and printed in the 'Annals and Magazine of Natural History,' 1856, p. 471.

Mr. Wallace's conclusions are based on the comparison of seventeen freshly-killed Orangs, all but one shot by himself, and of two skeletons and two skulls of Orangs, "the sex and external characters of which were ascertained from those who killed them" (*loc. cit.* p. 472).

Of this most important series for the settlement of the mooted questions of variety or specific distinction of the Orangs, sixteen were fully adult, nine being males, and seven females; and "all obtained in a very limited tract of country, watered by the same small river, and of very uniform physical features," in Borneo (p. 472).

Passing over, for the present, Mr. Wallace's judicious remarks on the characters of the larger Orangs (*Mias Pappan* or *Chappan*[4] and *Mias Rambi* of the Dyaks), I have the satisfaction to quote, with respect to the smaller kind of Orang (*Mias Kassar* or *Kassa* of

[1] *Op. cit.* and Comptes Rendus de l'Acad. des Sciences, 17th December, 1838.

[2] Proceedings of the Zool. Soc. 1841, p. 55. [3] Journal of the Asiatic Society of Calcutta.

[4] Mr. Blyth, in his "Further remarks on the different species of Orang-utan," seems not to have been aware that these native terms were synonymous, for he writes—"One of them (a small but full-grown female) is marked by himself *M. Pappan*; and another is sent by the new name *M. Chapin*," &c.

the Dyaks), that, having obtained two adult males and five adult females, Mr. Wallace regards them as a distinct species, and refers them to my *Pithecus Morio*. The females "so exactly correspond with Prof. Owen's figure, that there is no doubt of their belonging to the same species, the adult male of which will," Mr. Wallace believes, "now be made known for the first time" (p. 474).

The skins of the two small males and of the females were sent, in spirits, together with the skulls, in order to serve for the determination "of the characters of the two species of Bornean Orang, *Simia Satyrus* and *S. Morio*" (p. 475).

The skins and skulls of an adult male and an adult female of the *Pith. Morio* have been secured for the British Museum. The skulls of the other adult male and female *Pith. Morio* are now, through the kindness of Mr. W. Stevens, to whom Mr. Wallace consigned his collections, exhibited, together with the skulls of an adult male and adult female of the *Pith. Satyrus*, to the present Meeting of the Zoological Society (December 9th, 1856).

Mr. Wallace briefly records the height of the two male Morios shot by him, which were respectively 3 feet $8\frac{1}{2}$ inches and 3 feet $9\frac{1}{2}$ inches from the heel to the crown of the head, 6 feet 6 inches between the extremities of the outstretched arms, and about 2 feet 6 inches in the girth of the body; they showed no trace of the cheek-excrescences; the canine teeth "were quite as large as in most specimens of the larger animal, and of exactly the same form" (p. 474).

This was the character I was most desirous of knowing, and the testimony to it, which we owe to Mr. Wallace, sets at rest the question of the sex of the individual, on the skull of which the species *Pith. Morio* was founded twenty years ago.

I proceed now to the comparison of the skull of the adult male *Morio* (Plates XLIX. & L.) with one of the male *Satyrus*, of corresponding age, as indicated by the grinding surface of the molar teeth.

By this indication both skulls have belonged to mature, but not to very aged, animals; the inner enamelled cusps of the first molar (*m* 1), lower jaw, have impressed corresponding cavities on the inner side of the crown of the first molar above; and reciprocally, the two more produced outer cusps of that tooth have made impressions on the outer half of the grinding surface of the first molar (*m* 1) below. In the *Satyrus* the like impressions may be seen, of less size, on *m* 2 below, and the incisors have been more worn; but the crowns of the canines are almost entire, and the peculiar minutely wrinkled surface of the newly formed grinders of the Orangs is still retained on the last molars, as in the male *Morio*.

The canines in the male *Morio* presenting, like the incisors and molars, an equality of size with those of the great male *Pith. Satyrus*, the small size of the skull and lower jaw supporting them is more remarkable than in the female skull.

This difference is particularly marked in a comparison of the span of the zygomatic arches; in the breadth of the cranium as compared with its length; in the greater ex-

panse and flatness of the occiput occasioned by the more strongly developed lambdoidal crest in the *Pith. Satyrus*; and in the smaller relative as well as absolute size of the ascending ramus of the lower jaw and of the condyles in *Pith. Morio*. The incisors of the *Morio*, especially the large mid-pair above, are of equal size with those of the *Satyrus*. The molar series in one of the male skulls (that in the British Museum) occupy a longer tract in both upper and lower jaws than in the female *Morio* figured in my previous Memoir[1].

In the lower jaw the dental series is uninterrupted in the skulls of both species of Orang, the long and large crown of the upper canine diverging a little outwards as it descends, and terminating outside the interspace between the crowns of the lower canine and first premolar.

In the skulls under comparison, the premolar and molar teeth are absolutely larger in the smaller species of Orang.

	Pith. Morio.		*Pith. Satyrus.*	
	in.	lines.	in.	lines.
Extent of the molar series, above . . .	2	4	2	$1\frac{1}{2}$
,, . ,, ,, ,, below . . .	2	8	2	6

The bony palate is narrower and deeper in proportion to its length in the *Pith. Morio*. The correspondence in the configuration and structure of the teeth in the two species is very close.

The differences between the skulls of the two Orangs, *P. Satyrus* and *P. Morio*, besides those of size and proportion, which are noted in the "Table of Dimensions," are chiefly as follows:—

Concomitant upon the permanent retention of the characteristics of immaturity by the adult male of the smaller species, to which 'arrest of development,' *i. e.* of development in the Orang-direction, its more Human-like characters, are due, is the less produced temporal ridge, and its separation from the one on the opposite side by a smooth convex tract of cranium, 1 inch 10 lines in width at the narrowest part. To the same 'arrest' are due the more feeble and less outwardly arched zygomatic processes; the lower and shorter lambdoidal ridges, which are separated by the breadth of the posterior part of the space dividing the temporal ridges, and a consequently more uniformly convex occiput. The orbits are proportionally larger, and in one skull are more sharply defined. The shorter and narrower pterygoid plates in the *Pith. Morio* relate to its proportionally smaller mandible. The bony apertures, both external and internal, of the nasal or respiratory passage are smaller in the *Morio* than in the *Satyrus*; but the occipital foramen (*f. magnum*) in the skulls compared is relatively larger than in the *Pith. Satyrus*.

The two skulls of the male *Morio* transmitted by Mr. Wallace present some notable varieties, of which the most remarkable is that exhibited by the size and extent of the molar teeth, especially those of the upper jaw. In the individual, however (no. 1), in

[1] Trans. Zool. Soc. vol. ii. pl. 34.

which, as shown in the Table of Admeasurements (p. 178), these teeth are so much smaller,—the normal series of five not exceeding in fore-and-aft extent that of the last four of the same series in the other skull,—the smallness of the normal series has been compensated by the superaddition of a fourth molar on each side of the upper jaw, which makes the series of equal extent with that of the other skull. This supernumerary tooth is smaller than the last; it had not emerged from its formative cavity on the left side, nor attained the level of the grinding surface on the right side. There is no trace of a corresponding supernumerary tooth of the lower jaw of the same individual, in which the extent of the normal series of five grinders equals that of the six teeth above. The extent of the grinding surface of the molar series in the other male *Morio* (no. 2) exceeds that in the above-described, owing to the larger size of the crowns of the teeth, which are of the usual kind and number.

In one of the skulls of the female *Pithecus Morio*, transmitted by Mr. Wallace, the left series of molars in the lower jaw shows a supernumerary or fourth true molar; it is rather more than half the size of the contiguous *m* 3, which is not less than the *m* 3 of the right side, where there is no trace of the sixth tooth or its socket. That tooth on the left side has its crown in a proper position for use, and the fore and outer angle has been worn by the action of the last molar, *m* 3, above. There is no trace of the supernumerary tooth on either side of the upper jaw. The length of the molar series here is 1 inch 11½ lines; of the right side, lower jaw, 2 inches 3 lines; of the left side, lower jaw, 2 inches 6 lines.

I first noticed the variety of the supernumerary molar tooth in a skeleton of an adult male Orang (*P. Satyrus*) in the collection of Baron Van der Capella (formerly Governor of Batavia) at Utrecht[1], in the year 1838. In an adult of the large Bornean Orang, which Mr. Blyth believed to be a female, in the Calcutta Museum, but which from the size of the canines I deem to be a male, he records a similar anomaly, in "a fourth true molar, above and below, though on the left side only; that of the upper jaw being of small size and round form, its crown scarcely exceeding that of an upper false molar of *Macacus rhesus*; in the lower jaw the accessory fourth true molar is very little smaller than the normal molars; its crown is directed obliquely inwards, so that as a functional tooth it must have been almost useless; but the outer or upper margin of its crown is a little worn by attrition, as is also the outer cusp of the small accessory molar above[2]."

In consequence of the superior size of the upper incisors and canines in the male *Morio*, no. 1, there is no vacant space between the outer incisor and canine in that skull, and the series of teeth is as continuous in both jaws as it is in the Human subject (Pls. XXXI. & XLVIII.): the points of the long canines are so directed as to overlap, when the mouth is shut, the intervals of those teeth, which are widened into

[1] Odontography, p. 442.

[2] Blyth, "Further remarks on the different species of Orang," *loc. cit.* p. 3.

'diastemata' in other adult male skulls of *Pithecus*, at least in the upper jaw. In the skull of the male *Morio*, no. 2, with the supernumerary molars, the diastema is between 2 and 3 lines wide between the upper canine and the outer incisor on each side. The dental series of the lower jaw is as continuous as in the other male *Morio's* skull.

In the adult males of the *Pith. Satyrus* the intervals between the upper incisors and canines are seldom under 3 lines in extent, and are constant in all the skulls I have examined. I have only observed in one skull corresponding interspaces in the lower jaw: the left canine is separated by a space of a line in breadth from the first premolar, and by one of the same breadth from the outer incisor: the right canine is separated from the outer incisor by an interval of between 3 and 4 lines; but this is evidently due to an abnormal shape and backward twist of the canine on that side. In the upper jaw of the same skull, the right canine has a diastema on each side, that behind being $2\frac{1}{2}$ lines, that in front $1\frac{1}{2}$ line in extent; the left canine is, as usual, in contact with the premolar, but is separated from the outer incisor by an interval of $4\frac{1}{2}$ lines.

There is the same range of variety in the size of the premolar and molar teeth of the *Pith. Satyrus* as of the *Pith. Morio*: the average fore-and-aft extent of the grinding series is, in the upper jaw 2 inches 2 lines, in the lower jaw 2 inches 6 lines; the increase, here, being mainly due to the greater size especially in fore-and-aft extent of the last molar. In the great Bornean male Orang's skull, in the Hunterian Museum of the Royal College of Surgeons (Osteol. Catal. no. 5051), figured in the Zoological Transactions, vol. ii. pl. 32, the upper molar series is 2 inches $4\frac{1}{2}$ lines in extent: in the male's skull, locality unknown, figured in *op. cit.* vol. i. pl. 54, the same series has only 1 inch 9 lines in extent: in the skull of the adult male Sumatran Orang's skull, the skeleton of which is preserved in the Hunterian Museum (*tom. cit.* plates 49, 50 & 56, figs. 4 & 8, Ost. Catal. no. 5050), the extent of the molar series is just 2 inches.

Besides the two skulls, nos. 5050 & 5051, of adult male Orangs of the larger species (*Pithecus Satyrus*) in the Museum of the Royal College of Surgeons, and the skull of the adult male Orang in the possession of the late Mr. Cross of the Surrey Gardens, of which three skulls I published figures and descriptions in 1835 and 1836; I have since described the skull of the adult male, no. 5054, Mus. Coll. Chir., of which a figure of a longitudinal section is given in Trans. Zool. Soc. vol. iv. pl. 29; and the skull of the adult female, no. 5056, Mus. Coll. Chir.[1] I have also examined and compared the skulls of the adult Orangs in the Museum of the Garden of Plants at Paris, and in several museums, public and private, in Holland, together with the skulls, thirteen in number, of the adult male great Bornean Orangs, now in the British Museum.

The results of these comparisons, and of due consideration given to the figures and descriptions by other authors, more especially Temminck, Dumortier, Solomon Mueller, and Blyth, have confirmed me in the opinion expressed in my first Memoir of 1835, in

[1] "Descriptive Catalogue of the Osteological Series contained in the Museum of the Royal College of Surgeons of England," 4to. vol. ii. 1853, pp. 761, 762.

regard to the great Orang or *Pithecus Satyrus*, viz. that the observed and recorded differences "are not sufficient to afford grounds for specific distinction[1]."

The following are notes on the adult Orangs made in 1838, in the Continental Museums.

"*Museum of the University of Leyden. Adult Orangs.*—The skulls of the females all exhibit the relatively smaller canines and corresponding feeble development of the occipital and parietal crests which M. Temminck has described; but they differ in these respects and in relative size; and these differences, as is evident from the condition of the teeth, are not differences of age. I observed one of those crania in which the canine teeth were not more developed than in my *S. Morio*; it was marked '*Simia Satyrus*, female:' the strong ridges at the outside of the lambdoidal suture soon subsided, and were not continued into each other to form a single occipital crest, as described by M. Dumortier in both the male and female of the large Orang (*Simia Wurmbii*) at the fourth epoch, or when just arrived at maturity: there was no sagittal crest. The front incisors were as large as in the great male Pongo, but the longitudinal extent of the molar series of the upper jaw was only 2 inches 3 lines; that of my *Morio* being 2 inches 2 lines; so that the difference here is unimportant. The length of the molar series in the lower jaw was 2 inches 6 lines: length of the skull 8 inches, greatest breadth 5 inches. The grinding surface of the molars showed the animal to be fully adult. This skull presented the characteristics of the *S. Wurmbii* in the contracted interorbital space: there were numerous (three) suborbital foramina, and some vascular perforations in the thick outer border of the orbit. The nasal bone is totally interrupted by the junction of the nasal processes of the maxillary bones of the opposite sides with each other; the lower part of the nasal bone is triangular.

"In a second example of a female, having the canines and the molars of the same size as in *S. Morio*, all the sutures were obliterated, and the frontal and lambdoidal ridges were stronger than in the *Morio*.

"In the skull of a female, immature, all the permanent incisors and bicuspides, and the first and second molares, are in place: the points of the permanent canines are just appearing, having pierced the alveolus: the last molars are still in the formative cavity, but the crowns are complete. This would seem to show that the canines are later in appearing than in the Human subject. The intermaxillary suture has begun to be obliterated at its lower extremity, between the sockets of the canines and incisors; it continues open upon the face. The sutures of the head, with the exception of a small part of the lambdoidal, remain unobliterated. The temporal joins the frontal bone on both sides.

"In the skull of a male I observed the zygomatic process of the malar bone existing as a separate piece: the wise-tooth, *m* 3, was mal-placed, its grinding surface abutting against the adjoining molar: either the revolving motion had been carried too far, or the mal-position had been original.

[1] Trans. Zool. Soc. vol. i. p. 378.

"*M. Klingenberg's Museum.*—In the skull of an adolescent male *S. Satyrus*, all the permanent molars were in place, and the large canines had nearly got into place: there was a well-marked diastema between the canines and premolars in the lower jaw, as well as the diastema always present between the canines and incisors of the upper jaw: here the maxillo-premaxillary suture had become nearly obliterated; a small proportion of its upper part, and that within the nasal cavity, alone remaining open. The parietals do not join the frontals on either side.

"*Adult female.*—The lambdoidal, sagittal, and premaxillary sutures were obliterated: the canines were small, and these, with the incisors, had been well worn: there was scarcely any diastema or vacant space between the canines and bicuspides of the lower jaw; but a well-marked interspace between the canines and incisors in the upper jaw. The nasal bone was not compressed in this skull, as in one of the preceding.

"*Baron V. der Capella's Collection.*—Here I saw a singular variety in the skull of an adult *S. Wurmbii*, viz. six molar teeth instead of five on each side of the lower jaw. In the skeleton of the adult Sumatran Orang, at the College of Surgeons, there is the reverse variety of dentition, only four molars, two true and two false, being developed on each side of each jaw. It was this which partly led Dr. Harwood to imagine it to be a distinct species from the young *Simia Satyrus*.

"*Museum Senkenbergianum, at Frankfort.*—Here I saw the cranium of an adult Orang, sex unknown, most probably female, smaller than my *S. Morio*, the total length being 7 inches 3 lines: the canines were nearly as feebly developed, the length of the enamelled crown being 7 lines; the length of the molar series, upper jaw, was 2 inches 1 line; but the middle incisors were as large as in the *Morio*, the breadth of the crown being $6\frac{1}{2}$ lines: the principal difference in this cranium arose from the great development of the supra-orbitary ridge, which gave it the character of the skull of the Chimpanzee, from which, however, it differed in other essential points."

The chief variety in the skulls of the adult males of the large species of Orang is in the temporal ridges, depending on the development of the temporal muscles: in some (Pl. L. fig. 1) the ridges meet and form a 'parietal crest,' rising above the median line of the vertex; in others (Pl. L. fig. 3) they do not meet, but form two low lines or ridges, at varying distance from each other in different skulls.

Of the thirteen skulls of large male Bornean Orangs in the British Museum, seven have the parietal crest, and six have the two separate temporal ridges. Both series of skulls are fully adult, and show nearly the same differences of age, so far as such differences are indicated by the degree of abrasion of the teeth. The presence or absence of the parietal ridge clearly does not depend upon the age of the adult. In certain individuals only it depends upon age: the temporal ridges do not meet in any of the great male Orangs until the permanent canine teeth have come into place; but in many individuals those ridges remain separate throughout life, or until a very advanced age. The sixth stage, described by M. Dumortier[1], is characteristic of the adults of certain indi-

[1] *Op. cit.* p. 7.

viduals of the great Orangs (*Pith. Satyrus*) before they attain old age ('l'âge vieux'): it is not the absolute characteristic of any age of the species.

In the skull no. 3 B, Brit. Mus., the parietal crest is 3 lines high: the first true molar shows the small cavities on the grinding surface formed by the more prominent pair of cusps of the opposite tooth, upon the inner half of the upper, and on the outer half of the lower tooth. These cavities have hardly begun to be formed on the second molar; and the grinding surface of the third molar shows its primitive minutely wrinkled surface. In this skull about half an inch of the stylohyal is ossified and anchylosed to the vaginal ridge, forming the so-called 'styloid process' of the temporal bone.

The skull no. 1080, which by the state of the teeth is about the same age as the preceding, has also a parietal crest 3 lines in height, but it is thicker than in no. 3 B: the styloid processes are 3 lines in length.

In the skulls nos. 1085 and 1088, the cavities in the second true molars are rather better marked, but the crown of the third molar is wrinkled; the crowns of the canines are obliquely worn, the upper ones by attrition against the first lower premolars; but they retain their full length: the incisors have had half the crown abraded. The sagittal crest is similar to the foregoing: there are no styloid processes. The nasal bone is shorter in 1085.

In an adult male of the large Orang, in Mr. Stevens's charge, no. 2, with less-worn incisors and canines, the parietal ridge is 4 lines high. The nasal bone does not rise above the level of the malo-frontal suture; it is bisected by the maxillaries meeting at the median line, as in the skull in the Leyden Museum, above noticed[1].

In the skull in the British Museum, no. 3 A, with the canines and incisors much more worn down than in the foregoing skull, and with deep cavities in both the first and second molars, and also in the third molar of the lower jaw, the temporal ridge is less elevated, but is thicker: there is a styloid process on the right side, 5 lines in length.

In the skull no. 1079, all the molars, as also the premolars, show deep cavities through long attrition, and the crowns of the upper canines are much worn away: the temporal ridge is low and thick, not higher than in the skull no. 3 A. The styloid processes are 5 lines in length.

The skull no. 3 C (Pl. L. fig. 1) is of an aged individual: the inner halves of the upper molars (*ib.* fig. 2) are worn half-way down. The parietal crest is moderately thick, and 4 lines high.

In this series of crested skulls there are modifications of general size and proportions, of extent of the molar series, of the shape of the nasal bone, of the size and shape of the orbits, of the degree of prominence of the superorbital ridge, and of the pre-

[1] I have seen the skull of an Orang (*Pith. Satyrus*) in which the nasal bone was reduced to its lower border —a small piece wedged into the upper part of the bony nostril; and another skull of an Orang without any trace of nasal bone, the place of which was supplied by the united nasal processes of the maxillaries.

maxillaries, with concomitant varieties of profile contour,—offering forms and characters of cranium intermediate between the two extremes of the crested adult male skulls figured in the Zoological Transactions, vol. i. pl. 54, and vol. ii. pl. 32.

I next proceed to notice some characters in the series of six adult male skulls of the large Bornean Orang, which have no parietal crest.

In the youngest of this series, no. 1100, the temporal ridges are 14 lines apart, yet half the crowns of the incisors are worn away; but the crowns of the canines are nearly entire, and the molars are not more abraded than in the crested skull, no. 3 B. The lambdoidal ridges are interrupted by the breadth of the space between the temporal ridges.

In the skull no. 1101 (Pl. L. fig. 3), those ridges are 10 lines apart, and are more directly continued behind into the lambdoidal ridges: the inner halves of the upper molars (fig. 4) and the outer halves of the lower molars are worn into smooth cavities. There are styloid processes 3 lines in length.

In no. 1086, with the molars as much worn as in the preceding skull, the temporal ridges are 12 lines apart: there is a low smooth longitudinal rising, not to be called a ridge, in the midspace between the ridges. The styloid processes are 3 lines in length. The lower molars of this skull are figured in Plate L. fig. 5.

In no. 1087, the temporal ridges are 10 lines apart, with a low narrow median longitudinal rising; the molars are as much worn as in no. 1101, except that the last, owing to their unusually small size, have escaped their due share of abrasion. One half of the crowns of the canines are worn down: the lambdoidal ridge is strongly developed, and the occiput proportionally broad.

In no. 1131, the grinders are so much worn that the roots protrude from the sockets, yet the temporal ridges are 6 lines apart.

A still greater degree of abrasion is shown by the molars of no. 15, the inner halves of the upper ones being ground down to the roots, which project from the sockets: the temporal ridges are 3 lines apart.

The kind and degree of variety in the above series of non-crested skulls are the same as in the crested series. My interpretation of the difference of development of the temporal muscles, as indicated by the separation or confluence of the temporal ridges in these great Orangs, is as follows:—those muscles are closely related, in regard to their development beyond a certain size, to the magnitude and use of the canine teeth. The great proportional size of these teeth is a characteristic of the male sex; their chief use has probably, therefore, a sexual relation. Like the horns of the Bull or the antlers of the Deer, they are the weapons by which the males contend for the possession of the female.

Orangs may be born with original differences of disposition, some being more courageous, more combative than others. This proneness to fight and conquer is the probable concomitant of a superior general robustness of frame, of greater nervous

energy and consequent activity. Those males which are so endowed will acquire, by the more frequent and energetic exercise of their biting muscles in such conflicts, a greater development of these muscles; just as the blacksmith or boxer gains a greater bulk and firmer fibre in the muscles of the arms; and, as this development of the brachial muscles is indicated by stronger ridges on the humerus, so the corresponding development of the biting and fighting muscles in the combative Orangs is accompanied by the confluence of the temporal ridges and their development into an intermuscular crest along the top of the calvarium.

Males of a more peaceful and sluggish disposition have not the stimulus for the extra-development of the temporal muscles, the upper borders of which accordingly remain at a greater or less distance from each other, and the temporal ridges are more or less apart.

No physiologist would interpret such modifications in the development of a particular pair of muscles as a specific distinction. The question, with me, in 1836, was, whether intermuscular crests or ridges, with other observed varieties, in the skulls of the large Orangs of Borneo and Sumatra, were constant in particular breeds, or were indicative of local varieties. The number of skulls, however, of ascertained Bornean origin has, for some time past, satisfied me that there were no ascertained craniological characters differentiating the great Bornean Orang from the great Sumatran one. The valuable and acceptable evidence lately adduced by Mr. Wallace[1], proves that the single-crested and double-crested, or non-crested, skulls of the great males are not respectively the indications of races inhabiting any particular localities in Borneo, but occur in individuals resembling each other in stature, in kind and colour of hair, and in cheek-protuberances: such individuals have been shot in the same limited tract of country.

The skull of the crested variety of the male great Orang (*Pithecus Satyrus*) is figured by Mr. Blyth, as the *Mias Pappan*, in plates 1 and 2 of his "Remarks on the different Species of Orang-utan." The skull of the non-crested or double-ridged variety of the male great Orang is figured, as the *Mias Rambi*, in plates 5 and 6 of the same memoir. Plates 3 and 4 are stated to be of an aged female of the *Mias Rambi*, from Borneo. This specimen is referred to, at p. 1 of Mr. Blyth's memoir, as "an aged female skull marked 'from Borneo' in this Society's Museum," and again at p. 8, as "an aged female skull of a *Mias Rambi* from Borneo." I have looked closely through every part of Mr. Blyth's "Remarks," in the hope of finding some direct evidence of the sex of this specimen. It would seem that the sole record received with the specimen related to its locality. The size of the canines, in the plates of Mr. Blyth's memoir, satisfies me that the specimen was of the male sex. The degree of abrasion of these teeth, of the incisors, and of the outer portions of the inferior molars, indicates it not to have been very old. It exemplifies the single-ridged variety of cranium, of the adult male *Pithecus Satyrus*.

[1] *Loc. cit.* p. 472.

The size of the skull of that specimen, from Borneo, which Mr. Nicholls says was given him, "if he remembers right, as that of a male *Pappan*, full-grown, but not aged," and which skull Mr. Blyth states to be fully equal or even to exceed in size that of the foregoing single-ridged skull, proves it to be, in my opinion, also of the male sex, in which it illustrates the variety without the median crest, the temporal ridges "being an inch apart where most approximated" (p. 8). Mr. Blyth founds his belief that the specimen presented by Mr. Nicholls was a female, on modifications of the pelvis; but I doubt whether the long and flat ossa innominata of the great Bornean Apes are safe guides for determining sexual characters. The skeleton from Sumatra, in the Mus. Coll. Chir., No. 5050[1], to which he refers, p. 10, is that of an adolescent male animal. I have not yet received any good evidence, or proof, that the canines are developed to the degree presented in that skeleton, in any female individual of the large species of Orang.

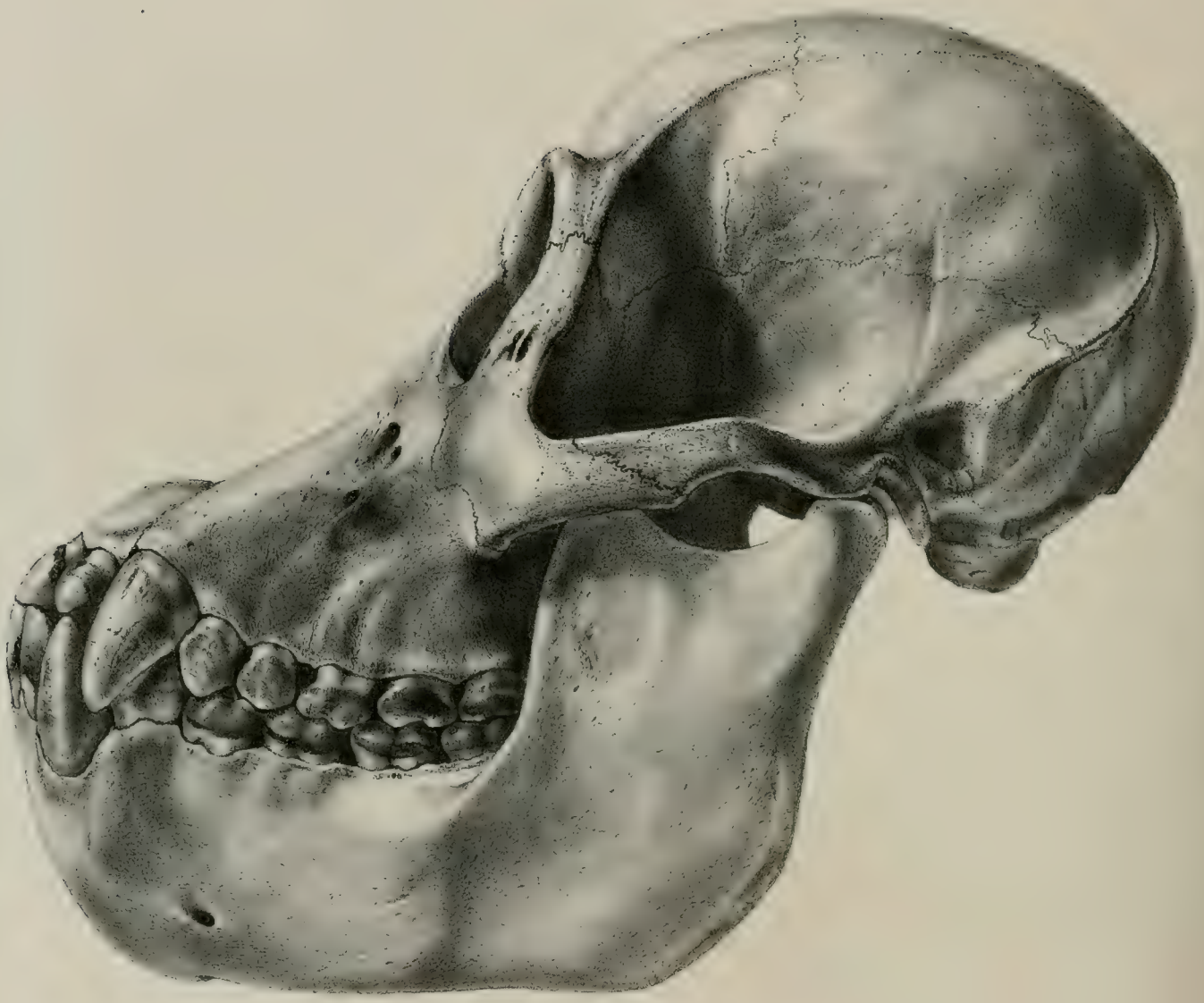
Mr. Blyth has recorded a very remarkable and interesting variety presented by an "adolescent female resembling *Pithecus Morio* in size, but having a much shorter fore-arm and more anthropoid conformation of skull," of which he gives a sketch of the side and front view in his plates 9 and 10.

On this subject I would remark, that, in a genus characterized by so unusual a length of upper limbs as *Pithecus*, or the Orang-kind, we ought not to be surprised to find, as an individual variety, an arrest of development of those limbs; the abnormality, as it regards the genus, being a nearer approach to the general type.

Much more evidence than a single specimen is required to establish our confidence in the existence of a propagating variety of shorter-armed Orang,—still more research to prove it to be a species. The cranium, indeed, shows (in pl. 10 of Mr. Blyth's memoir) a shorter and more receding chin; but this part of the lower jaw is subject to variation in other Orangs.

When we review the varieties, already recorded, in the large Orang (*Pithecus Satyrus*) of Borneo and Sumatra, especially in regard to the presence or absence of the nail and its phalanx in the hallux; the occasional supernumerary molar tooth; the length of arm; the intermuscular ridges and crests of the skull; the shape of the orbits; the size and other conditions of the nasal bones; the fore-and-aft extent of the molar series, and the profile contour of the skull; we derive additional proof *that the* Simia Satyrus *of Linnæus is subject to a greater amount of variety in a state of nature, than has hitherto been observed in any other Quadrumanous species.* As to the primitive originality of the *Pithecus Morio* in Borneo, I by no means entertain a decided opinion. Had the whole dental series been proportionally smaller, as it is in the *Troglodytes niger*, in comparison with the *Trogl. Gorilla*, there might have been more reason for concluding as to the distinction of the species. For I have observed, that in the shorter or dwarf varieties of the human species, the teeth do not diminish in size in the ratio of the general stature.

[1] See the description of the skeleton in my Catalogue of the 'Osteology' in that Museum, vol. ii. p. 759.



C.H. Ford.

W. West. imp.

Thomas Motte, m.d.

Fig 1

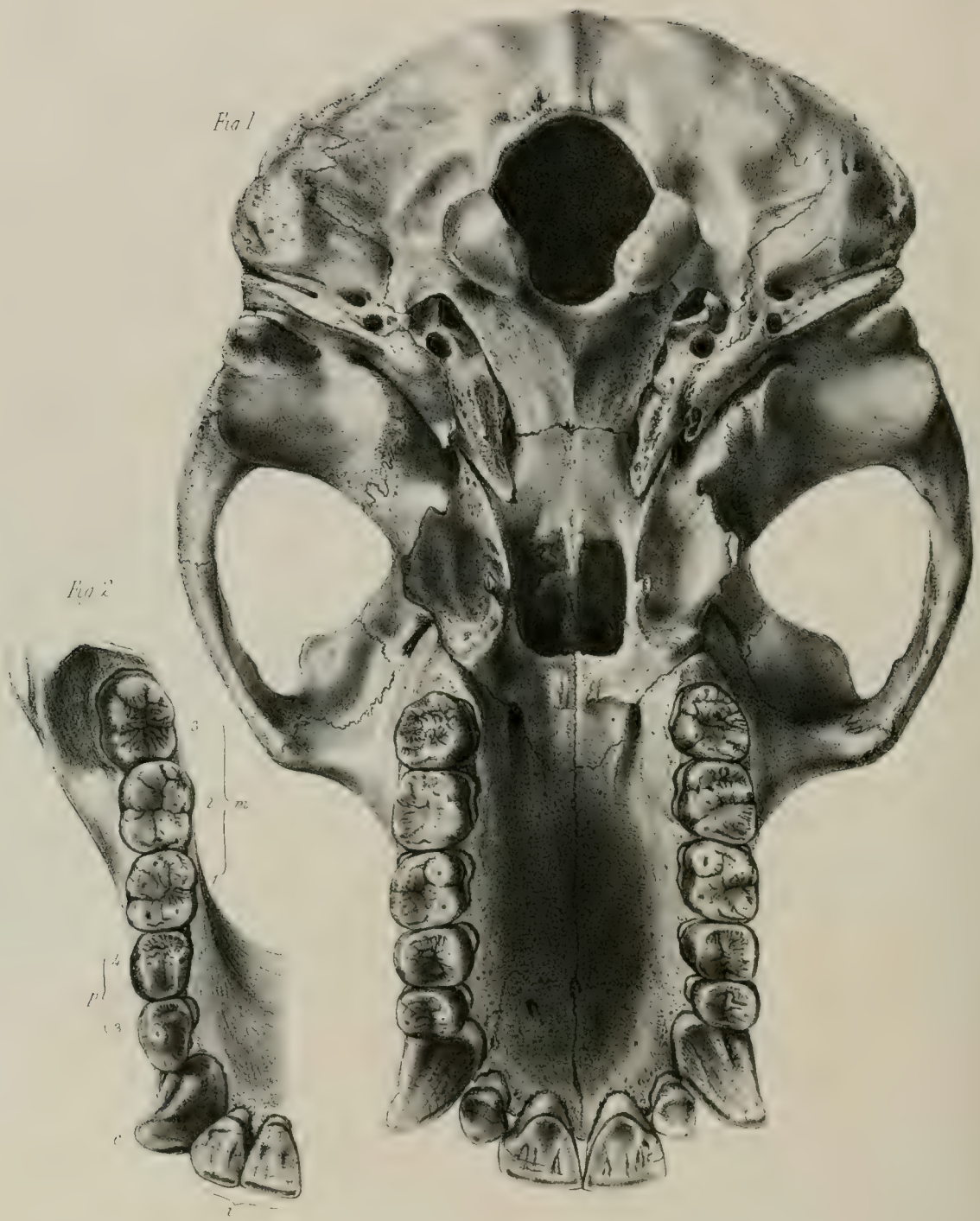
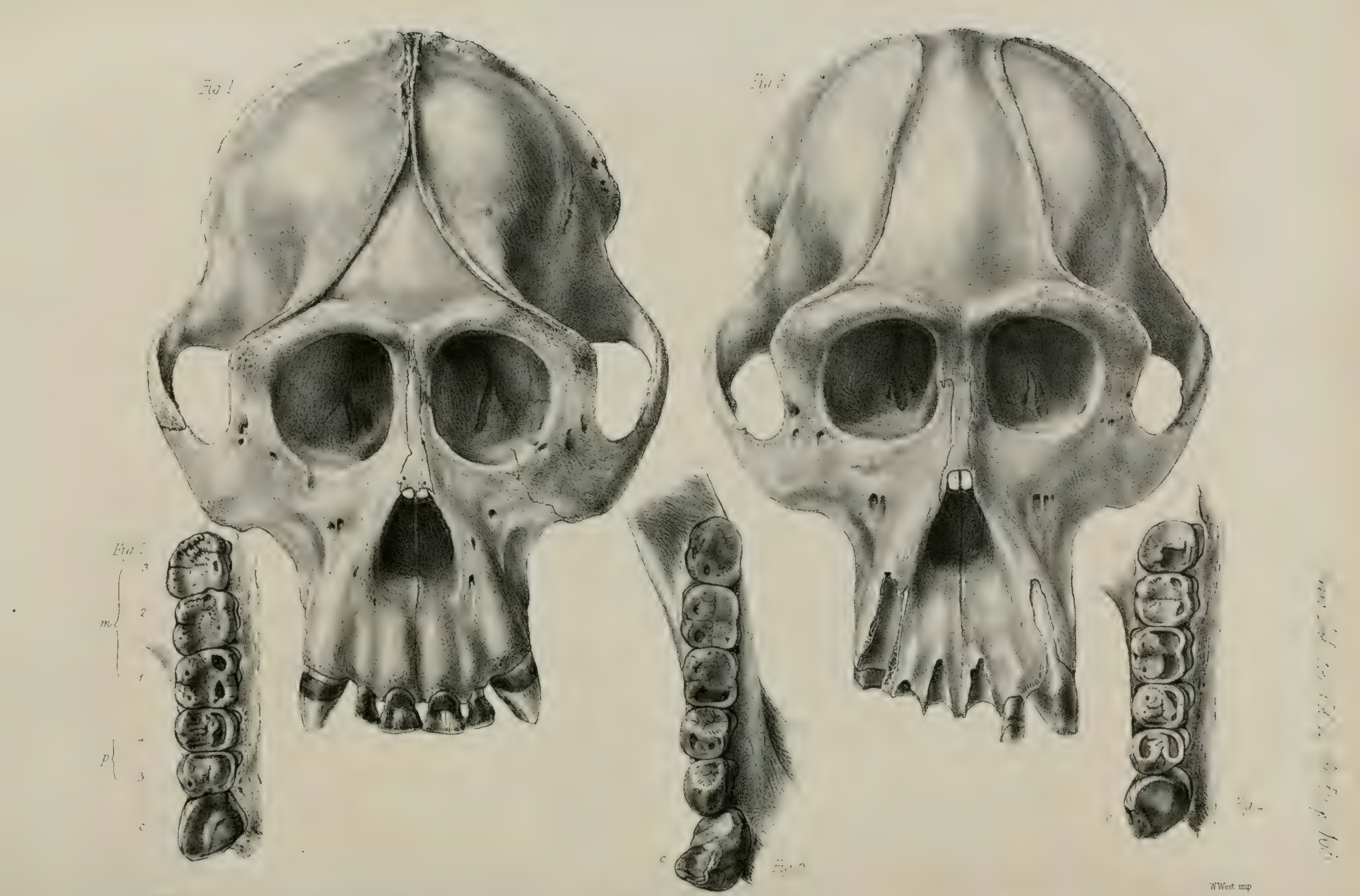


Fig 2



Figs. 1. 2. Pithecus Satyrus var. Gigas.

Figs. 3. 4. & 5. Pithecus Satyrus var. Wurmbii.

The *Pithecus Morio* may, therefore, *quoad* its origin, be an old-established, and now permanent, dwarfed variety of the *Pith. Satyrus*. I apprehend that few naturalists, now-a-days, in describing and proposing a name for what they call "a new *species*," use that term to signify what was meant by it twenty or thirty years ago, that is, an originally distinct creation, maintaining its primitive distinction by obstructive generative peculiarities. The proposer of the new species now intends to state no more than he actually knows; as for example, that the differences on which he founds the specific character are constant, in individuals of both sexes, so far as observation has reached; and that they are not due to domestication or to artificially superinduced external circumstances, or to any outward influence within his cognizance; that the species is wild, or is such as it appears by nature. It becomes, therefore, a matter of convenience, if not of necessity, to indicate the species by a distinct name, in the imparting of zoological knowledge.

The justification of such a procedure depends on the kind and degree of evidence, and I believe that I have at length been enabled to record such evidence, in regard to the *Pithecus Morio*, in the 'Transactions of the Zoological Society.'

DESCRIPTION OF THE PLATES.

PLATE XLVIII.

Side view of the skull of an adult male *Pithecus Morio*: nat. size.

PLATE XLIX.

Fig. 1. Base view of the same skull: nat. size.
Fig. 2. Grinding surface of the lower teeth, right side: nat. size.

PLATE L.

Fig. 1. Top view of the skull of an adult male *Pithecus Satyrus*, var. *Pappan*: half nat. size.
Fig. 2. Grinding surface of upper molars and canine, left side: nat. size.
Fig. 3. Top view of the skull of an aged male *Pithecus Satyrus* (the variety called *Mias Rambi* by Blyth), with separated temporal ridges: half nat. size.
Fig. 4. Grinding surface of upper molars and canine, left side: nat. size.
Fig. 5. Grinding surface of lower molars and canine, right side: nat. size.

Table of Admeasurements.

	P. Morio. Mas. No. 1. in. lin.	*P. Morio.* Mas. No. 2. in. lin.	*P. Morio.* Fem. in. lin.	*P. Satyrus.* Fem. in. lin.	*P. Satyrus.* Mas. Crested. in. lin.	*P. Satyrus.* Mas. No crest in. lin.
Length of the skull from the vertex to the base of the occipital condyle	3 10	3 10	3 6	3 7	4 2	3 10
Length of the skull from the posterior plane of the occiput to the margin of the incisors	8 3	8 3	7 6	8 0	9 3	8 6
Length of the skull from the posterior plane of the occiput to the fronto-nasal suture	4 11	4 9	4 6	4 6	5 0	4 10
Length of the skull from the fronto-nasal suture to the margin of the incisors	3 9	4 0	3 8	3 7	4 6	3 11
Length of the skull from the anterior margin of the occipital foramen to that of the premaxillaries	5 $7\frac{1}{2}$	5 8	5 0	5 6	6 2	5 10
Breadth, between the outsides of the zygomata	5 2	5 3	4 10	5 9	6 6	6 0
Breadth, between the post-auditory ridges	4 6	4 9	4 6	5 8	5 6	5 3
Breadth, behind the orbits	2 7	2 6	2 5	2 6	2 6	2 9
Breadth, between the outsides of the orbits	3 $10\frac{1}{2}$	3 10	3 8	4 3	4 $2\frac{1}{2}$	4 3
Transverse diameter of orbital cavity	1 $4\frac{1}{2}$	1 5	1 4	1 6	1 6	1 5
Vertical diameter of orbital cavity	1 $8\frac{1}{2}$	1 7	1 6	1 7	1 7	1 8
Vertical diameter of nasal aperture	1 3	1 $2\frac{1}{2}$	1 $1\frac{1}{2}$	1 3	1 7	1 $4\frac{1}{2}$
Transverse diameter of nasal aperture	0 $10\frac{1}{2}$	0 9	0 9	1 0	1 2	1 0
Interspace between suborbital foramina	1 9	1 7	1 6	1 9	2 1	1 11
Distance between the inferior margin of the nasal bone and that of the premaxillary	2 2	2 6	2 1	2 0	2 9	2 3
Distance from the anterior margin of the occipital foramen to the posterior margin of the bony palate	2 10	2 6	2 5	2 5	3 0	2 8
Length of the bony palate along the median suture	2 10	3 $2\frac{1}{2}$	2 9	3 0	3 3	3 3
Length from the anterior margin of the premaxillaries to that of the prepalatal foramen	0 9	0 11	0 9	0 11	1 2	0 11
Breadth of the crown of the first incisor, upper jaw	0 $6\frac{1}{4}$	0 7	0 6	0 6	0 7	0 $6\frac{1}{2}$
Breadth of the four incisors, *in situ*, upper jaw	1 6	1 $7\frac{1}{2}$	1 6	1 5	1 6	1 6
Fore and aft extent of the grinding surface of the molar series, upper jaw[1]	1 $11\frac{1}{2}$[2]	2 $3\frac{1}{2}$	1 $11\frac{1}{2}$	1 11	2 2	2 0
Length of the enamelled crown of the canine tooth, upper jaw	1 0	1 1	0 7	0 7	1 0	1 0
Breadth, greatest, of the enamelled crown of the canine tooth, upper jaw	0 7	0 $7\frac{1}{2}$	0 6	0 6	0 8	0 $7\frac{1}{2}$
Length of the lower jaw, from the condyle to alveolar margin of incisors	5 7	5 13	5 3	6 0	6 9	6 2
Height of ascending ramus of lower jaw	3 $5\frac{1}{2}$	3 6	3 3	4 0	4 4	3 10
Greatest breadth of lower jaw (between outsides of condyles)	4 6	4 9	4 3	4 10	5 5	5 0
Interspace between mental foramina	1 $7\frac{1}{2}$	1 8	1 10	2 0	2 1	1 10
Fore-and-aft extent of grinding surface of the molar series[1], lower jaw	2 4	2 8	2 2	2 3	2 6	2 6
Least interspace between temporal ridges	1 4	1 10	1 10	0 7	....	1 3

[1] The bicuspids or premolars are included in this series.

[2] Exclusive of the small supernumerary back-tooth; including that, the length of the molar series is the same as in Nos. 2, 2″, 2‴.

XIV. *On the Anatomy of the Great Anteater* (Myrmecophaga jubata, *Linn.*).—Part II.

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

Read February 10, 1857.

In my former communication on the Anatomy of the Great Anteater [1], the position of the stomach and its relations to adjoining viscera were briefly pointed out. In the present paper I propose to describe the form and structure of this very remarkable organ in the *Myrmecophaga jubata*.

Moderately distended (Pl. LI.), the stomach presents a subglobular form, of about 8 inches diameter, with a smaller subglobular appendage as it seems, of about 3 inches diameter (*g*, *g*,), intervening between the main cavity (*c*, *c*) and the intestine (*m*).

The œsophagus (*a*) terminates near the middle of the upper surface of the main portion, of which about 4 inches extend to the left of the cardia, to form what Haller called the 'saccus cæcus.' The general configuration of the stomach, as seen from the anterior surface, is shown in Plate LI.

On the middle of both the anterior and posterior surfaces of the stomach is a sheet of tendon (*d*), of an irregular triangular form, 6 inches in longest diameter, which is in the direction of the length of the stomach, and in which the tendon extends from the large to the small division of the organ, expanding upon both divisions, but acquiring upon the latter its greatest thickness and whitest colour.

Upon bisecting the stomach lengthwise, as in Plate LII., the part described as the main cavity (*c*, *c*) is seen to correspond with the cardiac division, and the appendage (*h*, *i*) to correspond with the pyloric division of the stomach, in Rodentia: but they are much more distinct in structure and functions in the *Myrmecophaga jubata* than in any other mammal with a stomach similarly divided externally. The cardiac cavity has a vascular secreting surface, the lining membrane being disposed in very numerous small wavy rugæ: at the parts where the parietes have yielded most to the distending force, the rugæ are nearly effaced: other larger and more permanent folds are confined to the vicinity of the communication (*f*) with the pyloric cavity, and converge towards the aperture (Pl. LIII. fig. 1, *e*).

The cardiac orifice in the inverted stomach (Pl. LIII. fig. 1, *b*) presents the form of a narrow, slightly bent crescentic slit. It is situated about $3\frac{1}{2}$ inches from the similarly shaped aperture (*f*) of communication between the cardiac and the pyloric cavities:

[1] Trans. Zool. Soc. vol. iv. p. 117.

but the margin of this latter aperture is indented, as it were, by the ends of the converging folds of the lining membrane, about ten in number (*e*, *e*), which are continued into the pyloric cavity. The length of the cardiac slit (*b*) is 1 inch, that of the intercommunicating aperture (*f*) is 1 inch 3 lines.

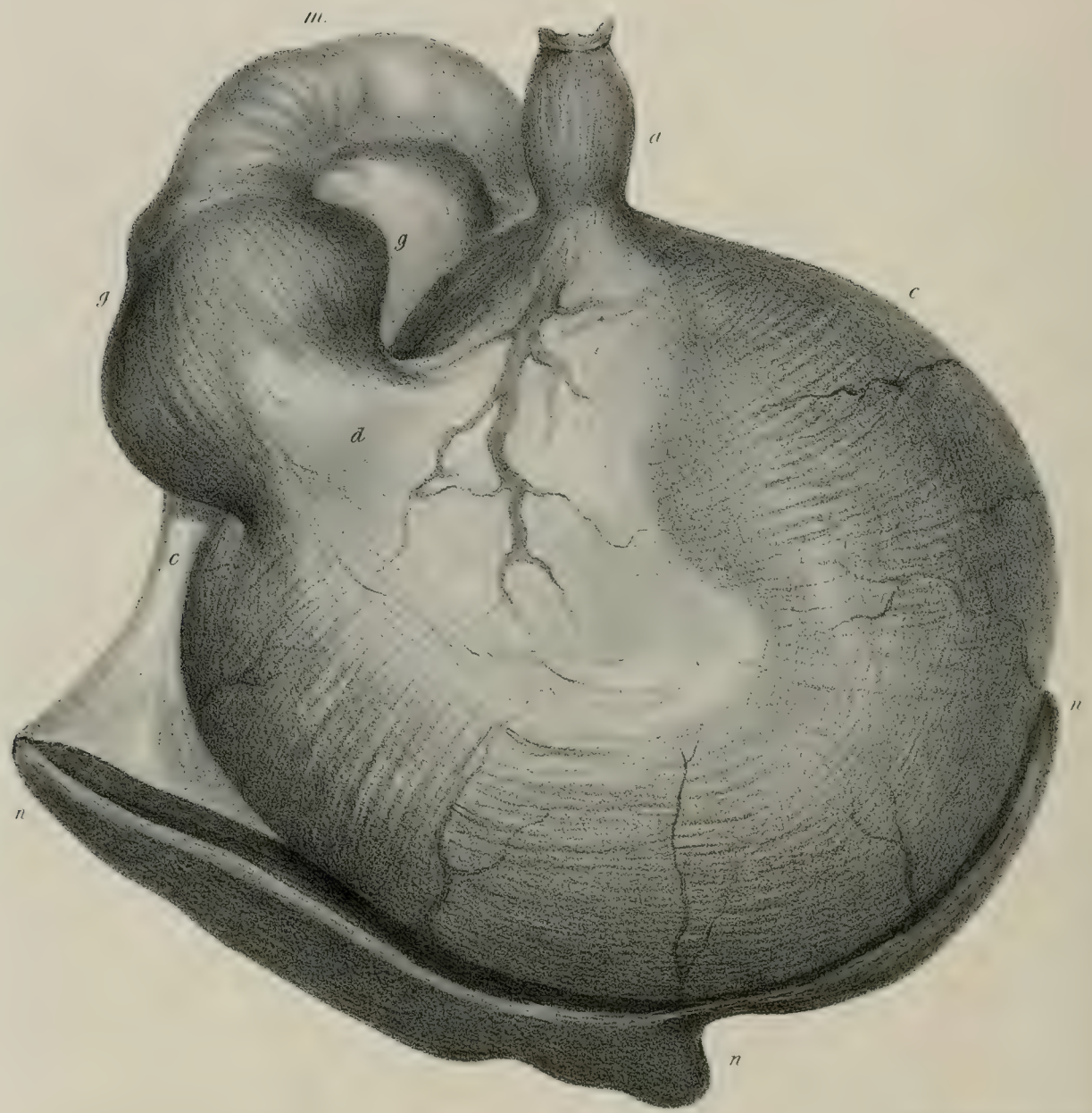
The pyloric division of the Great Anteater's stomach is remarkable for the thickness of its muscular tunic and the density of its epithelial lining, which convert it into a veritable gizzard.

The muscular coat (Pl. LII. fig. 2, *h*, *h*) varies from one inch to half an inch in thickness; at the middle of the cavity it is separated from the lining membrane by an unusual accumulation of the elastic submucous cellular tissue (*i*), which is most abundant in the upper wall of the cavity. A very small proportion only of food can enter at one time into this cavity (*k*), to be subjected to the triturating force of its parietes, operating, with the aid of swallowed particles of sand, in the comminution of the unmasticated or imperfectly masticated Termites.

The area of the pyloric cavity, as exposed by a vertical longitudinal section, as in fig. 1, Plate LII., appears a mere linear, slightly sinuous, tract, with a dilatation near the pylorus (*l*), due to a kind of valvular protuberance of the upper wall projecting towards that aperture. But, when the pyloric cavity is bisected transversely, as in fig. 2, its area then presents a crescentic figure, owing to the protuberance formed by the thicker muscular tunic and the more abundant submucous elastic tissue (*i*) in the upper parietes. The lower longitudinal plicæ (*k*), which commenced on the cardiac side of the intercommunicating aperture, give a longitudinally ridged character to the inner surface of the cavity.

This character is changed near the pylorus, for a reticular rugosity: the pylorus, when viewed from the duodenal side, as in Plate LIII. fig. 2, presents a crescentic form, with the horns of the crescent directed upwards. The lining membrane of the duodenum (*m*) soon became smooth.

For the use of the accurate and beautiful drawings, made after my dissections by Mr. H. V. Carter, formerly Anatomical Student in the Museum of the Royal College of Surgeons, which illustrate the present portion of the anatomy of the *Myrmecophaga jubata*, I am indebted to the liberal permission of the President and Council of the Royal College of Surgeons of England.



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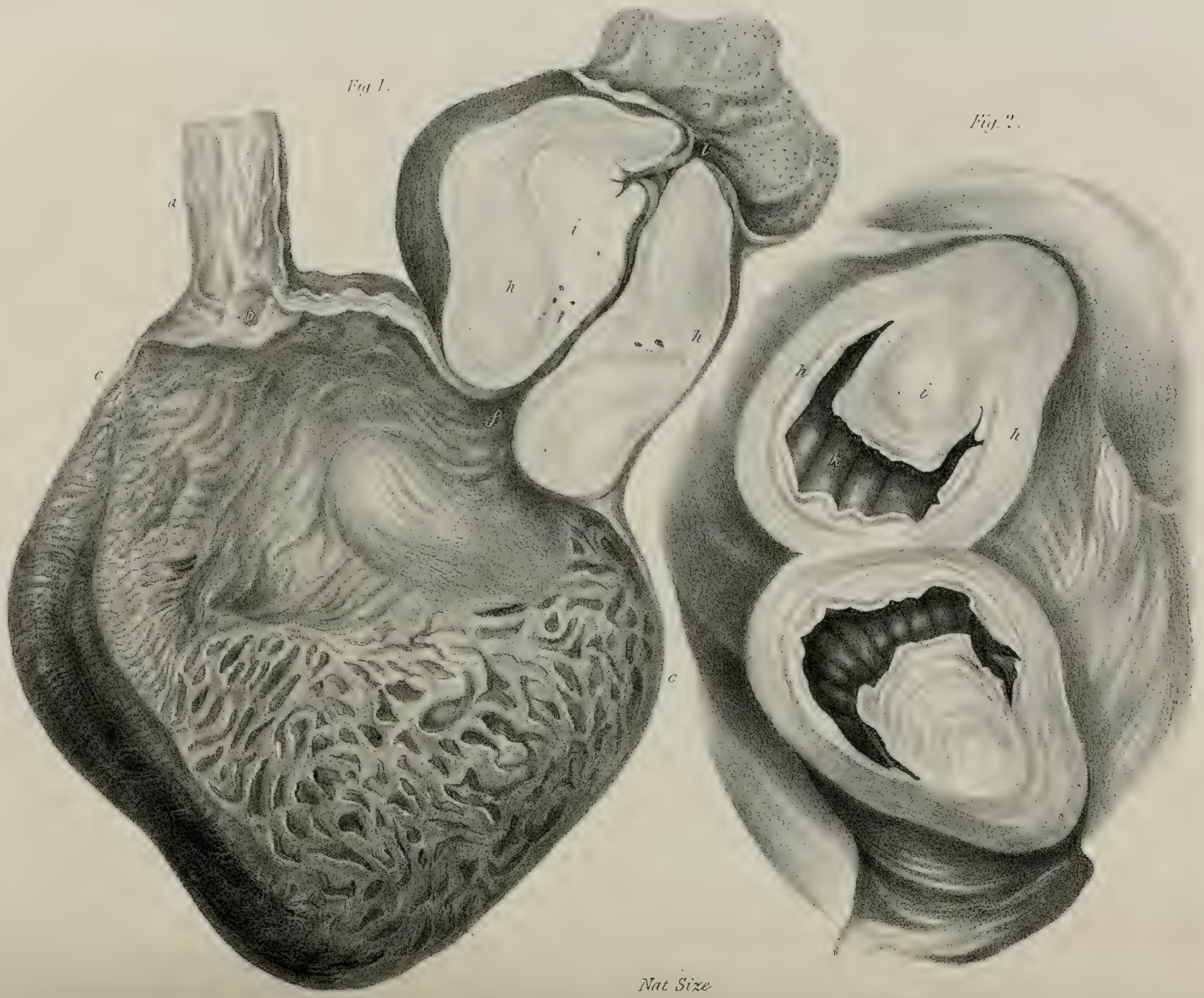
Fig 1.
Fig. 2.
a
b
c
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Nat Size

Fig. 1.

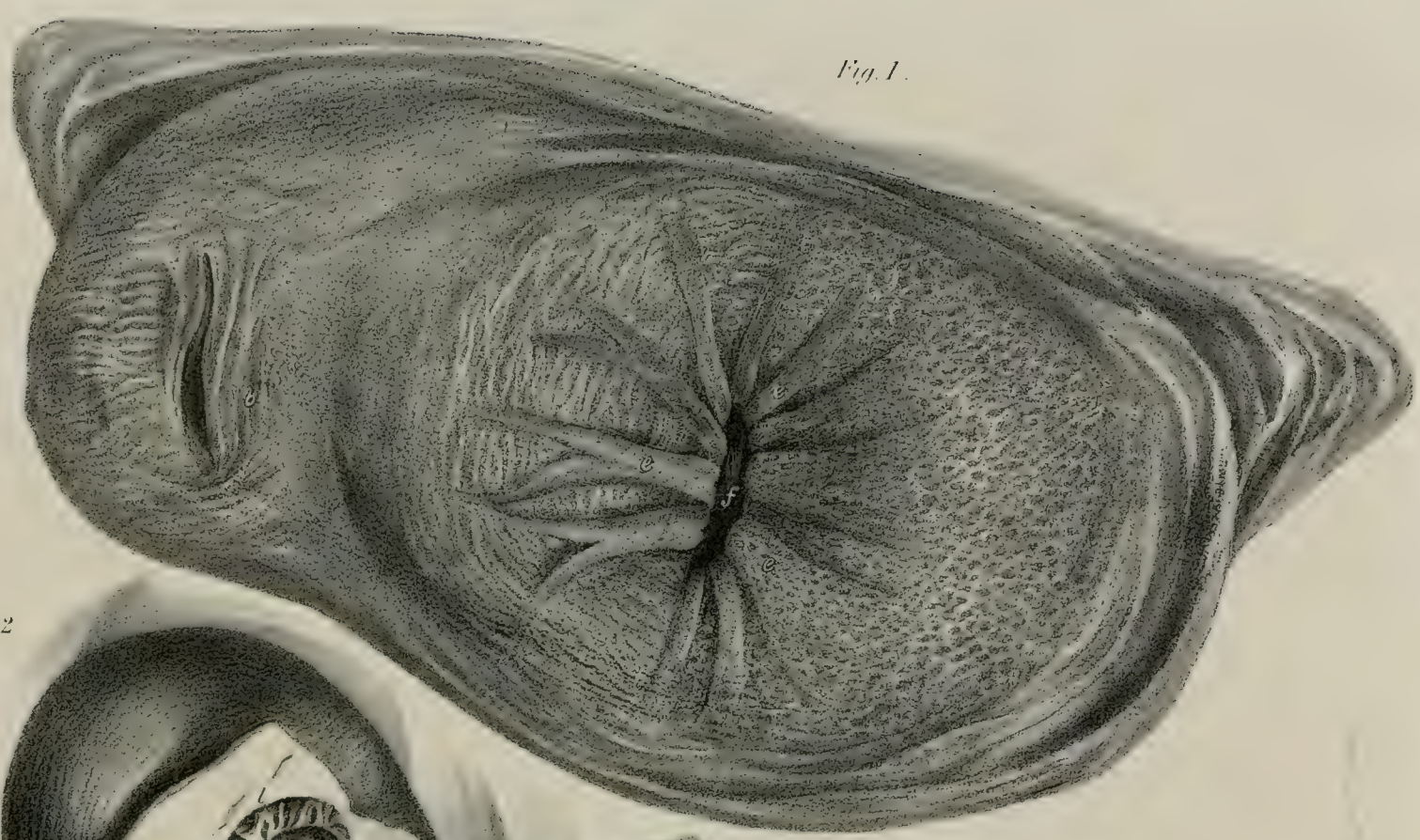
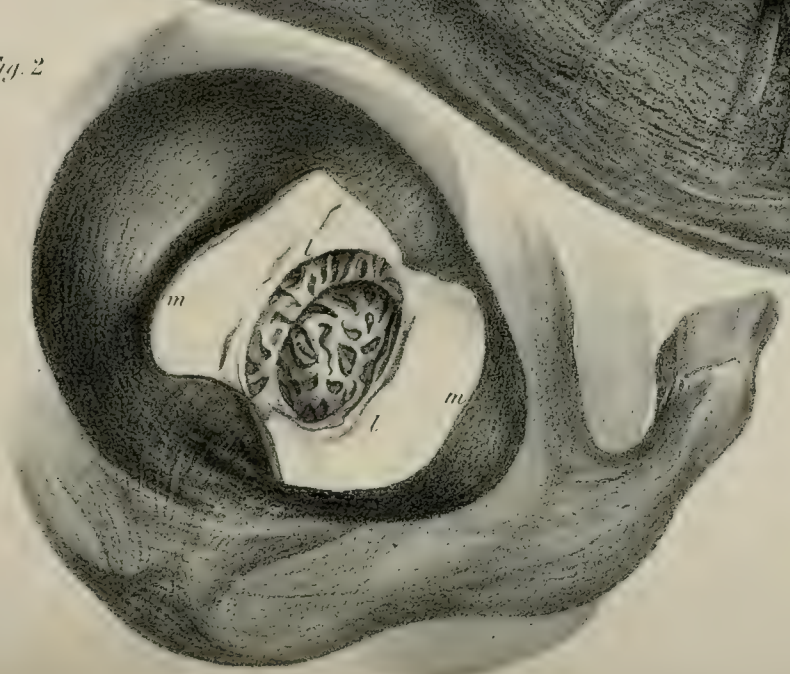


Fig. 2



Nat Size.

DESCRIPTION OF THE PLATES.

PLATE LI.

The stomach, moderately distended, with the spleen; two-thirds of the natural size.

PLATE LII.

Fig. 1. Longitudinal section of the stomach, moderately contracted; natural size.
Fig. 2. Transverse section of pyloric division; natural size.

PLATE LIII.

Fig. 1. The cardiac portion of the stomach inverted to show the termination of the œsophagus and the opening into the pyloric portion; natural size.
Fig. 2. The beginning of the duodenum slit open to show the form of the pyloric aperture; natural size.

The following letters indicate the same parts in each figure:—*a*, œsophagus; *b*, cardia; *c*, cardiac division of stomach; *d*, gastric tendon; *e*, *e*, folds converging to, *f*, orifice of, *g*, pyloric division; *h*, the muscular coat; *i*, the submucous cellular valve; *k*, dense plicated epithelial lining of the cavity; *l*, pylorus; *m*, duodenum; *n*, spleen.

THE DODO.

XV. *Additional evidence relative to the Dodo.* *By* W. J. Broderip, *Esq.*, *F.R.S.*, *L.S.*, *G.S.*, *Vice-President of the Zoological Society of London.*

Read March 28, 1852.

THE interest which attaches to any communication relative to an extinct, and, at one time, a doubted species, must be my apology for offering the following addition to the evidences of the existence and habits of the Dodo.

My old and valued friend Professor Owen presented me, on his return from Holland some time since, with a short thick volume, bearing on its title-page (not without black letter) the following promise :—

"C. Plinii Secundi Des wijdt-vermaerden Natuurkondigers vijf Boecken.

Handelen van de Nature.

I. Van de Menschen.
II. Van de viervoetige en Kruypende Dieren.
III. Van de Vogelen.
IV. Van de Kleyne Beestjes of Ongedierten.
V. Van de Visschen, Oesters, Kreeften, &c.

"Hier zijn by-gevoeght de Schriften van verscheyden andere oude Authueren de Natuur der Dieren aengaende. En nu in desen laetsen Druck wel het vierde part vermeerdert, uyt verscheyden nieuwe Schrijvers en eygen oudervindinge: en met veel Kopere Platen verziert t'Amsterdam, By Abraham Wolfgangh, 1662."

The frontispiece presents the artist's notion of the Garden of Eden, with a very Dutch Adam and Eve, the latter with the apple in her hand, while the serpent twined round the tree looks sly and satisfied. Our first parents are surrounded by beasts, and in the foreground is represented a piece of water with waterfowl and "ill-shaped fishes."

The superscription is "C. Plinius S. van de Menschen, Beesten, Vogelen en Visschen."

Mr. Strickland, in his elaborate work on 'The Dodo and its Kindred[1],' in which he has done me the honour to adopt the arrangement and the information collected in my article "Dodo," in the 'Penny Cyclopædia[2],' gives some addenda in his post-script to Part I. of his and Dr. Melville's book. "The first of these," writes Mr. Strickland, "is a rare edition of Bontekoe's Voyage, kindly communicated to me by Dr. Bandinel, the Bodleian Librarian, entitled 'Journael van de acht-jarige avon-

[1] London, 4to. Reeve and Co., 1848.

[2] Vol. ix. p. 47 (1837).

tuerlijcke Reyse van Willem Ysbrantsz Bontekoe van Hoorn, gedaen nae Oost-Indien,' published in quarto at Amsterdam, by Gillis Joosten Zaagman. There is no date; but from a narrative introduced at the end, it must be subsequent (probably by a year or two) to 1646. The narrative is nearly a verbatim version of the other Dutch editions of Bontekoe; and the only variation of text which concerns us, is in the statement that the underside of the Dodo dragged along the ground, which is here qualified thus :—'sleepte haer de neers *by na* (i. e. *almost*) langs de Aerde.' But what gives a peculiar interest to this volume is, that it contains (alone of all the editions of Bontekoe which I have seen) a figure of the Dodo, which I here present." Then follows the cut.

"This highly ludicrous representation," continues Mr. Strickland, "is more like a fighting cock than a Dodo; and the black letter of the Dutch text omits to tell us whether this design was due to the pencil of Bontekoe or his publisher Zaagman, or whether it was copied from some contemporary painting now forgotten. But there can be no doubt that this figure refers to the true Dodo of Mauritius, and not to the 'Solitaire' of Bourbon, with which Bontekoe confounded it.

"We may regret that the rudeness of the original woodcut leaves us in the dark as to the nature of the object on which the Dodo appears about to feed. This figure would pass equally well for a testaceous mollusk, or for an arboreal fruit; so that the problem of the Dodo's food seems as far from a solution as ever."

In Wolfgangh's publication, p. 480, is the following description :—

"Op't Eylandt Mauritius in Oost-Indien, als mede op sommige andere plaetsen gelijck mede in West-Indien, vindt men voegels soo groot als Swanen, die men Dodaersen of Dronten noemt, sy hebben groote hoofden, en daer op een velleken in manier van een Kapken, sy hebben geen vleugels, dan in plaetsvan dien, 3 of 4 swarte pennekens, en daer haer staert behoorde te staen, daer Zijn 4 of 5 gekrulde Pluymkens, van graeuwachtige verwe. Sy hebben een dicke ronde Naers, daer uyt het schijnt, dat haer de naem van Dodaers toe gekomen is; in de maegh hebben sy gemeenlijck een Steen van een vuyst groot, dese is bruyn, graeuw van verwe, en vol gaetkens, en hollingheydt, doch soo hart als grauwe Bentemeer-steen. Het Boots-volck van *Jacob van Neck*, noemdense Walgh-vogels, om datse die niet recht gaer of murruw konden koken: of om datse soo veel Tortel-duyven konden bekomen, die leckerdev smaeckten, datse van dese Dod-aersen de walgh kregen. Aen 3 of 4 van dese Vogels had al't Scheeps volck van een Schip, voor een maeltijdt genoegh t' eeten: Dese Dod-aersen hebbense oock ingesouten en op de reys mede genomen."

This description may be thus rendered :—

"In the island of Mauritius in the East Indies, as also in sundry other places, likewise in the West Indies, men find birds as big as swans, which they call *Dod-aerses* or *Drontes*. They have large heads, upon the top of which is a skin (a little skin-membrane) in the shape of a cap (little cap). They have no wings, but in the place of them there are three or four black feathers; and there where the tail should be, there

are instead four or five curling plumes of a greyish colour. They have a thick round rump, and from this it appears they got the name of Dod-aerses. In their stomachs they have commonly a stone as big as a fist; this stone is of a brown-grey colour, and full of little holes and hollows, bnt as hard as the grey Bentemer stone. The boat's-crew of the *Jacob van Neck* called them Walgh-vogels (surfeit birds), because they could not cook them till they were done, or make them tender; or because they were able to get so many turtle-doves which had a much more pleasant flavour, so that they took a disgust to these birds. Likewise it is said that three or four of these birds are enough to afford a whole ship's company one full meal. Indeed they salted down some of them, and carried them with them on the voyage."

At the top of the page in which this passage commences is printed "*Van de Dod-aersen.*" And immediately below it and above the description is a copper-plate of the bird, superscribed "*Dod-aers,*" in engraved italics.

The engraving of the bird is identical in position and accessories with the woodcut given by Mr. Strickland; but the sharpness of the work and the nature of the plate make the whole much clearer. The object at which the Dodo is looking, as if about to feed, is manifestly a testaceous mollusk with a turbinated shell, and between that and the raised foot of the bird is a half-buried spiny *Echinus*.

The locality on which the Dodo is walking has the appearance of a strand which the tide has left dry.

Wolfgangh's account confirms the opinion which I hazarded in the article "Dodo" in the 'Penny Cyclopædia.'

"As to the stories of the disgusting quality of the flesh of the bird found and eaten by the Dutch, they will weigh but little in the scale when we take the expression to be, what it really was, indicative of a comparative preference for the turtle-doves there found, after feeding on Dodos *usque ad nauseam*. 'Always partridges' has become proverbial, and we find from Lawson how a repetition of the most delicious food palls. 'We cooked our supper,' says that traveller, 'but having neither bread nor salt, our fat turkeys began to be loathsome to us; although we were never wanting of a good appetite, yet a continuance of one diet made us weary;' and again, 'By the way our guide killed more turkeys, and two polecats, which he eat, esteeming them before fat turkeys.'"

It does not follow that because the Dodo is represented as looking at the *frutti di mari*, he is about to devour them. But if it be granted he is, the admission would not militate against the opinion of those who would place the Dodo between the Struthious and Gallinaceous birds. It is well known that the turkeys in America come down to the shore and feed upon the "fiddler" crabs; and there would be nothing extraordinary in a quisquilious feeder, such as the Dodo probably was, varying its fruit and vegetable diet occasionally by resorting to such animal substances as it might find on the strand. Common poultry eagerly pick up insects and slugs in the fields, and, in

the neighbourhood of tidal rivers and estuaries, may be seen availing themselves of the smaller *mollusca* and *crustacea* left by the retreating tide.

In my article "Struthionidæ[1]," under the section "Didus," is inserted the following extract from a letter written to me by Professor Owen:—

"Whilst at the Hague in the summer of 1848, I was much struck with the minuteness and accuracy with which the exotic species of animals had been painted by Savery and Breughel, in such subjects as *Paradise*, *Orpheus charming the beasts*, &c., in which scope was allowed for grouping together a great variety of animals. Understanding that the celebrated menagerie of Prince Maurice had afforded the living models to those artists, I sat down one day before Savery's *Orpheus and the beasts*, to make a list of the species, which the picture evinced that the artist had had the opportunity to study alive. Judge of my surprise and pleasure in detecting in a dark corner of the picture (which is badly hung between two windows), the Dodo beautifully finished, showing for example, though but three inches long, the auricular circle of feathers, the scutation of the tarsi, and the loose structure of the caudal plumes. In the number and proportions of the toes and in general form, it accords with Edwards's oil-painting in the British Museum; and I conclude that the miniature must have been copied from the study of a living bird, which it is most probable formed part of the Mauritian menagerie."

I little thought, when, with his permission, I published this graphic product of my kind friend's pen, what was in store for me. Not long afterwards, a friend informed me that he had seen a picture at a dealer's painted by one of the Saverys, and that he was pretty sure there was a Dodo in one corner of it. I sent for the picture, and there, sure enough, in the right-hand corner, and consequently to the left of the spectator, was the bird, in all the beauty of its ugliness. The Dodo stands on one foot with its back to the spectator, and turning round its head, which is represented with the huge bill picking the other uplifted foot. Like all the rest of the birds in this picture, which bears the name of Roland Savery, the Dodo is highly finished. The picture is now in my possession. The accompanying plate (Plate LIV.) is a faithful copy of the bird as represented in it.

[1] Penny Cyclopædia, vol. xxiii. (1842).


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Fig 3
Fig 4
Fig 5
Fig 6
Fig 7
Fig 1
Fig 2

XVI. *On some Bones of Birds allied to the Dodo, in the Collection of the Zoological Society of London.* *By* H. E. Strickland, *F.G.S.*

Read April 27, 1852.

An interesting series of bones, procured in the Island of Rodriguez in 1831, and presented by Mr. Telfair to the Zoological Society, which were unfortunately mislaid for twenty years, have lately been discovered by Mr. A. D. Bartlett among the Society's stores. As they throw some important additional light upon the osteology of the Dodo and other extinct birds allied to it, I considered that a description and delineation of these relics might be acceptable to the Society. It will also serve as a supplement to the work published in 1848, by Dr. Melville and myself, on 'The Dodo and its Kindred,' in which all the osteological materials, which were then available to us, were fully described and delineated.

An examination of these bones has shown that they must have belonged to more than one species of bird, and has enabled us to extend this conclusion to the other bones from the same locality, which were formerly referred to a single species. In order to show this, it is requisite to give a brief *résumé* of the entire evidence which we possess on this subject.

It will be remembered that the true Dodo, *Didus ineptus*, of which three heads and two feet are preserved in our museums, appears to have been wholly confined to the island of Mauritius. To expect a bird unable to fly or to swim, to recur, specifically identical, in the volcanic islet of Rodriguez, which is separated from Mauritius by three hundred miles of ocean, would be contrary to those views of "Specific Centres of Creation," which are now becoming generally adopted as zoological truths. On the other hand, the fact of the comparative proximity in geographical position of these two islands would lead us to expect in Rodriguez a recurrence of the same organic structures, but with specific or even generic modifications, which characterize the fauna of Mauritius. Accordingly, it is highly interesting to find, that the bones of extinct birds which have been found at Rodriguez do in fact present, at once, a close zoological affinity and a marked specific diversity, in their relations to that extraordinary bird, the Dodo, for which Mauritius has long been celebrated.

The bones of extinct birds which have been brought from Rodriguez are altogether eighteen in number, and were collected at two distinct periods.

First, is a collection of six bones found in 1789, in a cavern in Rodriguez, where they

had become incrusted with stalagmite. Five of these are in the Museum of the Jardin des Plantes at Paris, and one is in my own collection.

Secondly, we have the series of bones, twelve in number, procured in 1831 by the exertions of the late Mr. Telfair. These were found in a cavern, probably the same one in which the former series were found; but instead of being exposed, on the floor of the cave, to stalagmitic incrustations, they were buried in the alluvial soil at the entrance (see Proceedings of Zool. Soc. Part i. p. 31). They are consequently in much better preservation than the bones of the former series, and are wholly free from incrustation. Of these bones, six are in the Andersonian Museum at Glasgow, one is in my possession, and five are the property of the Zoological Society, and form the especial subject of this memoir.

The bones of the *first* series, or those procured in 1789, consist of—

1. A portion of the cranium, figured in 'Dodo and its Kindred,' pl. xiii. figs. 1, 2, 3, 4.
2. Part of the sternum, figured in the same work, pl. xiii. figs. 5, 6.
3. A left humerus, figured *l. c.* pl. xiv. figs. 1, 2, 3.
4. A left femur, figured *l. c.* pl. xiv. figs. 8, 9, 10.
5. A right tarso-metatarsus, figured *l. c.* pl. xv. fig. 3.
6. A left tarso-metatarsus, mentioned in 'Annals and Magazine of Natural History,' 2nd Series, vol. iv. p. 335.

From the similarity in appearance of the above six bones, and the uniform thickness of their stalagmitic covering, it is evident that they have all been found near together in the same part of the cavern; and from the agreement in their proportions and the absence of duplicate bones, I infer that they all belong to the same individual. This is further confirmed by the following label attached to the bone No. 6 by Prof. Bojer, Curator of the Mauritius Museum, when he sent it to me in 1849:—"Tarsus of the Dronte, being a remaining fragment of a more perfect skeleton sent by M. J. Desjardins to the Baron G. Cuvier. The said skeleton was found in a cave at the island Rodrigue by M. Roquefeuille, inhabitant of Mauritius." This proof of the individuality of the above six bones enables us to draw some important conclusions regarding those of the second, or Mr. Telfair's series.

The latter consist of twelve bones, belonging to at least four different individuals. They are all evidently adult, but differ considerably in size, and may be accordingly divided into two sets.

A. Bones of the *larger* dimensions.

7. Proximal portion of a right humerus, belonging to the Zoological Society. See Pl. LV. figs. 1, 2.

8. An imperfect right femur in the Andersonian Museum, wanting both extremities, described in 'Dodo and its Kindred,' p. 117 (but erroneously said to be a *left*, not a *right* femur).

9. The distal half of a right femur, belonging to the Zoological Society. See Pl. LV. fig. 3.

10. A left tibia, wanting the proximal portion, figured in 'Dodo and its Kindred,' pl. xv. fig. 1.

11. A very perfect right tibia; exactly corresponding to No. 10; belonging to the Zoological Society. See Pl. LV. fig. 4.

12. An imperfect left tarso-metatarsus, figured in 'Dodo and its Kindred,' pl. xv. fig. 2.

13. Proximal portion of a right tarso-metatarsus, figured *l. c.* pl. xv. fig. 4.

B. Bones of the *smaller* dimensions.

14. A perfect right femur, figured in 'Dodo and its Kindred,' pl. xiv. figs. 4, 5.

15. A left femur corresponding to No. 14, but mutilated at the extremities, described in 'Dodo and its Kindred,' p. 117, line 6.

16. A nearly perfect right femur, belonging to the Zoological Society, agreeing in size with No. 14.

17. A perfect right tarso-metatarsus, belonging to Mr. H. E. Strickland, described in Ann. and Mag. Nat. Hist. 2nd Ser. vol. iv. p. 336. See Pl. LV. figs. 5, 6, 7.

18. A nearly perfect right tarso-metatarsus, similar to No. 17, belonging to the Zoological Society.

The bones which compose the series A. present a perfect agreement in size and proportions with each other, and also with those numbered 1 to 6, which I regard as members of a single skeleton. There seems therefore no reason whatever to doubt that the whole of the bones numbered from 1 to 13 belong to one and the same species of bird. So likewise the bones of the smaller-sized series, Nos. 14 to 18, agree together so completely in their size and proportions, as to leave no doubt that they likewise belong to a single species. We have next to inquire whether the larger bones Nos. 1 to 13 can be regarded as specifically identical with the smaller ones Nos. 14 to 18, or not.

At the time when Dr. Melville undertook his elaborate discussion of the Rodriguez bones (see 'Dodo and its Kindred,' p. 117), the only bones of the *smaller* series accessible to him were the two femora, Nos. 14 and 15. Being unwilling to found specific distinctions on a mere difference of size, exhibited in these two femora only, he supposed them to be either females or young birds of the same species as the bones of larger dimensions. As, however, we have now obtained an additional femur and two very perfect tarso-metatarsals, all closely agreeing in size, and unquestionably adult, presenting no signs of transition to the large-sized series, we shall probably be justified in drawing a different conclusion.

On comparing together the corresponding bones of the two series, we find that their proportions are to each other as 100 : 77, or very nearly in the ratio of 4 : 3, as the following measures will show:—

	Large series.		*Small series.*		
Femur,	No. 8.	No. 9.	No. 14.	No. 15.	No. 16.
	Lines.	Lines.	Lines.	Lines.	Lines.
Smallest circumference	29	30	$23\frac{1}{2}$	23	23

Tarso-metatarsus,	No. 12.	No. 17.	No. 18.
	Lines.	Lines.	Lines.
Total length	87	68	69
Smallest circumference	$23\frac{1}{2}$	17	17

But though the difference in size of the corresponding bones of these two series is thus considerable, I have not been able to detect any diversity whatever in the proportions of their parts. No question can possibly arise as to their *generic* identity; we have only to consider whether a diversity of size, amounting to the ratio of 4 : 3, suffices to indicate *specific* distinctness.

In the first place, it is evident that this difference of dimension cannot be due to age, the smallest-sized bones affording the same proofs of complete maturity as the largest. The small femur No. 16 in particular appears, from the rugose condition of its surface, to have belonged to an aged individual. Nor is it, I think, probable that these differences of size can be sexual. Were these bones referable to the Gallinaceous order, we might perhaps find examples in that polygamous group, of diversities of size in the two sexes, sufficient to justify such a conclusion. But the bones in question have been satisfactorily shown to belong to the order of *Columbæ* (see 'Dodo and its Kindred,' pp. 54, 114), a group in which the males and females present very nearly the same dimensions, and certainly never vary in so large a ratio as 4 : 3[1].

It seems to me equally impossible to believe that a difference of size amounting to 4 : 3 can come within the limits of ordinary or accidental variations in the same species. Such varieties of stature, if they ever occur to this amount among birds of the same species, are always due to peculiarities of food or climate, operating at remote localities, and never affecting the individuals inhabiting a small island, and all subjected to the same external influences. I cannot therefore avoid the conclusion, that we have here the proofs that two distinct species formerly inhabited the island of Rodriguez, differing greatly in size, and probably (like other birds) exhibiting some other distinctions of external appearance, of which no traces are left on the parts of their skeleton which have been yet discovered. Should, however, the bones of the beak of these two supposed species be ever obtained from the alluvia of Rodriguez, we may expect to find some indications of specific distinctions depending on form as well as on size.

In the work referred to, Dr. Melville and myself have uniformly spoken of the

[1] Leguat's statement regarding the *Solitaire*, that "some of the males weigh forty-five pounds," certainly indicates that the females were somewhat smaller; but as he does not mention the weight of the latter, his words prove nothing as to the amount of sexual disparity.

bones brought from Rodriguez as those of the *Solitaire*, which we now know to have existed in that island as recently as 1735 (see Ann. and Mag. of Nat. Hist. 2nd Ser. vol. iii. p. 138). That some of these bones have belonged to that extinct bird, there is no reason to doubt; but as I consider it proved that these relics indicate two distinct species, it is worth while to inquire which of these is to be regarded as the true *Solitaire* of Leguat and D'Heguerty. In this inquiry we have no other data but that of size to guide us. Now Leguat compares *Solitaires* in a general sense to Turkeys (*Meleagris gallopavo*), but adds that they are longer in the leg ("plus haut montés"). He states, that in the winter season, when they are "extraordinairement gras," some of the males weigh forty-five pounds. This statement is confirmed by D'Heguerty, who describes them as "plus gros qu'un Cygne."

It is evident from these statements that the *Solitaire* must have been larger than a Turkey, the males of which rarely exceed the weight of thirty pounds. And as the tarso-metatarsus of a large Turkey is barely 6 inches in length, that of a *Solitaire*, which was proportionally longer in the leg, must have considerably exceeded 6 inches. Now the tarso-metatarsi of the smaller series of bones are only 5 inches 8 lines in length, while those of the larger series measure from 7 inches 1 line to 7 inches 3 lines, and thus fully conform to the dimensions of the *Solitaire*, as indicated by Leguat.

I therefore conclude that it is the larger of the two supposed species which we are to regard as the *Solitaire* of Leguat and D'Heguerty, and for which therefore the names *Didus solitarius* of Gmelin, and *Pezophaps solitaria* proposed by Dr. Melville and myself, must be retained.

With regard to the smaller-sized species of which we possess bones, we may either conjecture that it had become extinct before Leguat's visit to the island, or we may suppose that in these bones we see the relics of the birds obscurely described by Leguat under the name of "Gelinottes" (see 'Dodo and its Kindred,' p. 55), and to which M. de Selys Longchamps has rather prematurely applied a scientific name, *Apterornis bonasia* (Revue Zoologique, 1848, p. 294). Our information respecting these *Gelinottes* is, however, at present too vague to justify any specific or generic identifications of them; and until our knowledge is advanced by procuring further osteological evidence from Rodriguez, I prefer to attach to the bones of smaller dimensions the provisional specific name of *Pezophaps minor*[1].

I will now conclude by briefly describing the five bones belonging to the Society, pointing out such structural peculiarities as their more perfect condition enables us to

[1] In a communication respecting these bones, made by Mr. A. D. Bartlett to the Zoological Society on Dec. 9, 1851, of which an abstract is given in the Literary Gazette, 1851, p. 923, it will be seen that he refers them to *three* distinct species—the true *Didus ineptus*, the supposed *D. nazarenus*, and the *Solitaire* of Leguat. I have, however, endeavoured to prove that they belong to *two* species only, neither of which can be referred to the Mauritian *D. ineptus*, nor to the *D. nazarenus*, which is merely a synonym of that bird, based on the erroneous description of Cauche (see 'Dodo and its Kindred,' p. 21).

add to our pre-existing information. I will also append a notice of the single bone in my own possession (No. 17), which has been obtained since the publication of Dr. Melville's chapter on the osteology of the Solitaire. The Nos. used in the list, p. 188 *supra*, are here retained.

No. 7. Proximal portion of the right humerus of *Pezophaps solitaria*. The conformity in size of this fragment to the humerus No. 3, proves that it belongs to this species, and not to *P. minor*. The perfect state of its surface exhibits several characters which in No. 3 are concealed by incrustation. In its general form it closely agrees with the humerus of the *Columbidæ*, but differs in the non-development of the anterior crest, to which the great pectoral muscle is attached. In Pigeons and most birds of strong flight this crest is expanded into a narrow ridge, projecting forwards and outwards, while in this bird we find only an obtusely rounded surface for the insertion of the pectoral muscle. In the incrusted humerus No. 3, the absence of this ridge induced Dr. Melville to suppose that it had been broken off before the bone became incrusted; but the specimen before us proves that its non-development is a characteristic feature in the structure of the bird.

As it is the projection of this crest in volatile birds which supplies the pectoral muscle with a powerful lever for producing the downward stroke of the wing, and thus sustaining the bird in the air, so we can see the probable reason why in the Solitaire, which we know from historical sources to have been incapable of flight, this ridge should remain entirely undeveloped.

I may add, that the small size of the humerus in this bird is alone sufficient to prove its inability to fly. In the volatile *Columbidæ* we find the humerus to be slightly *longer* than the femur. Thus in *Columba palumbus* the humerus is to the femur as 13 to 11, and in *Goura coronata* as 20 to 17. But in the species before us, the humerus No. 3, which I consider to belong to the same individual as the femur No. 4, is *shorter* than it in the very considerable ratio of 47 to 73.

The pneumatic foramen of this humerus is large, and proves that air was admitted into its interior,—a fact, however, quite consistent with inability to fly, as is shown in the case of the *Struthio* and *Rhea*, which, though non-volatile birds, yet possess a certain amount of pneumaticity in their bony skeleton.

The transverse fracture of the shaft enables us to see that its interior cavity is filled towards the upper part with coarsely interlacing cancellous fibres.

The measurements of this humerus are as follows:—

	inch.	lin.
Extreme width from the anterior to the posterior crest . .	1	$5\frac{1}{2}$
Smallest horizontal diameter of shaft	0	6
Smallest vertical diameter of shaft	0	$5\frac{1}{2}$
Horizontal diameter of medullary cavity	0	4
Vertical diameter of medullary cavity	0	3

Proceeding to the hinder extremities, we have next to notice the bone No. 9, a fragment of a right femur, comprising the distal half, of which the articular extremity is much injured. From the rugged condition of its surface, it seems to have belonged to a very aged individual. Its dimensions appear to correspond exactly with those of the femur No. 4, allowing for the thickness of the incrustation on the latter bone. The only measurements which the broken condition of this fragment enable us to take, are the following:—

	lines.
Transverse diameter of the shaft	10
Antero-posterior diameter of the shaft	8
Transverse diameter of medullary cavity	$7\frac{1}{2}$
Antero-posterior diameter of medullary cavity	$5\frac{1}{2}$

We will next speak of the very perfect right tibia, No. 11, which, from its precise conformity to the broken left tibia, No. 10, is probably a portion of the same individual. The distal portion of the tibia, No. 10, has been already fully described by Dr. Melville in 'Dodo and its Kindred,' pp. 116, 117.

The proximal extremity is nearly perfect, with the exception of the internal ridge, which is broken off. In general form it agrees with the same bone in the *Columbidæ*. The fibula is absent, but the rugose ridge to which it was attached is distinctly shown.

The dimensions of this bone are as follows:—

	inch.	lin.
Total length	10	1
Transverse diameter of proximal extremity	1	7
Antero-posterior diameter of proximal extremity	1	9
Length of fibular ridge	2	3
Distance from distal extremity of fibular ridge to intercondyloid groove	6	$2\frac{1}{2}$
Smallest transverse diameter of shaft	0	8
Smallest antero-posterior diameter of shaft	0	$6\frac{1}{2}$
Breadth of lower extremity	1	4
Antero-posterior diameter of lower extremity	1	$3\frac{1}{2}$

The discovery of this nearly perfect tibia has now enabled us to compare the dimensions of the three principal bones of the hinder extremity in the larger species of Solitaire. We are thus enabled to draw approximate conclusions both as to its absolute stature, and as to the proportions of its parts, as compared with other species of birds.

We may now therefore adopt as the maximum length, in *Pezophaps solitaria*, of the

	inch.	lin.
Femur	7	2
Tibia	10	1
Tarso-metatarsus	7	0

In a skeleton of *Goura coronata* now before me, we find the

	inch.	lin.
Femur	3	4
Tibia	4	10
Tarso-metatarsus	3	7

The proportion between the three bones is nearly the same in these two birds. Now the measurements of the *Goura* are very nearly half those of the *Pezophaps*, and as the *Goura* when living measures about 19 inches from the ground to the crown of its head, we may assume the Solitaire to have been about 38 inches in height, a stature which sufficiently corresponds with the descriptions of Leguat and D'Heguerty.

Proceeding from these larger bones to the smaller series on which I have based the specific name of *Pezophaps minor*, we have, first, the right femur, No. 16. This differs from the femur No. 14, figured in 'Dodo and its Kindred,' pl. xiv. figs. 4, 5, 6, 7, only in being of rather smaller dimensions (a quarter of an inch shorter), though the rugose state of its surface indicates an aged individual. As it is less perfect at the extremities than the femur No. 14, which has been already figured and fully described by Dr. Melville, I need not notice this bone further than to append its dimensions:—

	inch.	lin.
Length from the intercondyloid notch to the upper surface of the neck	5	0
Transverse diameter of the shaft	0	8
Antero-posterior diameter of the shaft	0	$6\frac{1}{4}$
Transverse diameter of superior extremity	1	$5\frac{1}{2}$
Transverse diameter of inferior extremity	1	$4\frac{3}{4}$

The right tarso-metatarsus No. 18, belonging to the Zoological Society, is an almost exact duplicate of the bone No. 17, sent to me by M. Bojer, and noticed in 'Annals and Magazine of Nat. Hist.' Ser. 2. vol. iv. p. 336. As the latter bone is rather the more perfect of the two, I have given a figure of it (Pl. LV. figs. 5, 6, 7) in preference to the former. The only noticeable difference between these two bones consists in the form of the concavity beneath the proximal extremity, which is rather shallower and more expanded in No. 18 than in No. 17. This is especially the case in its lower part, beneath the internal interosseous foramen, at the insertion of the *tibialis anticus* muscle. So slight a modification in form must not be regarded as indicating any specific distinction. It will be seen from the following Table that the bone No. 18 is slightly the longer of the two.

	No. 17.		No. 18.	
	inch.	lin.	inch.	lin.
Length from lower border of middle trochlea to summit of intercondyloid tubercle	5	8	5	9
Transverse diameter of the shaft	0	6	0	6
Antero-posterior diameter of the shaft at the upper portion of articular surface for posterior metatarsal	0	4	0	4
Transverse diameter of lower extremity	1	$3\frac{1}{2}$	1	$3\frac{3}{4}$
Distance from upper border of posterior metatarsal articular facet to internal intertrochlear notch	1	3	1	$3\frac{3}{4}$
Length from external trochlea to external condyloid fossa	5	$1\frac{1}{2}$	5	$2\frac{1}{2}$
Length from internal trochlea to internal condyloid fossa	5	$2\frac{1}{2}$	5	$3\frac{1}{2}$
Breadth of upper extremity	1	2	1	$2\frac{1}{4}$
Antero-posterior diameter of upper extremity	1	1		
Projection of ento-calcaneal process	0	$5\frac{1}{2}$		

The tarso-metatarsus is the only bone of the genus *Pezophaps* (with the exception of the very imperfect fragment of the cranium No. 1) which we are at present able to compare with its corresponding member in the genus *Didus*. Fortunately also it is one of the most characteristic bones in the ornithic skeleton, presenting peculiarities of structure in each of the orders and families which enable us in most cases to identify with certainty the group of birds to which any example of this bone has belonged.

On comparing the bones Nos. 17 and 18 with the tarso-metatarsus of the Dodo, described at p. 102, and figured in plate xi. figs. 1, 2, 3, 4, 5, 6, of the work above referred to, we are struck at once by the much slenderer proportions of this bone in *Pezophaps* than in *Didus*. Although the tarso-metatarsus of the former is longer by 6 lines than the latter, its transverse diameter is one-sixth less. The width of both extremities of the bone is also considerably less in the *Pezophaps* than in the *Didus*.

These differences of proportion all indicate that the *Pezophaps* was a taller bird, but of lighter weight and more active movements than the *Didus*—a distinction, to which the historical accounts of the Solitaire and of the Dodo bear ample testimony.

With the exception, however, of this difference in the proportions of its length and breadth, the entire details of structure are almost identical in the tarso-metatarsus of these two birds. The elaborate description given by Dr. Melville of the tarso-metatarsus of the Dodo ('Dodo and its Kindred,' p. 103) would apply almost word for word to the bones before us, and afford the most convincing proof of their close affinity. There are indeed some very slight modifications of form which distinguish the tarso-metatarsus of the Solitaire from that of the Dodo, which are carefully pointed out by Dr. Melville, *loc. cit.* p. 118, and which I need not now adduce. I may, however, refer to two points, which the perfect state of the specimens Nos. 17 and 18 has now for the first time

brought to light. These are, first, the considerably less development of the inner or longest calcaneal process in *Pezophaps* as compared with *Didus*. Thus, while the antero-posterior diameter of the proximal extremity in the tarso-metatarsus of *Didus* amounts to 1 inch 4 lines, the same measurement in *Pezophaps minor* reaches only 1 inch 1 line. Again, at the lower extremity we find that the three trochleæ are placed more nearly in the same vertical plane in *Didus* than they are in *Pezophaps*, in which latter bird the two lateral trochleæ are placed more obliquely and more posteriorly in reference to the middle one than they are in *Didus*. This arrangement seems to imply a greater divergence in the lateral toes of *Pezophaps* than in those of *Didus*, which would probably enable the former bird to run with a speed never attained by the latter.

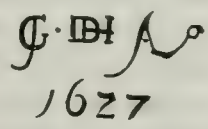
The peculiar position of the calcaneal canal on the *outer* side of the posterior ridge, which distinguishes the Pigeons, and the allied group of *Pteroclidæ*, from all other birds, and which forms one of the strongest proofs of the Columbine affinities of the Dodo, is well seen in the bone No. 18. It fully justifies our former conclusions not only as to the proximity of *Pezophaps* and *Didus*, but as to the position of both these birds, showing that they are a peculiar and exceptional, yet in all essential points a genuine subfamily of that great and isolated family the *Columbidæ*.

The views of ornithic structure, which the examination and comparison of these scattered relics have thus gradually developed, render it more than ever desirable to search for other portions of the skeleton of the different members of the group *Didinæ* which once inhabited the Mascarene Islands. Of the two species of *Pezophaps* from Rodriguez, many important parts of the skeleton, and especially the cranium, have yet to be discovered. Of the *Didus* of Mauritius we still want the femur, the tibia, and all the bones of the body and anterior extremities, while of the so-called "Solitaire" of Bourbon not even a fragment has yet been brought to Europe. After the success, however, which has attended similar researches in New Zealand, we cannot doubt that an active naturalist, by excavating the alluvia of these different islands, might restore the entire skeletons of these extraordinary birds.

XVII. *Notice of an Original Painting, including a Figure of the Dodo, in the Collection of His Grace the Duke of Northumberland, at Sion House.* *By* W. J. Broderip, *Esq., F.R.S., V.P.Z.S., &c.*

Read April 12, 1853.

Professor Owen, at whose disposal the Duke of Northumberland placed the following additional pictorial evidence of the existence of the Dodo in the seventeenth century, has requested me to draw the attention of this Society to the highly interesting picture which the Duke has been so good as to send for the inspection of the Fellows. The size of the picture, which is in the finest preservation, is thirty-two inches by nineteen. It is executed in oil, and bears the following monogram and date.



Mr. William Russell, with his usual discernment, detected in this monogram the signatures of Jean Goeimare and Jean David de Heem, and proved the correctness of his judgment by a reference to Brulliot[1]. Jean Goiemare, who is not noticed by Descamps, Bryan, Sandrart, or Houbraken, is described by Brulliot as a Flemish artist who flourished

[1] Dict. des Monogrammes, 1 partie, pp. 201, 274.

at the commencement of the seventeenth century, and painted landscapes with many animals, executed with great care, but in rather a dry manner[1]. Of De Heem, the celebrated painter of still life, it would be superfluous to say anything. We may conclude, then, that in this joint production the landscape and animals were painted by Goeimare, and the shells by De Heem.

In this picture, which seems to have been intended as a record of rarities, the foreground represents a sea-shore from which the tide has retired, leaving empty shells of the following genera:—*Nautilus*, *Pteroceras*, *Strombus*, *Triton*, *Pyrula*, *Cassis*, *Cypræa*, *Conus*, *Mitra*, *Turbo*, *Nerita*, *Mytilus*, *Ostrea*, &c. Behind, on elevated ground, are two Ostriches; and below, to the right of the spectator, the Dodo is represented as in the act of picking up something from the strand. The head and body of the bird, covering an area as large as the palm of a man's hand, are seen; but the legs are hidden. The painter of the Dodo, in *my* picture, has given the only complete foreshortened back view of the bird known to me. In the Duke's picture the head and body are presented to the spectator on a larger scale; and I have nowhere seen the hood or ridge at the base of the bill, from which the bird obtained the name of *Cygnus cucullatus*, so clearly represented. Near the Dodo are a Smew and other aquatic birds, and further off Hoopoes and Terns. In the distance is the ocean, with a sea-monster awaiting the attack of Perseus, who descends on a winged steed to the rescue of Andromeda chained to a rock. Those who have had occasion to describe and figure new species of Testacea, know how difficult it is to find a draughtsman who can give a correct design of the shell to be represented. Unless the artist, like Mr. G. B. Sowerby, jun., is aware of the internal structure of the shell, and acquainted with its organization, a lamentable failure is generally the result. In the picture before us, with one exception—and even in that the specimen may have been distorted—so accurate was the eye of the painter, that if he had been aware of the organization of each shell—knowledge which he probably had not—he could not have represented the objects more correctly. The *Nautili*[2], *Strombus gigas*, *Triton*, and *Pyrula* are painted with great breadth and power, and all are drawn and coloured with wonderful truth; indeed a conchologist may name every species. One of the *Nautili* is partially uncoated, to show the nacre, and the other dissected, to display the concamerations. None of the shells have the epidermis, and all are of the natural size. The artificial condition of these subjects, and especially of the *Nautili*, is, it must be allowed, rather out of place in an assemblage of testaceans left on the sands by the retired tide, unless we are to suppose that the sea-nymphs had been amusing themselves by polishing the specimens and displaying the internal structure of one of them; but this very treatment shows that the designs were accurately made from real objects then considered as rarities. With the exception of the Dodo, none of the natural objects represented are now rare. The shells, especially those whose *habitats*

[1] I am indebted to Mr. Russell for this information.

[2] *Nautilus pompilius*.

are the seas of the Antilles, are at present very common ; but at the date of the picture—the second year of the reign of our first Charles—the natural productions of the West Indies were not well known, and were, comparatively, very scarce. With the shells on the shore is the cranium of a carnivorous quadruped, apparently of the family *Canidæ*. The monster-cetacean in the distance has evidently no chance with the avenger who is coming down upon him mounted on a winged steed. But Pegasus, who, with other prodigies, sprang from the blood that dropped from Medusa's head, as the conqueror who had cut it off with his harpe traversed the air with his gory trophy, immediately winged its flight to Helicon, there to become the pet of the Muses. The best version of this mythological story relates, that when Perseus afterwards killed the sea-monster and delivered Andromeda on the coast of Ethiopia, he effected his purpose by raising himself in the air through the aid of the wings and talaria given to him by Mercury, and not with the help of the winged horse on which most of the painters mount him.

Professor Owen informs me that Roland Savery's picture containing the Dodo, in the Berlin collection, bears the date of 1626 ; and that the colour of the Dodo in the Duke of Northumberland's picture resembles that of the portrait of the bird, of life size, by the same painter, now at Oxford. L'Estrange describes the hue of the back of the living Dodo which he saw exhibited in London "about 1638," as of "dunn or deare colour."

XVIII. *Monograph of the* Strigidæ. *By* Dr. J. J. Kaup, *Director of the Museum at Darmstadt; Corresponding Member.*

Read June 8, 1852.

Subfamily I. SURNIINÆ, *Kaup.* Day-Owls.

I. *Glaucidium.* II. *Nyctale.* III. *Athene.* IV. *Surnia.* V. *Ieraglaux.*

Diagnosis.—They have the handsomest and roundest skull, with large brain, high rounded front, small pneumacity. The greater number of this genus have a little ear-orifice without operculum; the feather-wreath round the ear is mostly not so distinct as in the Night-Owls. No genus in this subfamily has feather-horns, or a dentellated claw on the middle toe, as *Strix*. Most birds of this genus are Day- or Twilight-Owls, except *Nyctale*, which is in this respect a true Night-Owl.

Genus I. Glaucidium[1], *Boie.*

a. *Glaucidium.* b. ——? c. *Microglaux.* d. ——? e. *Tænioptynx.*

Diagn.—The nostrils mostly in the middle of the swollen pea-shaped *cera*. The first wing-feather shorter than the tenth wing-feather. Wings short, only reaching to the upper coverts of the long and variegated tail. We find in this genus the smallest of all the Owls; their food is insects.

Description.—The yellow bill curves rapidly from the *cera*. The lower jaw is on the end and sides emarginated by four teeth-like points; the short wings only reach to the upper tail-coverts; the webs of the wing-feathers are small, the first to the fourth with emarginations; the first wing-feather short and dentellated. Tarsi and toes very well developed. The cross-banded or spotted tail as long as the body. The handsome skull shows a thorn-shaped prominence on the front part of the eye-margin (Plate LVI. fig. 1); and the *zygoma* has on its posterior part (fig. 2) a leaf-like prominence, of which all the true *Striginæ* are destitute, and which is in other *Surniinæ* not so well developed. All the species have a white, black and rufous spotted collar, which reminds us of the American *Tinnunculi*. Up to the present time we know only of three subgenera.

Subgenus a. *Glaucidium*, Boie.

Diagn.—Nostrils in the middle of the pea-shaped *cera*; inner webs of the wing-feathers broader, with emarginations more towards the end, and a spotted or unicolor plumage. All the species are found in the southern parts of America.

[1] Boie gives this name in the 'Isis' to *Strix nana* et *passerina*. The latter species belongs to the genus *Surnia*, with very different *cera* and nostrils. G. R. Gray and Bonaparte erroneously give this name to *passerina*.

1. Glaucidium pumilum, *Kp.*

Strix pumila, Ill. Temm. Pl. Col. 39.
—— *ferox,* Vieill. Azara, N. 49.
—— *minutissima,* Pr. Max.
Athene pumila, G. R. Gray.
—— *minutissima,* Bp.

Diagn.—Tail 53 mm. long only, with three to four white spots, not reaching to the shafts.

Descr.—The head-feathers light ash-grey; each with three round white spots, and margined with black. Shoulder-coverts partly unicolor, partly with three white or rufous-yellow-white spots, mostly on the outer webs, which do not form a large band. The smaller feathers of the wings with round white spots on the outer webs, sometimes on the shaft and concealed. Outer webs of the first and second wing-feathers unicolor; third and fourth with two to three rufous-yellow spots. The wing on the interior parts whitish, towards the end dusky, with five to six dark cross bands. The tail with three to four pairs of white spots, not reaching to the shafts. The lower parts white, with large rufous spots, and two long stripes along the belly. Tarsi rufous-yellowish-white, distinctly spotted with rufous.

Azara says that this smallest of all the Owls, or *Rapaces*, attacks with success the Turkey and Caracara. All the species of this genus feed on insects, and we cannot understand how this pigmy is able to kill birds which surpass him so greatly in weight and strength. Azara possibly observed this unusual courage in a captive one, and he therefore concluded it exercises the like boldness in a wild state. This, although possible, admits of doubt.

2. Glaucidium nanum, *Boie.*

F. Boie, Isis, 1826, p. 976.
Strix nana, King, Zool. Journ. iii. p. 426; Bonap. Consp. p. 37.
Athene nana, G. R. Gray, Genera of Birds, t. 12.
—— *leucolaima,* H. et Jacq. Voy. pl. 4. 2, 3.

Diagn.—Tail 63–70 mm. long, with eight to ten rufous cross bands reaching to the shaft.

Descr.—Head-feathers rufous or grey-brownish, with white shafts and shaft-stripes. Back rufous-brown, with two to three rufous-white spots round the shafts. Shoulder-coverts with rufous-yellowish-white spots, and long, white, dark-margined spots on the exterior margin, forming long stripes. Smaller feathers of the wing with large, round, black-margined spots on the outer webs, and smaller rufous-yellow concealed spots. Exterior web of the first wing-feather with two, second with two or three, third with three white spots. Interior wing-feathers whitish, darker towards the end, with

four to six cross bands. Tail rufous, with eight to ten black cross bands. Lower parts white. Sides brownish, with white spots. Tarsi dirty white, cross-banded.

Dimensions.—Wings 92–99, tail 63–70 mm. in length.

Hab. Southern America; Straits of Magellan; Peru.

The figure given in the 'Voy. au Pôle Sud' is too large.

3. Glaucidium infuscatum, *Kp.*

Strix infuscata, Temm. Man. d'Orn. i. p. 97 (1820).
—— *passerinoides*, Temm. Col. 344 (1824); Pr. Max. Beitr. iii. 239.
Glaucidium gnoma, Wagl. 1832, mas juv.
Athene passerinoides et *gnoma*, G. R. Gray.
—— *infuscata*, Bp.

Diagn.—Tail 61–66 mm. long, black, with five to six pairs of white spots not reaching to the shafts.

Descr.—Head-feathers rufous-brown, with white concealed shaft-spots enlarged in the middle. Back unicolor, in young birds light-rufous spotted. Shoulder-coverts rufous-brown, with white spots on the margin of the outer webs, and with rufous concealed spots. Small feathers of the wings with pure white spots on the outer webs. First wing-feather with five light-rufous spots, the second with three to five, third with three light and four dark spots. Interior parts of the wings whitish, with dark ends, and five irregular stripes. Tail dark brown. The lower parts white, with small, distinct, light and dark brown shaft-spots. Sides of the breast when young with rufous-yellow spots. Tarsi whitish.

Dimens.—Wings 90–95, tail 61–66 mm. long.

Hab. Brazil; Mexico; California[1].

An old female from Uruguay, which I have received by the kindness of Professor Lichtenstein, under the name of *Strix eluta* (*elata*, Bp.), has smaller spots on the head and tail, darker back, and more predominant dark brown on the white underparts. It is 6″ long. Professor Lichtenstein gives as a synonymous species with *Strix eluta*, *Str. passerinoides*, Temm.

4. Glaucidium ferrugineum, *Kp.*

Strix ferruginea, Pr. Max. Col. 199 (♀ juv.); Beitr. iii. 234.
Athene —— ?, G. R. Gray.
Noctua —— ?, Cuv.

Diagn.—The largest and most rufous.

Descr.—The head-feathers rufous, with rufous-yellow shafts; in young birds with rufous-yellow stripes along the shafts. Back unicolor-rufous. Shoulder-coverts rufous,

[1] The Californian species is different—*Glaucidium californicum*, Sclater, P. Z. S. 1857, p. 4: see Cassin's 'Birds of California,' p. 189 (P. L. S.).

with large rufous-yellow or rufous-whitish spots on the outer webs. The smaller feathers on the wings rufous, with very few rufous-yellow, in the middle white, dark-margined spots. Exterior web of the first wing-feather unicolor, in young birds spotted; third wing-feather with traces of five rufous spots. Interior of wing rufous, with six to nine cross bands, in youth with five to seven. Tail unicolor-rufous, in young birds with eight blackish bands. The lower parts rufous-yellow, with large rufous spots, in young birds with long shaft-spots.

Dimens.—Wings 105–111, tail 76 mm. long.

Prince Maximilian of Neuwied states that this very handsome Owl is to be found in nearly all the forests of Brazil, where it is called Cabouré. In his travels he very often heard its voice, which has a great similarity to that of *Falco subbuteo*, and sounds nearly like Keck-Keck, quickly uttered and often repeated. On cautiously approaching, he invariably found a pair of these Owls sitting close together, having certainly their nest in the neighbourhood. They were quite active in motion, very tame, and less oppressed by daylight than other owls. Very often, when in bivouac round the fire in the melancholy forest, he heard these little Owls overhead on a tree. In their stomach he usually found remains of insects.

Subgenus c. *Microglaux.*

These have all the characters of the former; but the nostrils are placed on the margin, and not in the middle, of the pea-shaped *cera*.

5. Glaucidium havanense, *Kp.*[1]

Strix havanensis, Licht. in Mus. Berol.

Diagn.—Size of *Gl. infuscatum*. Wing 98–99, tail 65 mm. long, with six narrow bars of rusty-yellow colour.

Descr.—Lorum, face, a stripe over the eye, and stripe under the ear-coverts white. Ends of the long lorum-bristles black. Ear-coverts light rusty-yellow, with blackish spots. Head and neck brownish, with rusty-yellow shaft-spots. Back and shoulder-coverts with more concealed rusty-yellow band and spots. On the margin of the shoulder-coverts no white spots, only broad rusty-yellow bands on the outer webs. The feather of the thumb on the outer web with four rusty-yellow-whitish spots. Alongside this feather a series of coverts with rusty-yellow bands, which are on the outer web white-spotted. The wings with six to seven rusty-red bands, which are on the outer web whitish-spotted. The lower parts white, round the chin rusty-red. The throat white; breast, sides, and belly with irregular rusty-red and black shaft-spots. Tibiæ and the upper part of the whitish, black-spotted tarsi rusty-yellow.

Hab. Cuba. (Mus. Berol.)

[1] This species should stand as *Glaucidium sigu*, Cab. Journ. f. Orn. 1855, p. 465. *Noctua sigu*, D'Orb. (P. L. S.)

6. Glaucidium perlatum, *Kp.*

Athene perlata, G. R. Gray.
Nyctipethes perlatus, Sw. Cl. ii. p. 218.
Scotophilus perlatus, Sw. West Afr. Birds, p. 130.
Strix perlata, Vieill. N. D. d'H. Nat. vii. p. 26; Encycl. Méth. p. 1290.
—— *occipitalis*, Temm. Col. 34.

Diagn.—Size of *Surnia passerina*. Wings 108, tail 78 mm. in length. Lorum, stripe over and under the eye, ear-coverts, chin and throat white; end of the lorum-feathers black. Head reddish, with white, black-margined spots, three on each feather. Back down to the tail-coverts with white, black-margined, but mostly concealed spots. Shoulder-coverts similarly spotted, but bordered on the outer webs with larger, white, black-margined spots. Small feathers of the wing with white dots edged with black, which on the arm-coverts form a long stripe. Thumb-feather with two round white and rusty-yellow spots, and a white margin near the end. Arm and hand wing-feathers rufous-grey or dark brown, with reddish, black-margined spots. Inner wings with broader and more rufous-yellow cross bands. Tail blackish, at the base white, with seven pairs of white, black-margined spots, not reaching to the shaft. Breast spotted with rufous. Sides and belly with rufous and black shaft-stripes. Tibiæ and a part of the tarsi white, spotted with rufous-black. Tarsi thickly feathered, with a black stripe on the outer side.

Dimens.—Head 42 mm. Diameter of the eye 10 mm. Bill from the gape 17½ mm.

Hab. The whole of Africa.

7. Glaucidium licua, *Kp.*

Athene licua, Bp. Consp. p. 37.
Strix licua, Licht.

Diagn.—Very near to *Gl. perlatum*, but with darker colouring, and more brownish on the upper parts. The white spots on the head and neck broader. The shaft-stripes on the sides and belly broader and blackish. The tail with five to six pairs of white spots not reaching to the shaft. Tarsi white, with black spots. Eye not so large as in *G. perlatum*. The male is smaller, and has on the under parts broader stripes, and only five pairs of spots on the tail.

Dimens.—Head 39–41 mm. Wing 100–102 mm. Tail 68–70 mm.

Hab. Caffreland.

Subgenus e. *Tænioptynx*.

Diagn.—Nostrils in the middle of the pea-shaped *cera*. Wings shorter; wing-feathers with the inner webs smaller, and emarginated more towards the quill; fourth and fifth wing-feathers of the same length. The whole plumage banded more frequently and distinctly. It represents the subgenus *Tænioglaux* of the genus *Athene*. We only know of one species, from India.

8. Glaucidium Brodii, *Kp.*

Noctua Brodiei, Burt, Proc. Zool. Soc. 1835, p. 152.
Athene Brodiei, Blyth, Journ. A. S. B. 1842, p. 163.
Noctua tubiger, Hodgson, Journ. A. S. B. 1837, p. 369; As. Res. xix. p. 175; Icon. ined. Accip. 82. 2, 3, et 83.

Diagn.—The whole body banded with rufous-yellow or whitish bands.

Descr.—Head brownish, with one to two rufous-yellow bands and ends to each feather. Back and tail-coverts brownish, with two to four small bands on each feather. Shoulder-coverts with three rufous-yellow bands, which are nearly pure white on the exterior web, and the small feathers with one or two small rufous-yellow bands without white spots. The first primary with two white spots on the external web, the second with three, the third and fourth with from three to four rufous-yellow spots. The under wing-coverts rufous-yellowish, with a black stripe. The wing-feathers before the emarginations light-coloured, afterwards dark, with two to seven cross bands. Tail blackish, with seven to eight small rufous-yellow cross bands, which do not continue quite to the shaft. Under parts white, with three brownish, dark-margined bands on each feather. Femur-coverts with large brown shaft-spots, which are partially and irregularly banded. Tarsi whitish, banded and spotted with brownish.

Dimens.—Male. Wing 87, tail 58 mm. long.—Female. Wing 97, tail 63–66 mm. long.

It is an error to place this species in the subgenus *Tænioglaux* of the genus *Athene*.

Hab. Nepal.

Genus II. Nyctale.

Brehm, Isis, 1828, p. 1271.

a. —— ? b. *Nyctale*. c. —— ? d. —— ? e. —— ?

Diagn.—Very large asymmetric ear-orifice with a well-developed operculum and veil. Bill short, not projected, with a rudimentary *cera* and nostrils on the margin.

Brehm has compared the skull of this genus with that of *Caprimulgus*; we may also compare it with that of *Otus*. Nitzsch says that the *furcula* is divided, and forms a pair of bones, which are connected by a membrane. All the known species are true Night-Owls in their mode of life. The first subgenus, with the first wing shorter than the tenth, is not yet discovered.

Subgenus b. *Nyctale*, Brehm.

Diagn.—First and second wing-feathers with inner webs broad, and emarginated only towards the end. Toes thickly feathered.

1. Nyctale acadica, *Bonap.*

Geogr. Comp. List of Birds of Eur. and N. Am. p. 7.
Strix acadica, Gmel.
—— *acadiensis*, Lath. Ind. Orn. i. p. 65; Syn. i. pl. 5. fig. 2.

Noctua acadica, Rich. and Sw. Fauna Bor. Am. Birds, p. 97.
Scotophilus acadicus, Sw. Cl. of Birds, ii. 217.
Ulula acadica, Aud. pl. 199.
Strix passerina, Wils. pl. 34. i.; Lichtenstein.

Diagn.—Wings 131, tail 70 mm. long.

Descr.—Smaller than the European *N. funerea*, and not so much spotted. The spots on the head are smaller and longer. Back brownish, without spots. Tail with three pairs of white spots. The first six wing-feathers have from one to four white marginal spots. The under parts are white, with rufous-brownish shaft-spots, and large spots on the sides. Bill black.

Specimens of this bird are rare in collections.

Hab. Northern parts of America.

2. Nyctale funerea, *Bp.*

Nyctale funerea, Bp.
Strix funerea, Linn. (diagn., not the description).
—— *passerina*, Pall. Zoogr. i. p. 323.
—— *Tengmalmi*, Gmel. Naum. t. 48. 2 & 3, adult and young.
Noctua Tengmalmi, Cuv.
Athene ——, Boie.
Nyctale Tengmalmi, Bp. Geogr. Comp. p. 7.
Strix dasypus, Bechst. Brehm's Beitr. p. 354; Gould, Birds of Eur. pl. 49.

Diagn.—Wing 163, tail 100–103 mm. long.

Descr.—Back with concealed white spots. Tail with five to six pairs of white spots, not reaching to the shafts. Under parts white, with obsolete rufous-brownish spots at the bases and the ends of the feathers. Bill horn-brown, with yellow base. Weight 4–4½ ounces. The young bird is dark brown, beneath light grey, tinged with dark brown; on the throat and on the sides of the breast dark brown; coverts of the wings brown.

We find this species thinly scattered through the northern parts of Germany in the pine and mountain forests. Its voice is like the *Athene noctua*, and sounds "Kêüw-Kêüw," after which follows three or four times "Kuick." The voice resembles very much that of *Otus vulgaris*, but the sound is higher. In the spring it is very difficult to discover any difference between the voices of these two species (*Naumann*). Its voice then sounds more like a continual barking of dogs—"Wa-wa" (*Brehm*). In a cage it is a perfect night bird at the commencement of its confinement, and in daylight seeks the darkest corner; but afterwards its habits are changed by the custom of feeding it only during the day, and it becomes a day-owl. As it hops it lifts the tail high, and leaps like an ape. If provoked, it knacks and bites with the bill. On a sudden surprise it throws itself on its back directly, and defends itself with its projected legs, although

it may be at the same time very tame (*Brehm*). This Owl makes grimaces which usually much entertain the spectator, and possesses the remarkable faculty of dilating the feather-wreaths to such an extent, that over each eye is formed an elevated protuberance, which gives the appearance of two little feather-horns. Its flying is like the *Otus vulgaris*, but the strokes of the wing follow more quickly (*Naumann*). It lays four round white eggs, which Brehm describes as with smooth surface and few pores. One of these was 1 inch 5 lines long, and 1 inch $2\frac{1}{2}$ lines broad.

3. Nyctale Richardsoni, *Bp.*[1]

It has nearly the same dimensions (wings 164, tail 96) as *N. funerea* (wings 163, tail 100–103). The only difference is a darker colour on the upper parts, and this is the reason that the white spots are more distinct. The character "longer tail" is not correct.

This is certainly not a true species.

Hab. Northern parts of America.

Genus III. Athene, *Boie.*

a. *Cephaloptynx.* b. *Athene.* c. *Pholeoptynx.* d. —— ? e. *Tænioglaux.*

Diagn.—The nostrils are situated on the margin of the swollen short *cera* (Plate LVI. fig. 3). Ear-orifice small. Wings moderately long, reaching nearly to the end of the short tail. Toes naked, with a few bristle feathers. The emarginations on the lower jaw not so distinct. These birds are very nearly connected with the first genus (*Glaucidium*), and the fifth genus (*Ieraglaux*), and are spread over the whole world.

Subgenus a. *Cephaloptynx.*

Diagn. —The first wing-feather shorter than the tenth. First, second, and third very clearly emarginated, fourth not so distinctly. The plumage not banded, but much spotted.

1. Athene punctulata, *G. R. Gray.*

Noctua punctulata, Quoy & Gaim. Voy. Astrol. Ois. t. i. fig. 1.

Descr.—A little larger than *Athene noctua*, with larger head and stronger bill. Front, a stripe over the eye, the whole chin, belly, tarsi, and under wing-coverts pure white. The lorum-feathers mixed with blackish bristles, and with black shafts, reach to the end of the yellowish bill. Ear-coverts brownish-rufous, spotted at the end of each feather. Head, the whole back, the little feathers of the wings dark-brownish, with rufous-yellow

[1] A fourth species of true *Nyctale* is *N. albifrons,* Cass., *Strix albifrons,* Shaw. See Cassin's 'Birds of California,' p. 187, in which book it is also figured as *N. Kirtlandi,* pl. 11. *Hab.* N. America, Wisconsin, and Canada (P. L. S.).

spots, from one to three pairs on each feather. A brownish band under the white chin; on the point of the breast a white spot; next this white spot a dark spot on each side of the rufous-banded breast. The sides and the lower parts of the breast more rufous, with rusty-yellow bands. The backs of the wing-feathers on the inner side yellowish-white; the upper parts with bands not reaching to the shafts; the parts below the emarginations nearly unicolor, because the bands are very indistinct; three to four spots on the margin of the external webs; five narrow bands not reaching to the shafts of the tail-feathers.

Dimens.—Head 57, from the gape 26, wing 158, tail 76, tarsus 35–36, middle toe with nail 30, without nail 22 mm. long.

Hab. Celebes.

Subgenus b. *Athene.*

Diagn.—The first wing-feather as long as the sixth or seventh; first to the fifth slightly emarginated. The first wing-feather dentellated on the external web; the second to the fifth with external emarginations. Tarsus not very high. Plumage spotted. Ear-orifices asymmetric (Pl. LVI. fig. 4).

2. Athene meridionalis.

Noctua meridionalis, Risso, Hist. Nat. de l'Eur. Mér. iii. p. 32.
—— *glaux,* Sav.
—— *passerina,* Rüpp.
Surnia noctua, v. d. Mühle.

Diagn.—Toes with bristly feathers. The lower parts with rufous shaft-stripes. Tail with three yellowish dark-margined cross bands.

Descr.—The head-feathers with smaller and more distinct white shaft-spots. Shoulder-coverts with large white spots.

Dimens.—Head 51, wings 152, tail 75 mm. long.

This Owl is a native of the southern parts of Europe and northern parts of Africa. In Egypt it lives in date-trees, and is very common (*Rüppell*). According to Graf von der Mühle, this Owl is the true 'bird of Minerva' of the old Greeks, and at the present time is very common throughout Greece, where the inhabitants protect it, although it shows little pity towards other birds. It makes its nest in the month of March in fissures of rocks and old walls, and is very often to be seen during daylight on projecting rocks. These birds see very well in the daytime, and fly away on the approach of the hunter. The little birds which live in their neighbourhood, as *Saxicola aurita*, *S. stapazina*, *Monticola cyanea*, *Emberiza cæsia*, &c., have no fear of them, as they never attempt to attack them. They feed their young during daylight, and v. d. Mühle frequently shot the females in the act of doing so. They had only insects in their stomachs. In its manner of living this Owl is very similar to a diurnal hawk, and its voice may be heard the whole day; but no mention is made of hearing it in the

night-time. On uttering their peculiar cry they bow their head,—it sounds like *Kukou-wa*. The Grecian name κοηχούβαια is an imitation of it. Savi pronounces it 'Cucutio.' Its name in Lucca is 'Cucca-megia.' No traveller mentions having seen this species in forests, or on a single tree, but all the rocks and naked hills abound with it[1].

3. Athene noctua, *Bp.*

Strix noctua, Retz. Fauna Suec. p. 85.
—— *passerina*, Lath.; Temm. Naum. t. 48. 1; Gould, B. of Eur. pl. 48.
Athene passerina, Boie.

Diagn.—Toes with bristly feathers, which have some radii at the base on each side. Tail with four rufous-yellow bands.

Descr.—The head-feathers with large shaft-spots, which are broader at the ends. Shoulder-coverts with large white spots. The lower parts with rufous-brownish shaft-stripes.

Obs.—This is more a twilight bird than the *A. meridionalis*, and belongs to the temperate parts of Europe. It seems to seek the neighbourhood of man, and is found very often in old buildings; also in thin woods, in stone-pits, in the hollows of trees, and in high banks. It is capable of being tamed very quickly. Naumann contends that its flight in the day-time is like that of a woodpecker or hoopoe, descending in arcs. At night it is attracted by a light, and on approaching, utters its peculiar cry with much vehemence, which has given this poor bird an unenviable reputation amongst the superstitious.

Dimens.—Head 50–52, wing 159–180, tail 72–100 mm. long.

4. Athene brama, *G. R. Gray.*

Strix brama, Temm. Col. 68.
—— *indica*, Frankl. Proc. Zool. Soc. 1831, p. 115.
Athene indica, Blyth, Journ. A. S. B. p. 369.

Diagn.—Toes with bristly feathers. Tail with four to five distinct small white cross bands. Lower parts with arrow-like black cross bands.

Descr.—The head-feathers with white bands in the middle, and two spots on the ends. Shoulder-coverts with small white spots. The white bands of the tail do not reach to the shaft.

Dimens.—Head 50, wing 152, tail 75 mm. long.

Asia and its Archipelago.

[1] This gave rise to the old Greek adage—when speaking of an unnecessary or superfluous act,—that it was "bringing owls to Athens." This in later days has been anglicised, and we read of men advised "not to carry coals to Newcastle" (K.).

Subgenus c. *Pholeoptynx*.

Diagn.—Middle toe (without the nail) half as long as the long thin tarsus. Wings long. The first wing-feather shorter than the fourth; the first and second clearly, third and fourth indistinctly emarginated.

They live in the southern parts of America and its islands, and make their nests in the holes of Armadillos and of the prairie dogs (*Arctomys ludovicianus*).

5. Athene cunicularia, *Bonap.*[1]

Geogr. Comp. List of Birds of Eur. and N. Am. p. 6.
Strix cunicularia, Mol. Chili, p. 233; ? Aud. Birds of Am. pl. 412; Azara, N. 47 (Urucuru).
Noctua coquimbana, Briss. Orn. i. p. 72.
Strix grallaria, Temm. Col. 146.
Noctua urucuru, Cuv.

Diagn.—Rufous-grey. Tarsus $1\frac{3}{4}$ inches long, feathered to the toes.

Descr.—In the colouring very similar to our *Athene noctua*, but with smaller and more numerous spots, which on the back are black-margined. Breast-sides grey-brown, with rufous-yellow-whitish dark-margined spots, which do not extend to the shaft. Tail with white root and margins, and four pairs of spots, which do not always reach to the shaft. The young bird is darker; the bands especially are darker and more distinct.

Dimens.—Head 54, wing 182, tail 88 mm. long.

Hab. S. America; San Paolo; nests in holes of Armadillos, &c.

Subgenus e. *Tænioglaux*.

Diagn.—The first wing-feather shorter than the tenth. The plumage with many cross bands. Size of *Athene noctua*.

Found in Asia and Africa.

6. Athene castanoptera, *Blyth*.

Blyth, Journ. A. S. B. p. 164 (1842).
Strix castaneoptera, Horsfield, Linn. Trans. xiii. 140.
—— *spadicea*, Reinw. Col. 98.

Diagn.—The head rufous, black-banded. Shoulder-coverts unicolor, brown, with large, white, brown-margined spots on the margins. Tail with six rufous-yellow bands.

Descr.—Each head-feather with four black bands. Back unicolor-rufous. The tail-coverts with three rufous bands on each feather. Shoulder-coverts rufous or brown, with large, white, brown-margined spots on the external web. Arm- and hand-wings dark brown, irregularly banded. The inner webs rufous, with six to seven irregular,

[1] *Athene dominicensis*, Bp. Consp. p. 38, from the Antilles, and *Athene hypogæa*, ibid., from N. W. America, are now often considered as distinct species from this (P. L. S.).

broad, black bands. Breast black, with small rufous bands. Lower parts white, with dark shaft-spots. Tail dark brown at the base, rufous-yellowish, with six bands and the extremity yellowish.

Dimens.—Wing 147, tail 79 mm. long.

7. Athene erythroptera, *Blyth.*

Strix erythroptera, Gould, Proc. Zool. Soc. 1837, p. 136.
Noctua perlineata, Hodgs. Journ. A. S. B. 1837, p. 369.
Strix radiata, Tick.
—— *cuculoides,* Jerd.
Athene undulata, Blyth.

Diagn.—The head blackish, with rufous-yellow or whitish bands. Shoulder-coverts with very small bands, with larger white spots on the margins of the wings. Tail black, with nine to ten irregular small bands.

Descr.—The head with two rufous-yellow or whitish bands on each feather. Back to the tail-coverts with three to four cross bands and margins on each feather, which are on the back rufous-yellow, and on the tail-coverts whitish. Shoulder-coverts similarly banded, five to six bands on each feather. The small feathers of the wings dark brown, rufous-spotted, with some large white spots on portions of the exterior webs. Arm and hand wing-feathers black, banded with rufous. The inner wing light reddish along the shafts, spotted and banded with blackish; on the coverts white and rufous, with dark spots. Sides of the breast rufous-yellowish. Belly and its sides with blackish bands. Tail-bands in a crooked direction irregularly connected with the shaft. Tarsus white, with irregular dark spots.

Dimens.—Wing 130, tail 76 mm. long.

Hab. Northern Hindostan.

8. Athene cuculoides, *Blyth.*

Noctua cuculoides, Vig.
—— *auribarbis,* Hodgs.; Gould, Cent. Him. Birds, t. 4.

Diagn.—Total colour of the wing brownish. Tail with seven cross bands.

Descr.—Very much like *A. erythroptera,* but larger, and in the drawing of the feathers broader. The young bird is more spotted than banded on the upper parts.

Dimens.—Wing 140–149, tail 83–85 mm. long.

Hab. Northern Hindostan.

9. Athene capensis, *A. Smith.*

Ill. S. Afr. Zool. t. 33.

Diagn.—Tail with fourteen small rufous bands.

Descr.—Head brownish-grey, spotted with white, two spots on each feather. Back dark brown, each feather with two small, rufous, arrow-like bands. Shoulder-coverts

similarly coloured, with three bands on each feather, and the margins white margined with black. The small feathers of the wings banded with rufous; the outermost having the external web white, terminated with black. Arm- and hand-wings dark brown, with small rufous cross bands, which are white-spotted on the margin of the hand-wings. The inner wings rufous-yellowish, with eight to ten irregular blackish bands. Breast rufous and white, with black bands. Belly and sides pure white, with large, round, black end-spots.

Obs. A very handsomely coloured species.

Dimens.—Wing 143, tail 86 mm. long.

Hab. S. Africa.

Genus IV. Surnia, *Dum.*

Diagn.—Nostrils situated on the margin of the rudimentary cera. Ear-orifice small, without operculum. Bill curved from the cera, and covered with feathers. Toes more or less thickly feathered. Shafts of the wing-feathers strong and stiff.

a. *Microptynx.* b. *Nyctea.* c. ——? d. ——? e. *Surnia.*

Subgenus a. *Microptynx.*

Glaucidium (pars), Boie.

Diagn.—First wing-feather shorter than the tenth. First to fourth wing-feathers emarginated. Toes very thin, covered with feathers. No bristle-feathers.

It represents in its genus the genus *Glaucidium.*

1. Surnia passerina, *Kp.* (Pl. LVI. fig. 5 *a*, bill; *b*, wing.)

Strix passerina, Linn.
—— *pusilla*, Daud.
—— *pygmæa*, Bechst.
—— *acadica*, T. Naum. t. 43. 1, 2.
Glaucidium passerinum, Boie.
Athene passerina et africana, G. R. Gray; Lev. Afr. t. 46; Nils. Scand. Faun. t. 3.

Diagn.—Tail 56–62 mm. long, with five arrow-like cross bands reaching to the shafts.

Descr.—Head ash-grey, with white dark-margined spots. Back and tail-coverts with concealed white spots, the feathers on these parts having a white band near the base, and a spot at the end. Shoulder-coverts with three to four whitish shaft-spots or bands on each feather. The small feathers on the wing with white spots. Arm- and hand-wings blackish, with rufous and small rufous-brownish bands, which on the external and internal margins are spotted with white. The wings are crossed by six to eight lighter-coloured bands, which are white over the emarginations. Sides of breast

brownish, banded with white. Breast and belly white, striped with blackish. Tarsi and toes white.

Dimens.—Wing 95 (♂), 99 (♀), tail 56 (♂), 62 (♀) mm. long.

Hab. Northern and eastern parts of Europe and Asia.

Subgenus b. *Nyctea*, Steph.

Diagn.—The long wings cover two-thirds of the tail, which is as long as the body. The first wing-feather is shorter than the fourth. First to fourth wing-feathers have broad inner webs, and are emarginated to the end. Ear-orifice larger than the diameter of the eye (perhaps asymmetric).

2. Surnia nyctea, *Selby.*

Strix nyctea, Linn.
—— *candida*, Lath.
—— *erminea*, Shaw.
Nyctea erminea et cinerea, Steph.
Strix nivea, Thunb.; Daud.
Nyctea nivea, Bp. Pl. Enl. 458; Edw. B. t. 61; Naum. taf. 41; Vieill. Am. Sept. t. 18; Levaill. Afr. t. 45; Wils. Am. Orn. pl. 32. fig. 1; Aud. pl. 121; Gould, Eur. t. 43.

Descr.—Bill and nails black. Whole plumage in advanced age pure white, in youth black-spotted. Size of *Bubo maximus* (♀).

Hab. High northern latitudes of Europe, Asia, and America.

Subgenus e. *Surnia*, Dum.

Diagn.—The first wing-feather as long as the seventh. First to third wing-feathers distinctly emarginated. Ear-orifice less than the diameter of the eye. Tail longer than the body.

3. Surnia ulula, *Bp.* (Pl. LVI. fig. 6 *a*, bill; *b*, wing.)

Strix ulula, Linn. Fauna Suecica, 78.
—— *Hudsonia*, Gmel.
—— *funerea*, Lath.
—— *canadensis et freti-hudsoni*, Briss.
—— *doliata*, Pall.
—— *arctica*, Sparrm.
—— *nisoria*, Mey., Naum. 42. 2.
Surnia borealis, Less.
—— *funerea* (Lath.), Cuv.; Enl. 463; Edw. t. 62; Wils. pl. 50. fig. 6; Aud. 378; Gould, t. 45.

Diagn.—A broad black vertical stripe from the ear to the neck.

Descr.—A little smaller than *Otus vulgaris*. It is distinguished from all other European owls by its banded plumage. The bill is horn-brown, posteriorly yellow. Head

and after part of neck white, with black bands and margins. On the hinder neck three black spots, one next to the ear-stripe. Shoulder-coverts white, banded and spotted with brownish, towards the interior part more brown, and towards the exterior nearly pure white. Smaller feathers on the wing lighter or darker brown, with white spots on the exterior webs. Wings blackish, with seven to ten white cross-spots, of which those on the inner webs do not reach to the shaft. The ends of the wing-feathers margined with white. Tail long; the first exterior feather one inch shorter than the centre feathers; all with light or nearly white cross bands, which on the middle feathers do not come together with regularity. Beneath the chin black; on the sides of the breast a black cross band; the other parts white, with two to five bands on each feather. The face, throat, and upper parts of the breast nearly white, without spots.

Hab. The same countries as *S. nyctea*, coming very rarely to England and Germany.

Genus V. Ieraglaux, *Kp.*

Athene, Auct.

Diagn.—The nostrils situated on the margin of a long, strongly-developed cera, which covers the last half of the bill. Toes long, thinly covered with bristles. Wings long, with long wing-end[1]. Tail always long.

Descr.—Head mostly small, with very small ear-orifice, smaller than the diameter of the eye. No distinct feather-wreath. The wings with pretty strong quills, and not reaching to the end of the tail.

In size middling or large; the species chiefly occurring in Australia and its vicinity. Bill mostly black, with yellowish back.

a. *Cephaloglaux.* b. *Spiloglaux.* c. *Sceloglaux.* d. *Ctenoglaux.* e. *Ieraglaux.*

Subgenus a. *Cephaloglaux.*

Diagn.—Head large. Bill strongly curved. *The first wing-feather shorter than the tenth.* Toes shorter than the tarsi. Tarsi covered with stiff shafts. Toes with strong bristles.

Three species, from India and Oceania.

1. Ieraglaux superciliaris.

Athene superciliaris, Puch.
Strix superciliaris, Vieill.
—— *Sonnerati*, Temm. Col. 21.
Noctua ——, Less.

Diagn.—Wings and tail-feathers rusty-red, with white traces only on the margins of

[1] I call 'wing-end' that part of the end of the hand-wings which is not covered by the arm-wings.

the inner webs, and some of the outer webs. Breast and belly white, banded rather broadly with brown.

Descr.—Nearly the size of *I. scutellatus*, but with larger head and bill, shorter wings and tail, and stronger tarsi and toes. Face, chin, and a stripe over the eye dirty yellowish-white. Bristle-feathers on the cere very long, with black points. Head and occiput brown, with small round white spots. Back uniform brown. The small feathers on the wings and the arm-wings with larger, round, white spots. The hand-wings with white spots next to the emarginations only, and with their ends uniform reddish. Under tail-coverts whitish. The strong bristle-feathers of the tarsi rusty-yellowish. Bill, nails, and toes yellowish.

Dimens.—Bill from the cere 20, head 56, wing 190, tail 110, tarsus 29 mm.

Description taken from the unique specimen in the Paris Museum.

2. Ieraglaux Jacquinoti.

Athene Jacquinoti, Homb. et Jacq. Voy. au Pôle Sud, t. iii. 2.

Diagn.—Chin white, with a reddish-brown black-banded collar. Belly yellowish-white.

Descr.—Size of *I. superciliaris*. Face and a stripe over the eye white. Bristle-feathers over the nostrils white, with black shafts. Feathers of the cheeks and anterior ear-coverts reddish, with black spots. Over the yellow eyes a small black stripe. The crown of the head black; each feather with two pairs of reddish spots. The back dark brown; each feather with three to four rusty-yellow bands, which very often do not reach to the shaft. The wings dark brown; on the outer web spotted with yellowish, white spotted; on the inner web spotted or banded with yellowish-white. The end of the hand-wings uniform, with traces only of cross bands. The tail of the same colour, with about six bands, clearer on the inner webs. Tarsi with traces of brown spots. Bill yellow. Toes yellowish. Nails black.

Dimens.—Head (♂) 56, bill from the gape 25, wing 188, tail 105, tarsus 41, bill from the cere 18 mm.

Hab. Oceania; Salomon Islands. (Mus. Paris. Spec. unicum.)

3. Ieraglaux variegatus, *Kp.*

Athene variegata, G. R. Gray.

Noctua variegata, Quoy & Gaim. Voy. Astr., Ois. t. 1. 2.

Diagn.—Wing 194–198, tail 114–120 mm. long. Tail with ten light narrow bands. Breast and belly white, with three rusty-brownish bands on each feather.

Descr.—Size of *I. marmoratus*, with stronger bill. The front, face, and chin whitish, with black shafts on the lores. Concealed light spots on the greatest part of the greyish-brown head-feathers. The under parts of the neck with two pairs of white spots on each feather. The shoulder-coverts with white bands. Back brownish. Upper

tail-coverts with light spots. The smaller plumage on the wings with light rusty bands, which are white on the exterior margin. The arm- and hand-wings banded on the upper and inner side, on the under side with eight or nine bands. Tibiæ and tarsi rusty-yellowish.

Dimens.—Head 56, bill from the gape 26 mm.

Hab. New Ireland.

Subgenus b. *Spiloglaux.*

Diagn.—The first quill longer than the tenth, and the fifth distinctly emarginated on the inner web. Wings with rather long wing-ends. Toes shorter than the tarsi. Bill more curved, and not so much projected as in the other subgenera.

All from Australia.

4. Ieraglaux bubuk, *Kp.*

Strix boobook, Lath. Ind. Orn. Suppl. p. xv.
Noctua ——, Vig.
Athene ——, Gould, Birds of Austr. t. 32.
—— *ocellata*, Hombr. & Jacq. Voy. tab. 3. 2.

Diagn.—Head 55–58, wing 217–241, tail 140–150 mm. long.

Descr.—Equals in size *I. marmoratus*, in colouring resembles *I. connivens.* Front, a stripe over the eye and the throat white. Cheeks ash-grey, inclining to brown. The superior parts ash- or reddish-brown, with uniform back, reddish-yellow shining through the feathers. White spots on the wings more or less concealed. Inferior parts reddish-yellow, with scarcely distinguishable dark shaft-spots, and round white spots on the sides and belly. Inferior wing-coverts reddish-yellow, spotted oblongly with reddish-brown. Interior of the wing-feathers with five clearer bands, of which the three uppermost are white on the outer webs, and the two lowest are silver-grey, like the upper surface of the wings. Tail above uniform, beneath with seven cross bands. Tarsi white or reddish, with traces of dark spots.

The smaller dimensions are taken from two examples in the Jardin des Plantes, which are the types of *Athene ocellata*, from Oceania.

5. Ieraglaux maculatus, *Kp.*

Noctua maculata, Vig. & Horsf.
Athene maculata, Gould, Birds of Austr. tom. i. pl. 33.

Diagn.—Tail blackish, with six whitish bands. Head 58, tail 120 mm. long.

Descr.—Size of *I. bubuk.* Plumage dark brown, with white spots on the nape of the neck, back and wings. The interior of the wing dark reddish, with white spots and margins on the end of each feather. The inferior wing-coverts reddish-yellow,

spotted or banded with dark brown. The lighter bands on the exterior tail-feathers are nearly entirely margined with black. Tarsi reddish-brown.

Hab. Australia.

6. Ieraglaux marmoratus, *Kp.*

Athene marmorata, Gould, Birds of Austr. Intr. p. xxvi.

Diagn.—Occiput, neck, margin of the shoulder-coverts, and lower middle part of the small feathers of the wing white, spotted on the outer webs. Whole plumage of the superior parts light ash-brown.

Descr.—Size between *I. connivens* and *I. bubuk*, and colouring similar to *I. maculatus*. Superior parts light ashy-brown, with white spots; inferior parts reddish-yellow, white-spotted. Tail ash-grey, with scarcely perceptible bands on the upper surface, and seven bands on the under side. The under wing-coverts reddish-yellow, dark-spotted, the longest with three black cross bands. Wings blackish, with six to seven whitish bands.

Hab. Australia.

7. Ieraglaux novæ zealandiæ, *Kp.*

Strix novæ zealandiæ, Gmel.
Noctua ——, Quoy & Gaim. Astr., Ois. t. 2. f. 2.
Strix fulva, Forst. Descr. Anim. p. 71.
Athene ——, G. R. Gray.

Diagn.—Wing 204, tail 117–129 mm. long. Upper parts nearly black.

Descr.—Head rather small. Upper parts nearly black, sometimes with reddish spots on the nape of the neck. Small feathers of the wing- and shoulder-coverts reddish-yellow, with white spots. Near the margin of the wing small white spots. Breast black, with reddish margins to the feathers. Belly and sides reddish-yellow, with white spots. The upper surface of the tail with faintly-coloured bands; under surface with seven narrow light-coloured bands. The inferior wing-coverts reddish, spotted with black. Wings nearly black, with seven to eight cross bands, which near the base are almost white.

Hab. New Zealand.

8. Ieraglaux fuscus, *Kp.*

Athene fusca, Puch.
Strix fusca, Vieill.
—— *Maugei*, Temm. Pl. Col.

Diagn.—Head 51, wing 212, tail 117 mm. Tail with nine whitish bands.

Descr.—In size very near to *I. scutellatus* and *I. maculatus*, but with larger head and stronger bill. The upper parts like *I. scutellatus*, brownish ash-grey, with con-

cealed white spots on the shoulder-coverts and sides of the neck, and round white spots on the exterior webs of the smaller wing-coverts. The coverts of the first ten hand-primaries nearly black. Eight whitish or yellowish-white bands on the exterior and interior webs of the wings. Front, chin and lores dirty-white, with black shafts. Breast and belly brown, with white spots and stripes on the webs of each feather. Under tail-coverts white, with brown ends and shaft-spots. Tibiæ and the superior part of the tarsi rusty, the other under parts dirty-white.

Hab. Porto Rico (*Maugé*).

Subgenus c. *Sceloglaux.*

Diagn.—With projected bill. First to fifth wing-feathers emarginated on the inner web, and second to sixth on the outer web. The first wing-feather a little longer than the tenth. Tarsi very long, twice as long as the middle toe without the nail. Outer toe half as long as the middle toe. Toes with very much developed bristles. Plumage like that of *Otus vulgaris.*

9. Ieraglaux albifacies, *Kp.*

Athene ——, G. R. Gray, Voy. of Erebus and Terror, Birds, pl. 1.

Diagn.—Size of *Otus vulgaris.*

Descr.—Face and front dirty-white, with black shafts; next to the ear with black shaft-stripes. Head, nape, back, wings and lower parts dark brown, with reddish margin-spots and margins on each feather. On the hand- and arm-wings are six bands, which are reduced on the outer webs to light reddish spots. Tail very dark brown, with six narrow white cross bands, and reddish-yellow end bands. Tarsi whitish or rusty-reddish, with dark longitudinal spots.

Dimens.—Head 68, bill 19, from the gape 29–31, wing 245–280, tail 150 mm.

Hab. New Zealand.

Subgenus d. *Ctenoglaux.*

Ninox, Hodgs.

Diagn.—Head extremely small. Margins of the toes with small warts and bristles like a comb. Bill curved from the *cere.* First wing-feather longer than the tenth, and first to fourth wing-feathers emarginated on the inner web.

Distributed over Asia.

10. Ieraglaux scutellatus, *Kp.*

Diagn.—Bill black, with yellow back.

Descr.—Upper parts dark brown or greyish-brown, without spots. Front and lores whitish, some of the feathers which cover the bill black. Head with greyish tint. Shoulder-coverts with large white spots, concealed like the white spots on the arm-

wings. Throat reddish. Under parts white, with large longitudinal stripes or arrow-like cross bands. Tarsi banded. Upper tail-coverts banded with white or uniform. The tail like that of the common Sparrow-Hawk, with three to six cross bands, one narrow base-band, and the end light greyish; the end margined with white. Wings with some lighter bands.

Dimens.—Male. Head 45, wing 180 or $6\frac{1}{2}''$, tail 102 or $3''\ 7\frac{1}{2}'''$.—Female. Head 46, wing 196 or $7\frac{1}{2}''$, tail 120 or $4''\ 4'''$.

Subgenus e. *Ieraglaux.*

Diagn.—The first wing-feather longer than the tenth. First to fifth wing-feathers very distinctly emarginated; sixth very feebly. Tarsi and toes very strong and long. Middle toes (without the nail) as long as the tarsi.

11. Ieraglaux connivens, *Kp.* (Pl. LVI. fig. 7 *a*, bill; *b*, wing.)

Falco connivens, Lath. Ind. Suppl. p. xii.
Athene ——, G. R. Gray; Gould, Birds of Austr. tom. i. pl. 34.

Diagn.—A little larger than *Syrnium aluco*. Tarsi equal to the middle toe, and 43 mm. long.

Descr.—Body a little larger than *S. aluco*, but head smaller and tail longer, consequently the whole bird longer and more slender. Upper parts dark grey and brownish; under parts whitish, striped with dark grey and brownish. Upper tail-coverts with concealed whitish spots. Shoulder-coverts and small feathers of the wing with white spots on the outer webs. Second wing-feather to the sixth on the outer web with oblique white spots, which next to the shaft are coloured with clear brownish-grey. The six to seven corresponding bands of the inner webs are oblique. Under wing-coverts reddish-yellow, with black shaft-stripes; the longest of them black, with white margins. Tarsi whitish and reddish yellow, with dark-grey longitudinal spots. Tail above with six, beneath with eight silver-grey bands and light ends. Eye orange. Bill black, with yellow back.

Dimens.—Head 71, wings 303–316, tail 170–184, after-toe 17 mm. long.

12. Ieraglaux strenuus, *Kp.*

Athene strenua, Gould, Birds of Austr. tom. i. pl. 35.

Diagn.—Tarsi equal to the middle toe (without nail), and 58 mm. long.

Descr.—One of the largest, most powerful, and finest Owls, and in these respects not inferior to *Surnia nyctea*. Plumage very variegated, the dark-brown back being reddish-yellow, banded and spotted with white; inferior parts white, with black arrow-like spots. Arm-wing-coverts, arm-wings, hand-wings and tail with clearer end-margins;

the lighter bands of the wings form arrow-like figures, the points of which are directed towards the bill. The tail with seven to eight bands.

Dimens.—Head 86, bill 33, from the gape 45, wings 400, tail 230 mm. long.

Hab. Australia.

13. Ieraglaux rufus, *Kp.*

Athene rufa, Gould, Birds of Austr. tom. i. pl. 36.

Descr.—Very much resembling the last, but distinguished, according to Gould, by the reddish lower parts and the dark reddish cross bands, which are nearer together and more numerous.

I have not yet seen a specimen of this bird. The only example in Europe was in the collection of Mr. Gould, which was transferred to the Museum of the Academy of Natural Sciences of Philadelphia.

14. Ieraglaux humeralis, *Kp.*

Athene humeralis, Hombr. & Jacq. Voy. au Pôle Sud, Ois. t. 4. 1.

Diagn.—With black face, white chin, and plumage frequently banded with narrow bands. Upper parts dark brown, with three rufous bands on each feather.

Descr.—In size between *I. connivens* and *I. strenuus.* Tarsi shorter than in any other known Owl. Toes very strong and short, and with powerful nails. Bill yellow on the margin, with the base black. The upper parts dark brown, with narrow rufous bands. The lower parts whitish, with three to six rusty-brownish or rusty-yellow bands. Under tail-coverts at the base blackish, in the middle white, and at the ends banded with rusty-red. Tarsi dirty-white, with traces of rusty-red bands. The wing-margin between the top of the hand and the first hand-wing white, near the inner side brown-banded. Inner hand-coverts rusty-white, banded with rusty-red. The longest coverts white, with three to seven black bands. Hand- and arm-wings blackish or greyish, with six to seven clearer bands. Tail long, blackish, with six to eight very indistinct bands.

Obs.—The specimen in the Jardin des Plantes is a female. The figure of MM. Hombron and Jacquinot gives the colouring of the head and neck too brilliant, and too distinct from the breast. The tail is too broad and short.

Dimens.—Head 82, bill from the gape 43, wing 305, tail 200, tarsus 50–51, middle toe 36–37 without nail, with the nail 58 mm.

Hab. New Guinea.

Subfamily II. STRIGINÆ, *Kaup*. Night or true Owls.

I. *Scops*. II. *Otus*. III. *Bubo*. IV. *Strix*. V. *Syrnium*.

In this more numerous subfamily we find a greater ear-orifice, with large operculum, feather-horns, a very pneumatic skull, enlarged at the occiput. The plumage is softer and more darkly coloured. The inner webs of the wings are broader, and covered with a silk-like, very soft felt.

This subfamily is more nocturnal, and has a more noiseless flight than the former. The smaller birds of this group live upon insects, small birds, and mammalia, but the larger confine themselves to larger mammalia and birds.

Genus I. Scops, *Sav.*

a. ——? b. *Scops*. c. *Acnemis*. d. *Ptilopsis*. e. *Megascops*.

Diagn.—Very small Owls, with an ear-orifice not so large as the diameter of the eye, and with feather-horns.

Descr.—They show a very handsome round skull, nearly without pneumacity, and have the largest and most perfect brain.

They prefer warm to cold countries, and we find the species spread over the whole earth.

Subgenus b. *Scops*.

Diagn.—The nostrils placed on the margin of the cere. Wings long and pointed. The first wing-feather distinctly emarginated at the end, the second and third not so distinctly. The first wing-feather longer than the tenth, the third or fourth the longest. Tarsi feathered. Toes always naked and scaled. Confined to the Old World.

1. Scops ephialtes, *Sav.*

Strix scops, Linn., Naum. t. 43. 3.
—— *zorca* et *carniolica*, Gmel.
—— *pulchella*, Pall.
—— *giu*, Scop.
Scops zorca, Swains, Aldrovandi, Flem.
—— *europæus*, Less.
Ephialtes scops, Pl. Enl. 436; Gould, Birds of Europe, t. 41.

Diagn.—The wing 141, the tail 62 mm. long. First wing-feather as long as the fifth.

Descr.—Whole plumage ash-grey, with elegant white spots; with oblong black shaft-spots and fine cross lines. Face silvery ash-grey, sprinkled with fine dark spots. Margin-

feathers of the ear near the root reddish, with black cross lines and broad dark brown margins. A series of white and black pointed spots on the outer webs of the margin of the shoulder-coverts. Wings with eight to ten white spots, which are continued over the inner webs in narrow bands. On the chest and belly here and there some rusty-red colouring.

Hab. The southern and western parts of Europe and Africa.

2. Scops pennatus, *Hodgs.*

Scops sunia, Hodgs. Journ. A. S. B. 1837, p. 369; Jerd. Ill. Ind. Zool. t. 41.

Very near to the common *Scops ephialtes*, but shows more rusty-red on the head, with shorter wings, and mostly finer and more elegant markings.

Hab. North India.

3. Scops senegalensis, *Sw.*

Birds of Western Africa, i. p. 127.

Also very near to *Scops ephialtes*, but has a stronger bill, shorter wings, and coarser markings of the plumage. The feathers on the hinder margin of the ear not so distinctly margined with black. The bars on the inner side of the wing very distinct. The first wing-feather as long as the seventh.

Hab. Western and Southern Africa.

4. Scops latipennis.

Strix latipennis, Licht.

Also very near to *Scops ephialtes*, but with coarser markings, and the webs on the wing and tail broader. The anterior ear-coverts not so finely pointed with black. Bars on the inner side very indistinct, and the first wing-feather before the emargination only with four rusty-yellow traces on the margin of the inner web, and six white and rufous spots on the outer web. *Scops ephialtes* has ten such spots. The toes not so long. The wing 140, the tail 67 mm. long.

Hab. South Africa.

5. Scops longipennis.

Strix longipennis, Licht.
—— *striolata,* H. & E.

Still nearer to *Scops ephialtes*, but also with coarser markings; the lighter bars on the inner webs of the wing reaching to the shaft. The outer web of the first wing-feather with nine smaller, pronged, whitish rusty-yellowish spots. First wing-feather as long as the sixth. Longer wings 150, tail 70 mm.; middle toe the same length as that of *Scops ephialtes*.

Hab. Syria.

Obs.—I have seen but one specimen, but it is necessary to examine a greater number. I consider most of these species, so very nearly connected with *Scops ephialtes*, as subspecies.

6. Scops leucopsis, *Kp.*

Athene leucopsis, Hartl.

Diagn.—The wings on the inner side uniform blackish, without bands. First wing-feather as long as the ninth.

Descr.—A very distinct species, which cannot be confounded with any of the other species of this natural subgenus. It nearly resembles *Scops ephialtes*, in form very much, has the same long wings, but longer tail and thinner tarsi, which on the hind part are not feathered, but scaled. In its colouring it is very different. Round the eyes black, like *Otus brachyotus*. Lores white, partly rusty and black spotted, with black shafts or black shaft-ends. Stripe over the eye pure white, part of it with black margin on the inner side next the head, part with zigzag cross bands. The middle part of the front dark brown and rufous spotted. The feathers near the stripe of the eye with white spots on the outer webs. In the middle of the occiput some white feathers, with broad black shaft-spots and rufous or black pointed margins. The face is white, with black spots and black inner webs, which gives the face a variegated colouring. Below the middle of the eye next to the lorum more mixed with rufous and black. The feathers of the hinder ear-margins black, the next following with rusty cross bands, and the next series with white ends. The feather-horns, which are not very well distinguished, are dark brown, with rusty spots. The back rusty-yellow, white-spotted. Each feather with blackish root, white band in the middle, and rufous black-pointed margin. The under parts of the back to the tail-coverts dark brown, rusty-spotted. Shoulder-coverts similarly coloured, and on the exterior margin white, with black end-spots and points. The ten coverts of the ten hand-wings uniform black. The ten hand-wings black, near the end pale rufous, pointed with blackish. The two exterior feathers with rufous outer webs, and the following with two to three dirty-white longitudinal spots. The thumb-feathers black, on the outer web with white spots and end-spots. Some of the small coverts of the thumb-feathers similarly white-spotted. The wrist dark brown, with rufous spots. On the arm-wings the rusty colour predominates, and there are black shaft-stripes and dark zigzag drawing. The margin of the interior web at the base is dirty yellowish-white. The colouring of the tail is similar. The exterior feathers only with white spots on the exterior web. The lower parts are white; some feathers, as in *Scops ephialtes*, with broad bronzed shaft-stripes and pointed zigzag bands. The middle of the belly dirty rusty-brown. Over all these feathers pronged cross bands. The under tail-coverts white, with light-brown spots near the shafts, and with the margins dark-bounded.

Dimens.—Head 40, bill from the gape 17, wing 148, tail 69, tarsus 27, middle toe without nail 19 mm.

Hab. Island of St. Thomas, Western Africa.

I have described the original specimen, which I received through the kindness of Dr. Gädechens, the worthy President of the Museum at Hamburg. A second specimen is in the Museum at Bremen.

Subgenus c. *Acnemis.*

Diagn.—The nostrils situated on the margin of the cere. The first wing-feather longer than the tenth. Tarsi over the toes naked. Toes completely naked.

7. Scops gymnopodus, *G. R. Gray.*

Diagn.—Resembles in size and colour *Scops ephialtes*, but has shorter tarsi and wings. The wings on the inner side near the base with three small, dirty whitish-yellow bands not reaching to the shaft, and directed from the tail towards the bill.

Hab. India.

Subgenus d. *Ptilopsis*, Kp.

Ephialtes, Bp.

Diagn.—The nostrils placed on the margin of the cere. The first wing-feather very long, emarginated near the end, shorter than the second and third. Bill projected forwards, and covered with very long bristly feathers. Toes with thin bristle-feathers.

8. Scops leucotis, *Swains.*

Strix leucotis, Temm. Pl. Col. 16.

Descr.—The whole face, feathers of the lorum, and front pure white; over and under the margin of the eye a grey spot, the first of which is connected with the ear-horns; upper parts ash-grey, with fine black shaft-stripes and very fine cross lines. Margin-feathers of the shoulder-coverts on the exterior web pure white. Wings with a large number of narrow blackish bands on a grey ground; on the inner side of the wings the bands are more numerous, and form small arcs on the inner web directed towards the bill; the small feathers of the wings with some black stripes. Tail with fourteen blackish bands. The breast and belly rusty-red, with black shaft-stripes and fine cross lines. Feathers of the tibiæ, tarsi, and under tail-coverts pure white. The under parts of the young bird are paler, without cross lines, and the toes nearly naked.

Hab. W. Africa.

Obs.—This species shows, by the projected bill, the broad, black, horizontal margin-stripe next the ear, and by the finely drawn plumage, some analogy with *Bubo lacteus*, which belongs also to the fourth subgenus in its genus, *Bubo*.

If we may draw conclusions by analogies, we may expect some time or other to find

two species of this subgenus to represent the *Bubo orientalis* and *coromandus*, which are spread over Asia.

Subgenus e. *Megascops*.

Diagn.—Nostrils on the margin of the cera. First wing-feather as long as the seventh or tenth; first to fourth wing-feather emarginated on the inner web. Tarsi feathered; toes mostly naked.

Hab. Asia and America; the largest birds of the genus.

Descr.—They resemble in some respects the true *Scops*, but the upper parts are darker, and the bill in old age is yellowish or dark brownish, and never black. The ground colour is mostly rusty-red or grey, with irregular black shaft-spots and interrupted cross lines. Between these lines are small spots and rusty-red bands. Round about the occiput a white or rusty-red band, and nearer the back a second collar of the same colour: near the eyes darker: the face mostly lighter; there is also on the front a small stripe of white extending from the lorum over the eye. The feathers of the hinder margin of the ear have black or dark-brown points, with a black horizontal stripe. Along the shoulder-coverts a series of white or ferruginous spots, also some feathers of the same colour on the margin of the wing.

The first ten feathers of the wing are brown, pointed with from five to eight whitish or light rusty-yellow, black-margined spots. These inner webs are clearer in the young bird, and the under parts more lightly coloured, white or rusty-red, with black shaft-stripes and irregular cross lines, which come from the shaft-stripe. On the blackish ground-colour of the tail are irregular stripes and cross bands, which are clearer on the under side.

9. Scops flammeola.

Strix flammeola, Licht. in Mus. Berol.

Diagn.—Wing 120–130, tail 56–66 mm. long. Mexico.

Descr.—The smallest of all the species in this section, as also in the whole genus and subfamily *Striginæ*. I know of two specimens in the Berlin Museum[1]. The larger one is very elegantly grey, spotted with white, black, and rusty-yellow. The bristle-feathers very long, like *trichopsis*, white on the root and black on the end. The face is white and grey, with black points, and rusty tint next the eye. A stripe over the eye white with black margin. The veil white with rusty-yellow and black end. Under the chin with three black bands and rusty-yellow margin on each feather. Ear-horns with black cross bands, on the inner web white, on the outer web rusty-brown. The upper part coloured and with drawing like the other; round the occiput a band of white, black-lined and spotted feathers. A second neck-collar, similarly coloured and drawn, is

[1] Specimens of this species have been lately obtained by M. Sallé in Vera Cruz. See Proc. Zool. Soc. 1858, p. 96. (P. L. S.)

tinged with rusty-yellow. The margin of the shoulder-covert on the outer web white, with rusty-yellow margin, and black-spotted or black margin-end. Large white spots on the exterior web of the smaller feathers of the wing. The first wing-feather with seven rusty-yellow spots on the outer web; on the following feathers the spots are more white, and only near the shaft rufous. The black, grey-pointed tail with five lighter zigzag bands. The lower parts white, with fine-pointed, zigzag black lines, near the broader shaft-stripes tinged rufous. Under tail-coverts with long blackish shaft-stripes and spots. Tarsus thick-feathered and fine black-spotted.

On the smaller specimen the rufous colour predominates; the feather-horns are not developed; on the under parts the cross lines are in very small number. I think it is a young male.

Dimens.—Head 37, bill from the gape 15, wing 130, tail 66, tarsus 24, middle toe without nail 14 mm.

The following species from America are so intimately connected, that we can discover the distinct character of each only by a close scrutiny. It is certain that they are only subspecies from one and the same type.

10. Scops trichopsis, *Wagl.*

Isis, 1832, p. 276.

Diagn —Toes with bristle-feathers.

Descr.—This species is a little smaller than *S. brasiliensis*, but it has the bristle-feathers of the lorum over the cere longer. The drawing is darker and not so elegant as that of *S. brasiliensis*. The series of feathers on the margin of the shoulder-coverts is white, the outer webs with black margins and broad point, the inner webs with zigzag black lines. The outer webs of the hand-wings have seven irregularly spotted bands, nearly white in the middle. On the under side the bands nearer the end are not so clear. The arm-wings have seven regular rusty-yellow bands, of which the two near the end are more grey and dark spotted. On the exterior side are seen only five cross-bands. The breast is darker-coloured, because the shaft-stripes and cross lines are broader. The under tail-covert white, with a black and reddish arrow-like figure on the point. The tail grey-brown, with from five to six bands, which are reduced on the middle feathers to little spots of a rusty-yellow. The face is white, with one or two black bands or spots on the feathers; between the eyes and ears are long bristles. The feathers along the anterior margin of the ear have a broad black margin. The veil-feathers on the hind margin of the ear round the throat are rusty-yellow, with black points and cross lines and white spots. The toes covered with thin bristle-feathers as in *Athene noctua*.

Head 46, the longest of the bristle-feathers 28, wing 149, tail 69, tarsus 30, middle toe 22 mm. long.

There exists only one specimen, from Mexico, in the Museum of Würzburg. By the

liberality of Prof. D. Leiblein I was obligingly furnished with the original bird, from which Prof. Wagler took his description. I doubt whether it is an old bird.

11. Scops asio, *G. R. Gray*[1].

Strix asio, Linn.
—— *nævia*, Gmel.
—— *albifrons*, Lath.
—— *lineatus* et *striatus*, Vieill., Wils. 19. 1, 42. 1 ; Aud. t. 97.

General plumage greyish or rusty red ; toes with feathers. The wings 160, tail 76 mm. long.

Hab. N. America.

12. Scops brasiliensis, *Bp.*

Strix brasiliana, Gmel.
—— *choliba*, Vieill.
—— *crucigera* et *undulata*, Spix.
—— *decussata*, Licht.
Scops portoricensis, Less. : des Murs, Iconogr. Pl. p. 26.

The cape very dark brown, and rusty-red banded and spotted. Toes naked.

Hab. Brazil.

Prince Maximilian of Neuwied represents the female as reddish-brown, and the male grey-brown. The male shows more white on the belly and underside.

The wings 155, tail 85 (according to the Prince 95 mm. long), head 47, tarsus 29, middle toe 24 mm. long.

I cannot find any true difference between this and the preceding species, because the feathers of the toes sometimes vary very much in members of the same species without giving the bird a distinctive character. We find this the case in the genera *Bubo* and *Scops*.

13. Scops atricapillus, *Cuv.*

Strix atricapilla, Natt. Pl. Col. 145.

With the crown of the head black, and pointed feather-horns. The back and covering parts of the wings, throat, and upper part of the breast dark-coloured, like a *Caprimulgus*. Breast and belly similar to *Otus vulgaris*. Margin of the wings with from six to eight rusty-red, black, zigzag-spotted cross bands, which are clearer on the inner webs. Tail blackish rusty-red, spotted with eight ocellated cross bands of yellowish-white.

Wings 177, tail 87 mm. long.

Hab. Brazil.

I cannot find any difference between this species and *Scops lophotes*, Less., from Cayenne. It has nearly the same dimensions : wings 179, tail 90, wing end 47 mm.

[1] Nearly allied to this bird is the recently described *Scops maccalli*, Cassin, B. of California p. 108. (P. L. S.)

14. Scops rutilus, *Pucheran.*

Arch. du Mus. d'Hist. Nat. iv. p. 326. tab. 22; Rev. et Mag. de Zool. 1849, p. 29.

Diagn.—Toes, and also the small, scaled, hind part of the slender tarsi, naked; whole plumage rusty-red; occiput and neck without collars.

Descr.—A very handsome and interesting species, the size of *Scops lempigi.* The whole colouring is rusty-red. Front and eye-stripe white, pointed with white. Lorum feathers whitish at the base, black-spotted, with very long black or reddish bristles. Face and anterior ear-coverts reddish with lighter shafts. The hind ear-margin with black cross bands and ends. Head and back reddish, with black zigzag bands from the black shaft-stripes. Margins of the shoulder-coverts on the external web pure white, pointed with black. Two or three large white spots on the wing-coverts. Breast, sides and belly rufous, with black central stripes and white, black-margined cross bands. Wings blackish, light-banded; bands on the external webs sometimes white. Tail very irregularly pointed, with about eight lighter cross bands.

The example described is the one figured by Dr. Pucheran. Another smaller specimen in the Paris Museum is more rufous; it has on the head, back, and under parts only black stripes in the middle of each feather; wing and tail-feathers with very indistinct bars; only traces of some white bands on the external and internal margins of the webs.

Head 45, wing 156–147, tail 86–76, tarsi 27 mm.

Hab. Madagascar.

The Indian species, like *Scops asio*, &c., are also so intimately connected, that it is very difficult to make out their differences. It is only necessary to give an exact description of the oldest known species, and the trifling differences by which the others may be distinguished from it.

15. Scops lempigi, *Bp.*

Strix lempigi.
—— *noctula,* Reinw. Pl. Col. 99.
Scops javanicus, Less.

Descr.—A little stronger and larger than *Scops ephialtes*, larger head, bill and toes. The ground colour is dark rusty-brown, not grey, with an immense number of fine spots and zigzag bands. Around the occiput a rusty-yellow band, and a second collar a little lower on the neck. The face is light, nearly white, with black spots. The bristle-feathers of the lores are either with white shafts, or spotted and with black shafts. Near the anterior corner of the eye a dark spot. The white front and stripe over the eye have black cross lines. The ear-horns on the exterior web black, with rusty-yellow spots; on the inner webs the ground colour is rusty-yellow, with fine black points and cross bands. The head-feathers black, spotted with rusty-yellow. The shoulder-coverts have on the margin a series of rusty-yellowish spots on the exterior webs; these webs are spotted and sometimes margined with black. The outer webs of

the hand-wings are whitish or light rufous, with from five to nine black, regular or irregular pointed bands. The under wing-coverts white or rufous, black-spotted. The inner webs have indistinct bands towards their terminations; near the base they have white or rufous bands like flames. The tail brownish, with seven or eight light-rufous pointed bands. The breast and belly rufous, with innumerable black points, shaft-stripes and cross lines; sometimes the belly is nearly white, with finer points and smaller shaft-stripes. Tarsi spotted, or like the under tail-coverts pure white.

Dimens.—Wings 137–145 or 5″ 3‴–4‴; tail 69–73. Toes naked; middle toe without the nail, 18 mm. long.

16. Scops semitorques, *Bp.*

Otus semitorques, Schleg. Fauna Jap. t. 8.

Diagn.—Larger: the feathers on the toes reaching to the scales of the nails.

Dimens.—Wing 179 or 6″ 6‴; the middle toe without the nail 21 mm. long.

Hab. Japan.

Obs.—Differs from *S. lempigi* as *S. asio* from *S. brasiliensis*, and like *S. asio*, lives in a colder climate. *S. brasiliensis* and *S. lempigi* inhabit the torrid zone.

17. Scops manadensis, *Quoy et Gaim.*

Voy. Astrol. pl. ii. 2.

Obs.—This species is very near to *S. lempigi*, and of the same size. The wings 142–148, or 5″ 2‴–5″ 4‴; tail 67–70 mm. long. But the occiput has not the two collars. The shoulder-coverts on the margin have white and black spots. The head and the whole back are darker. No clear horizontal stripe on the hind margin of the ear.

I cannot find any difference between this species and *Scops mantis*, Bp. (*Otus mantis*, Müll. Fauna Japon. p. 25), which also comes from Celebes. Bonaparte gives us the dimensions of the wings (nearly 5 inches). A female individual presented by M. Bernier to the Museum at Paris is of larger dimensions (wings 160, tail 87 mm.). It is said to come from Madagascar, but I doubt whether this is so.

In the same section must be placed G. R. Gray's *Scops megalotis*, from Manilla. It is a young bird; therefore I have not given a description.

Genus II. Otus, *Cuv.*

a. *Pseudoscops.* b. *Otus.* c. *Rhinoptynx.* d. *Brachyotus.* e. *Phasmaptynx.*

Diagn.—The ear-orifices like the gill of a fish, reaching from the top of the head to the lower jaws; they are *asymmetric*. Very clear veil and more or less distinguished feather-horns.

Descr.—They are of middling size, and have a rich plumage, which, with their long

wings, gives them the appearance of being much larger than they really are. Plate LVI. fig. 8, *a*, shows a great part of the occiput, *a a a*, and the end of the lower jaw, *g*; *d d* shows the *sclerotica* through the skin; *e* and *f* is the *meatus auditorius*, which is divided on the right side of the head by a membrane, *i*, into two cavities: this membrane, *i*, can be divided into two separate, fine skins; *h* is the operculum, and *b* is the hind margin of the exterior ear.

Compare the left side (Plate LVI. fig. 8, *b*): the cavity for hearing is quite differently constructed; the membrane, *i*, which divides the right cavity into two, does not divide the *meatus*, but goes in an oblique direction to the end of the cavity. From this construction the left ear-hole is larger. Such asymmetry is found in no other family of Birds.

On the operculum we see some series of stiff feathers, like those of the hind margin of the ear. The latter shows the feathers of the middle of the under part directed towards the top of the head, and those of the middle of the upper part directed towards the lower jaw; where these two series come together they form an obtuse angle. The operculum is covered with series of feathers placed on folds of the skin, which are smallest and shortest next to the eye. The plumage of these species of *Otus* is very much developed and very soft. The concealed parts of the wing and tail webs are crossed with the finest felt. The first feather of the wing has a more or less dentellated margin on the outer web, like a comb. The skull near the occiput is very large, and can be compared only with that of the *Caprimulginæ*, which constitute the raptorial type in the family *Hirundinidæ*. On comparing the form of the bill, the configuration of the wings, and the covering of the toes, we find it necessary to divide the species, though small in number, into five different subgenera, which doubtless will be very considerably increased when the different parts of the earth are fully explored.

Subgenus a. *Pseudoscops.*

Diagn.—With smaller ear-orifice without operculum, larger and projected bill. Wing short. First wing-feather as long as the tenth. First to fourth wing-feathers feebly emarginated on the inner web. Toes completely naked and scaled, like the greater number of species of the genus *Scops*.

1. Otus grammicus, *Kp.*

Ephialtes grammicus, Gosse, B. of Jamaica, t. 19.

Diagn.—The tail 118 mm. long, with ten small bands on a pointed ground.

Descr.—The upper parts like the feather-horns rusty-yellow, with a great number of fine zigzag cross-lines and zigzag shaft-spots, especially on the shoulder-coverts. The wings on the interior side show six to seven cross-bands. Size of *Otus vulgaris*, but not so elegantly formed.

Dimens.—Head 70, bill from the cere 22, from the gape 34, wings 233, tarsus 47, middle toe 30 mm. long.

Hab. St. Domingo; Cuba; Jamaica.

2. Otus macrurus, *Kp.*

Diagn.—The tail brown, 148 mm. long, with five small whitish bands and end.

Descr.—The upper parts dark brown, with two to three irregular rusty-yellow cross-bands on each feather. The lower parts white, on each feather a broad dark-brown shaft-stripe. The under tail-coverts pure white. Wings on the inner side blackish, with from three to five whitish pronged bands and spots. Tarsi rusty-yellowish-white with rusty-yellow cross-lines. The bristle-feathers of the *lorum* white with black shafts. The stripe over the eye dirty-white, extending to the ear-horns, which are not very well distinguished. Veil white, each feather with rusty-yellow, black-margined shaft-spots.

Dimens.—Head 70, bill from the root 20, from the gape 34, wing 250, tarsus 60, middle toe without the nail 39; left ear-hole (taken on a stuffed specimen) 14, right ear-hole 22 mm. long.

Hab. Mexico. (Würzburg Museum.)

Subgenus b. *Otus*, Kp.

Diagn.—With small curved bill and long wings. The first wing-feather not so long as the fourth. The first wing-feather distinctly emarginated near the end, the second not so distinctly. Toes mostly covered with feathers to the scales next the nails. The dentellated margin of the first wing-feather very much developed. This subgenus is connected with the fourth subgenus, *Brachyotus*, Gould.

It appears that this subgenus contains species which are more night-birds than the other subgenera. *O. vulgaris*, *O. americanus*, and *O. zonurus* are formed on one and the same type. *Otus stygius* is a second type species.

3. Otus vulgaris, *Flem.*

Strix otus, Linn. Naum. t. 45; Gould, Birds of Eur. t. 39.

Diagn.—The wing 275–279 mm. long. The wing with 4–7, the tail with 6–8 cross-bands.

Descr.—From the lorum to the hind angle of the eye, like the chin, pure white, the first with black points; near the anterior corner of the eye black. The three anterior folds of the operculum covered with rusty-yellow feathers, having blackish shaft-points, and some not very distinct blackish spots. The margin of the operculum with two series of feathers placed in pairs, which are white, tinged with rusty-yellow; they have a broad black margin, and blackish roots with white shafts in the centre. The first series of feathers on the hinder ear-margin is stiff and black, except those of the superior and interior margins, which are softer and have white ends. The front and cap-feathers

black, with white and rusty-yellow spots on the margins. The long ear-horns (of which the longest is 40 mm. in length) are black, on the concealed outer webs rusty-yellow, and on the upper middle of the inner webs along the margin white, with small black cross-bands. Neck, back, shoulder-coverts, and the small covert-feathers of the wing near the roots rusty-yellow, with blackish-brown pronged shaft-spots, and white and black pointed spots on the end of each feather. Large white and black spots on the margin of the shoulder-coverts and on the points of the outer webs. Some coverts of the arm-wings are similarly spotted. The roots of the wing rusty-yellow; the ends of the wing brownish ash-grey, blackish-pointed, with from six to seven irregular broad cross-bands. On the inner side of the wing the soft coverts are pale rufous, on the hand-wing there are single black-brown shaft-spots. The first series of the coverts of the arm- and hand-wings have the anterior middle more or less grey-black. The wing-feathers are pale rufous on each web, with six to eight broad and line-like bands, of which those next the root are of no decided colour. The feathers on the under parts rufous, near the point white, with black shaft-spots and three to four zigzag cross-lines. Under tail-coverts with arrow-like shaft-spots, on the point small pronged cross-bands. Tail at the base rufous, with five to seven small pronged cross-bands. The tail has on the upper part nearly ten bands, of which the most distinct are pointed, and sometimes ocellated.

Hab. The whole of Europe; also found in India.

4. Otus americanus, *Bp.*

Strix americana, Gmel.
Otus wilsonii, Less. Tr. d'Orn. p. 110; Wils. 51; Aud. 383.

Diagn.—The inner wing with five to seven broad bands; the underside of the tail has nine line-like cross-bands. Wing 290 mm. long.

Descr.—Very much like *Otus vulgaris*, but differs from it in having longer wings, darker and broader drawing. The tail shows on its upper parts no predominant rufous, but is more of a black colour, and the broader webs of the middle tail-feathers are grey, dark-pointed, with light-margined arrow-like butterfly-shaped spots. The side-feathers of the *tibiæ* have blackish shaft-spots and five cross-bands, which in *O. vulgaris* are pointed zigzag lines.

Hab. The northern parts of America and Mexico, and possibly found still farther south.

5. Otus stygius, *Puch.*

Otus stygius, Puch. Arch. du Mus. d'Hist. Nat. p. 336. pl. 24.
Nyctalops stygius, Wagl. Isis, 1832.
Otus siguapa, d'Orb. Voy. Cuba, t. 2.
Strix melanopis, Licht. Berlin Mus.

Diagn.—Head and the upper parts dark brown. The largest of all the species of the whole genus. Toes naked, like the species of the subgenus *Pseudoscops*.

Descr.—A handsome and very distinct species. The bill yellow, the lower jaw black. The face black, with large whitish spots on the roots of some bristle-feathers and feathers of the anterior ear-coverts. The front and hind ear-margins covered with black feathers spotted with white and rufous. Under the dirty-white chin are long rusty-yellow narrow feathers with a black stripe along the shaft, and on the sides next them pure white feathers with black ends. Feather-horns black, with a rusty-yellowish spot at the base of the inner web. Head and neck rusty-yellow, black predominating at the top of each feather. Shoulder-coverts and wings blackish-brown, some feathers only with whitish and rusty-red marbled drawing on the exterior web. The inner side of the wings has the shafts of the feathers white, with a large triangular white spot next to the shaft, a second, more round, in the middle, and a third, more indistinct, near the emargination. The inner coverts of the wings are rusty-yellow spotted with black. Under parts rusty-yellow with broad black shaft-stripes, and white spots on the webs pointed with black at the end. The tail black, at the base white, with seven narrow white bands and broad white end-margins. The upper part only with four rusty-yellow, blackish-pointed bands no reaching to the end of the feather-margins. Tarsi rusty-yellow, blackish-spotted, near the toes black. The toes are in a great measure naked ; but I think this is an accident, and not found in all the specimens. The figure of d'Orbigny gives the yellow toes completely naked.

Dimens.—Head 70–71, bill from the gape 32, wing 325, tail 178, tarsus 46, middle toe without nail 35 mm. long.

Hab. Cuba.

6. Otus zonurus, *G. R. Gray.*

Diagn.—The under part of the wing and tail with twelve cross-bands.

Descr.—The plumage is also darker: black predominates on the upper and lower parts.

Hab. ——?

Dimens.—*Otus vulgaris*: head 58, bill from the gape 30, wing 275–279, tail 150, tarsus 39–40, middle toe 29. *O. americanus*: head 59, bill from the gape 30, wing 290, tail 148, tarsus 39, middle toe 29. *O. zonurus*: head 58, bill from the gape 30, wing 276, tail 148, tarsus 44, middle toe 30. *O. stygius*: head 70–71, bill from the gape 32, wing 325, tail 178, tarsus 46, middle toe 35 mm. long. The dimensions of the first three species are very nearly the same.

Subgenus c. *Rhinoptynx.*

Diagn.—Bill long and projected. Wing short and obtuse. The first wing-feather longer than the sixth to ninth. The first and second wing-feathers clearly emarginated. Toes feathered.

7. Otus mexicanus, *Cuv.*

Strix mexicana, Gmel.
—— *longirostris*, Spix.
—— *maculosa*, Wied.
Bubo clamator, Vieill.
Vieill. Ois. d'Am. Sept. t. 20; Spix, Av. Bras. 9 *a*; Aud. 412.

Diagn.—With white face and fine zigzag lines on the superior parts.

Descr.—A little larger than *O. vulgaris*, with larger head, bill, and feet. The face, lores, eye-stripe, chin, and throat pure white. The superior eyelid and anterior angle of the eye with single black bristle-feathers. The two folds on the operculum have white feathers, which at the base and top are black. The downward-directed feathers of the hinder ear-margin dark brown with white ends. The ascending feathers uniform dark brown; the inward-turned feathers at the base of the ear white, with blackish bases; under these a black spot, in which the feathers are white at the base. The continuation of the veil under the chin white, spotted with black and rufous. The cap of the head, like all the upper parts, rufous, with broad dark-brown shaft-spots, and with fine cross and irregular bands on the rufous margins. The ear-horn-feathers are black, on the inner webs banded with rufous. The shoulder-coverts have large white spots on the margins, as also have some small feathers on the margin of the hand-feathers. The wing-feathers are pale rufous, with five to six irregular blackish bands far apart from each other; those on the outer web are placed higher than those on the inner web. Near the ends of the hand- and arm-wings the bands are lighter and more grey- and brownish-marbled. On the inner side of the wing the coverts are white, rufous-tinted, with narrow and not very distinct blackish shaft-stripes. The superior part of the interior coverts of the hand-wings grey-black, as in the greater number of Owls. The tail rufous, brownish-marbled, with seven or eight irregular, blackish, rufous-pointed cross-bands. On the under side the tail is nearly white, and the bands, as usual, narrow. The under parts white, tinted with rufous, and with black shaft-spots, which are broadest on the breast and narrowest on the under tail-coverts. Tibiæ and toes light yellow. Eyes yellow.

Hab. Mexico and South America.

8. Otus madagascariensis, *A. Smith.*

Catal. of S. Afr. Mus.
Bubo madagascariensis, Puch. Arch. du Mus. tom. iv. pl. 23.

Diagn.—With dark face. Tarsus 37 mm. long.

Descr.—A little larger. The drawing of the whole body is not so fine and elegant. On the upper parts the spots are more distinct and more speckled. The under parts rufous, each feather with black-brown shaft-spots without cross-bands or lines. The

wings rufous-grounded like the tail, with six black cross-bands. The ear-horns are nearly 51 mm. long, black- and rufous-margined.

Hab. Madagascar.

Dimens.—*Otus mexicanus*: head 60, from the gape 34, wing 253–264, tail 142, tarsus 55. *O. madagascariensis*: head 56, from the gape 32, wing 320 (*Puch.*), tail 152, tarsus 37–45 mm. long (*Puch.*).

Subgenus d. *Brachyotus*, Gould[1].

Diagn.—With small curved bill and long wings. The first wing-feather shorter than the second, and nearly as long as the fourth. The first wing-feather near the end clearly, the second not so distinctly emarginated. The dentellated margin of the first wing-feather not so developed. Toes covered with feathers down to the scales of the nails.

The type of this small subgenus differs very much in its habits from the other species; it lives in meadows and fields and amongst reeds. In the northern part of Europe it makes its nest in the reeds.

9. Otus brachyotus, *Boie*.

Strix brachyotus, Gmel. Naum.
—— *ulula*, Gmel.
Noctua major, Briss.
Strix ægolius, ulula, et *accipitrina*, Pall.
—— *caspia*, Shaw.
—— *arctica*, Sparrm.
—— *tripennis*, Schrank.
—— *brachyura*, Nils.
Otus ulula, Cuv.
Brachyotus palustris, Gould.
—— *palustris europæus*, Bp.
Gould, Birds of Eur. t. 40; Enl. 438; Nozeman, t. 33, 34; Frisch, t. 98.

Diagn.—Black around the eye. Wing 295–300, tail 150 mm. long.

Descr.—The upper parts dark brown, with white and rufous margin-spots. The wing rufous, with three to four irregular broad dark-brown bands. Arm-wings with four ocellated and clouded rufous spots on the outer webs, and three narrow bands near the end on the inner webs. The operculum with white feathers, the last series blackish at the root, with black spots on the top. A black spot on the hinder ear-margins. Tail rufous, with five broad dark-brown cross-bands. The exterior tail-feather, as also the end of the tail, nearly white; the rufous bands of the middle feathers sometimes ocellated and spotted. The under parts rusty-yellow, with small dark-brown shaft-spots, which are broadest next the throat.

[1] An exact comparison of this subgenus with the subgenus *Otus* and the others, shows at once not the least generic difference in its osteology. To prove this, I figure the skulls of the two European species (see Pl. LVII. figs. 1, 2, 3, 4). Subgenera never have anatomical, but only exterior characters. I find this also the case in all the other genera and subgenera of the families *Falconidæ* and *Strigidæ*.

Hab. This species is spread over the whole world, with the exception of Australia.

Obs.—I have seen an immense number from all parts of the world, but can find no difference. I am not able to distinguish the *O. galapagoensis* of Gould, or the *Brachyotus palustris americanus*, Bp. The only specimen which I have seen of the *O. galapagoensis* is a little larger, and the upper tail-coverts have more rusty-yellow round spots and zigzag stripes.

I cannot find, amongst a very great number of specimens from all parts of America, any material difference.

Dimens.—Head 60, breadth 38 (*Otus vulgaris* 41), from the gape 34, wing 300, tail 50, tarsus 46, middle toe 31 mm. long.

Subgenus e. *Phasmaptynx.*

Diagn.—The bill small and curved. Wings long. First wing-feather not so long as the fifth. First to third wing-feathers beginning at two inches from the end more or less emarginated. The first wing-feather, as in *O. brachyotus*, very short and dentellated. Toes thinly feathered.

10. Otus capensis, *A. Smith.*

Ill. S. Afr. Zool. t. 67.

Descr.—Upper parts ash-brown, with more or less indistinct zigzag bands. Arm-wings with rusty-yellow end-margins. The hand-wings rufous, with dark-brown bands. The inner side of the wings very variable. The tops of the wings have a large emarginated spot. Through this spot on the hand-wing a black stripe runs over the emarginations. Other specimens show three black bands. The four middle tail-feathers are brown, on the exteriors more white with five cross-bands. Breast ash-brown; the other under parts with brownish, pointed, arrow-like spots and cross-bands, and broad white margins before the spotted end-band.

Dimens.—Head 67, bill from the gape 29, wing —?, tail 153, tarsus 58, middle toe 25 mm. long.

Hab. Whole of Africa. I have received specimens from Tunis and Algeria, and there is no perceptible difference in them.

Genus III. Bubo, *Cuv.*

a. *Lophostrix.* b. *Bubo.* c. *Ketupa.* d. *Urrua.* e. *Pseudoptynx.*

Diagn.—Large Owls with ear-orifice as large as the diameter of the eye, without operculum. Feather-horns more or less distinct. The skull very much enlarged on the occiput.

The greater number of these are large birds. They are spread over the whole world, with the exception of Australia.

They must be divided into five different subgenera, of which the greater part are erroneously considered as true genera by the later authors. This is a very grave fault.

Subgenus a. *Lophostrix*, Less.

Diagn.—The bill long and projected. *The first wing-feather, as in all the subgenera of the first rank, as long as the tenth*; second longer than the eighth; third longer than the seventh; fourth as long as the sixth; fifth nearly as long as the sixth and the longest. Tail as long as the whole body. Toes naked, with broad soles, and the nails falcated (as in the third subgenus, *Ketupa*, and the fifth subgenus, *Pseudoptynx*).

Obs.—This subgenus represents the genus *Scops* in its genus. This is the reason why some authors place it next to that genus, which is quite wrong.

1. Bubo cristatus, *Kp.*

Strix cristata, Daud. Tr. Orn. ii. p. 207.
Ephialtes cristatus, G. R. Gray.
Lophostrix cristata, Bp.
—— *griseata*, Less.
Strix griseata, Lath.
—— *superciliosa*, Shaw.
Bubo griseatus, Cuv.
Le Vaill. Afr. t. 48; Strickland in Jard. Contr. Orn. cum. fig. var.* (1848).

Descr.—Nearly the size of *Otus vulgaris*, but apparently larger from its long tail. Bill yellow. Front whitish, brownish-banded. A white stripe over the eye to the long ear-horns. On the hind margin of the ear a white spot. Upper parts chestnut-brown, with innumerable fine zigzag cross-lines and spots. Margin of the shoulder-coverts and the small coverts of the wings with irregular white spots on the exterior webs. The arm-wings rufous-brown, black-pointed, with six narrow zigzag bands, and rusty-yellow spots on the outer webs, which are rufous on the blackish inner webs. The interior of the wing from the emarginations is banded with rusty-yellow on a large clear rusty-yellow field. The inner coverts of the margins of the wings rufous, with blackish spots. The under parts finely and elegantly cross-banded and spotted, darkest on the chest. Tail on the superior part rusty-brown with fine blackish spots, with lighter points on the inner webs, and with ten irregular white or rusty-yellow cross-bands. Tarsi with rusty-yellow cross-bands.

Dimens.—Head 73, bill from the gape 33–35, wing 300, tail 200, the longest ear-horn-feather 58, tarsus 44, middle toe 32 mm. long.

Hab. Guiana and Cayenne.

Subgenus b. *Bubo*, Kp.

Diagn.—With small, curved, and black bill. Wings long. The first wing-feather shorter than the fifth. The first very clearly, second to fifth obtusely emarginated. (See Pl. LVII. fig. 5.)

These are the representatives of the genus *Otus* in its own genus.

* Since separated as a distinct species, *Lophostrix stricklandi*, Sclater and Salvin, in 'The Ibis,' 1859, p. 221.

2. Bubo bengalensis, *G. R. Gray.*

Otus ——, Frankl.
Bubo (*Urrua*) *cavearius*, Hodgs.
Gould, Cent. Him. B. t. 3.

Diagn.—The black vertical margin-feathers of the ear bound the veil. The feather-horns 62–67 mm. long, black at the roots, and on the interior webs rufous-margined.

Descr.—Smaller than the common *Bubo maximus*. Sides and belly rufous, with fine black shaft-stripes, and finer pointed arrow-like drawing. Tarsi uniform fawn-coloured.

Dimens.—Head 95–98, bill from the gape 49–51, tarsus 74–78, middle toe 44–50 mm. long.

3. Bubo ascalaphus, *Sav.*

Expéd. Egypt. Ois. 3. 2; Gould, Eur. t. 38; Pl. Col. 57; Brit. Zool. pl. B. f. 3.
Otus ascalaphus, Cuv.
Ascalaphia savignyi, I. Geoff.

Diagn.—A black vertical stripe bounds the veil of the ear. The ear-feathers short, 44 mm. in length, rusty-yellow, with black points. Sides and belly rusty-yellow, with round white, black-margined spots.

Descr.—The most slender species of all, having some analogies with *Otus*. The whole plumage rufous, with irregular dark-brown drawing on the superior parts, except the tail-coverts, which are nearly uniform rufous with some bands at the end. Along the shoulder-coverts and the superior parts of the wing a series of white spots. Sides and inferior tail-coverts elegantly pointed and banded. Near the *furcula* are large spots. The slender thighs and toes pale rusty-yellow. Under side of the tail nearly white, with six narrow black bands; the upper side with irregular drawing on the middle feathers.

Hab. Egypt and Nubia. Strays sometimes into Sardinia, Sicily, and even England.

Dimens.—Head 91, bill from the gape 49, wing —?, tarsus 79, middle toe 43 mm. long.

4. Bubo maximus, *Sibb.*

Strix bubo, Linn.; Gould, Birds of Eur. t. 37; Naum. t. 44.
—— *atheniensis* et *alba*, Daud.

Diagn.—The veil of the ear not bounded by a black stripe. Ear-horns nearly 80 mm. long, black, on the margins of the inner webs rufous-spotted. The wings 460 mm. in length.

Descr.—The largest bird in this subgenus. The face rufous-grey, with fine cross-bands. The upper parts rufous, with black shaft-spots and lighter cross-lines. The under parts of the back and tail-coverts rusty-yellow, with irregular brownish cross-bands, and darker rusty-yellow-pointed margins on each feather. The shoulder-coverts dark brown, at the base rufous, blackish-banded, on the margins white-spotted and

pointed with black. The smaller feathers of the wing are similarly coloured; the interior part of the wing rufous, near the points darker, with six irregular, zigzag, pointed cross-bands, which are more nearly uniform near the ends. The exterior tail-feathers rufous, the others black-brown, with seven to nine irregular, lighter, and pointed cross-bands. The under parts of the body rusty-yellowish, with innumerable zigzag cross-lines and darker shaft-stripes, which are broadest next the *furcula*. *Tibiæ* rufous, not distinctly banded.

Obs.—In the northern regions there exists a very light-coloured variety, nearly white. This is the *Bubo sibiricus*, Eversmann (Gray and Mitchell, Genera of Birds; Susemihl, Vögel Europa's). From Prince Bonaparte we hear that the *Bubo virginianus* in high northern latitudes also changes to a similar colour.

The *Bubo capensis*, Daud. (*africanus*, Steph.) (Levaill. Ois. Afr. t. 40; Sir A. Smith, Ill. S. Afr. Zool. B. t. 70), is also not a distinct species; it has not sufficient characters to separate it from the *Bubo maximus*.

It is possible that these two varieties are subspecies of the common *Bubo maximus*.

5. Bubo africanus, *Boie*.

Strix africana, Temm. Col. 50.
Otus africanus, Cuv.
Bubo maculosus, Cass.
Strix maculosa, Daud.
Otus maculosus, Less.
Bubo cinerascens, Guér.
—— *Dilloni*, Desm. & Prév.

Diagn.—Larger than *Syrnium aluco*. A black vertical stripe bounds the veil. Ear-horns 60–70 mm. long, black, with whitish rusty-yellow bands or spots. Wing 308–365 mm. long.

Descr.—The smallest species of the whole subgenus. The whole plumage is black-brown, with numerous white spots. Face and chin white, brown-banded like the side of the neck. The under parts white, with large spots near the *furcula*, otherwise with broad, black, zigzag cross-bands. Tail on the inner side with four to five broad black cross-bands; on the upper side with lighter rufous, sometimes with pointed bands. Tarsi nearly white, with irregular narrow brownish bands.

Obs.—*Bubo cinerascens*, Guér., is a very small male of this species; and *Bubo dilloni* is an exceedingly large, not very old female, with more rusty-red colour, and broader bands on the under side. It has the tarsi more thickly feathered, and dirty-white, with some traces of dark bands.

	africanus.	cinerascens.	dilloni.
Dimens.—Head	77	75	85
Bill from the gape	40–43	38	43
Wing	320–330	308	365
Tail	186–188	162	—

Hab. The whole of Africa.

6. Bubo virginianus, *Briss.*

Strix virginiana et *Strix Bubo magellanicus*, Gmel.
Bubo virginianus et *arcticus*, Rich. & Sw. t. 30.
—— *ludovicianus*, Daud.
—— *magellanicus*, Cuv.
Strix crassirostris, Vieill. Ois. Am. Sept. t. 19.
—— *macrorhyncha*, Temm. Pl. Col. 62.
Bubo magellanicus, Cuv.; Puch. Arch. du Mus. t. iv. p. 331; Wilson, t. 50; Aud. t. 61; Enl. 385.

Diagn.—The veil bounded with a black vertical stripe. The ear-horns 62–84 mm. long, black at the root, the inner web rufous. Wing 360 mm. long.

Descr.—In size between *B. africanus* and *B. maximus*. The under parts of the body mostly with large black bands on a rufous and white ground; on the breast near the *furcula* and on the broad white throat with larger spots. White spots on the margin of the shoulder-coverts, sometimes very indistinct. The tail on the under side with six narrow bands. The light-rufous bands on the upper parts of the wings very irregularly zigzag pointed and margined. Tarsi banded or uniform.

We find varieties with more white, rufous, and grey; others are nearly black; others, again, with white ground-colour.

This species has, in proportion to its body, the largest bill.

Dimens.—Head 95–106 (♀), bill from the gape 43–47, tail 205, tarsi 62–73, middle toe 42–45 mm. long.

Hab. The whole of the colder parts of America, as far as Mexico, California, Chili, &c.

I cannot find any true difference between *B. virginianus* and *B. magellanicus*.

Subgenus c. *Ketupa*, Less.

Diagn.—Tarsi and toes naked. The nails, except the middle toe, sharpened and falcated. The wing short; first wing-feather as long as the eighth; the first to the sixth feebly emarginated in the middle on the inner web. (See Pl. LVII. fig. 6.) Bill large, projected, and yellow.

In the form of the falcated nails this division shows great affinity to the first subgenus (*Lophostrix*) and to the fifth subgenus (*Pseudoptynx*).

Most of the species live in Asia, and only one species in Africa. Its flight must be with a rush, like that of the next subgenus, because the wing-feathers are not so elastic as in the true *Bubo*.

7. Bubo ceylonensis, *Kp.*

Strix ceylonensis, Gmel.
Ketupa ceylonensis, G. R. Gray.
Strix Leschenaulti, Temm. Col. 20.

Ketupa Leschenaulti, Less.
Strix Hardwickii, J. E. Gray, Ill. Ind. Zool. pl. 31.
Cultriunguis nigripes, Hodgs.
Brown, Ill. t. 4.

Diagn.—The size of *B. virginianus*. The under side grey, with black shaft-stripes and numerous fine cross-lines. Feet blackish.

Descr.—Head, neck, and feather-horns rufous-grey, with dark-brown shaft-spots. Feathers on the back dark brown, rufous-spotted and cross-banded on both webs. The lower parts of the back and tail-coverts more of an ash-grey, with narrow shaft-spots and rusty-yellow whitish spots. On the margin of the shoulder-coverts a series of white-margined feathers. The small feathers of the wing dark brown, white-spotted. Arm-wings brownish, with clear, brownish-tinged cross-bands. Tail dark brown, with four to five narrow, more lightly-coloured cross-bands, and with lighter margins.

Hab. India.

8. Bubo flavipes, *Kp.*

Cultriunguis flavipes, Hodgs. As. Soc. Beng. 1836, p. 364. pl. 26.
Ketupa flavipes, G. R. Gray.

Diagn.—Size of *Bubo maximus*. Under parts of the body rufous, with black shaft-spots. Feet yellow.

Descr.—Dark brown, with rufous spots and bands. On the margin of the shoulder-coverts no white spots, *but a large rufous stripe*. Tail with three rusty-yellow bands and margin. One specimen in the British Museum has the upper part of the tarsus covered with a fine down.

Hab. Nepal. Rare in collections. Discovered by Mr. Hodgson.

9. Bubo ketupa, *Kp.*

Ketupa javanensis, Less.
Strix ceylonensis, Temm. Col. 74.
—— *ketupa*, Horsf.
Scops ketupa, Cuv.

Diagn.—Size of *Bubo africanus*. Under parts rusty-yellow, with narrow black shaft-spots.

Descr.—Front and chin pure white. Upper parts dark brown, with rufous margins, spots, and bands. Margin of the shoulder-coverts rufous. The small feathers of the wing dark brown, with rufous bands and white margins. The inner side of the wing light rufous-yellow; wing-feathers black, with three rufous bands and nearly white margins. Tail dark brown, with three rufous-yellowish bands and white points. The wing 350, tail 165 mm. long.

Hab. Java, where it is quite common. Discovered by Dr. Horsfield. An outline of the skull is given in Pl. LVII. fig. 7.

Subgenus d. *Urrua*, Hodgs.

Diagn.—Bill very strong and projected. The first wing-feather to the sixth clearly emarginated on the inner web, nearer to the base of the wing-feathers. Tarsi feathered; toes thinly feathered. Nails of the usual form.

The birds of this division show a greater affinity to the second subgenus, *Bubo*, than to the first, third, or fifth subgenera. Like *Ketupa*, they must have a rushing flight. From their very strong bill, powerful tarsi, and longer toes and nails, they would appear to be more rapacious than the second subgenus, *Bubo*.

Possibly they are not sleepy by daylight, as is the case with the true *Bubo*, which represents the genus *Otus* in its genus.

10. Bubo coromandus, *G. R. Gray.*

Strix coromanda, Lath.
Urrua coromanda, Hodgs.
J. E. Gray, Ind. Zool. pl. 20.

Diagn.—Size of *Bubo africanus*. Whole plumage ash-grey, with dark shaft-stripes and fine cross-lines.

Descr.—The smallest species of all. Feather-horns on the outer webs dark brown. White spots on the exterior webs of the shoulder-coverts and on the small feathers of the wings. The wing-feathers light brown, pointed with broad dark-brown cross-bands. Tail with four or five blackish cross-bands. Under tail-coverts often with brown, black-margined, arrow-like spots.

Hab. India.

11. Bubo orientalis, *G. R. Gray.*

Strix orientalis, Horsf. Linn. Trans.
—— *sumatrana*, Raffles.
—— *strepitans*, Temm. Col. 174 ♂, 229 juv.
Bubo strepitans, Cuv.

Diagn.—Size 370–475 mm. The veil not bounded by a black stripe.

Descr.—A male specimen, of smaller dimensions, in the British Museum has the upper parts dark brown, with a great number of narrow rusty-yellowish bands, four to six on each feather; the under parts whitish, with a great number of black bands, four to six on each feather. A stripe over the eye to the longest feathers of the ear-horns nearly black. The base of the wings on the inner side whitish. The wings near the emarginations brownish, with two whitish irregular spots not reaching the shafts. The tail brown, with three to four narrow, very indistinct cross-bands, and broader greyish-white-spotted terminations. The under side of the tail at the base and the inner webs more whitish, and with three to four very irregular bands. Tarsi black, cross-banded. The bill and toes, which are completely naked, yellow.

Dimens.—Head 90, bill from the gape 48, wings 315, tail 167 mm. long.

Obs.—The figure given by Temminck much resembles *B. nepalensis*, and has very few resemblances to the male, which I have described. I am not quite sure that these two species are not subspecies of one and the same type.

12. Bubo nepalensis, *Hodgs.*

Diagn.—Size of *Bubo maximus* (600 mm.). Ear-horns, ear-margin, occiput, and under-parts with black arrow-like spots. Toes mostly thinly covered with feathers.

Descr.—The largest species, with the longest ear-horns. Front dark brown, with rufous margins and cross-bands. Cheeks ashy-grey. Occiput-feathers white at the base, dark brown at the end, in the middle rufous-banded. Under parts rufous, with from two to four black cross-bands on each feather, which are arrow-like at the extremity. Wings very much variegated, rufous-spotted, with irregular cross-bands and rusty yellowish-white, dark-brown-spotted margins. Tail on the under side whitish, with six black bands; on the upper side brown, with five pointed rusty-yellow bands and broad white ends.

Dimens.—Head 125, bill from the gape 55, wing 470, tail 250, tarsi 72 mm. long.

Hab. Nepal.

13. Bubo lacteus, *Cuv.*

Strix lactea, Temm. Pl. Col. 4.

Diagn.—The veil bounded by a black vertical stripe. Whole plumage rufous and ash-grey, with fine lacerated drawing.

Descr.—Size of *Bubo coromandus*. Ear-horns shorter, black-banded and pointed. Cheeks white, with blackish zigzag bands; near the *furcula* often darker. Along the shoulder-coverts and on the small feathers of the wing are white, dark-pointed spots: on the tarsi and under tail-coverts white spots. I have seen specimens with naked and with feathered toes.

Hab. Africa.

Subgenus e. *Pseudoptynx.*

Diagn.—*Ketupæ* with feathered tarsi, and feather-horns not distinct.

14. Bubo philippinensis, *Kp.*

Syrnium philippinense, G. R. Gray, Brit. Mus.

Descr.—Size of *Bubo ketupa*. Upper parts dark brown, with rusty-yellow or rufous margins. The shoulder-coverts have white margins on the outer webs, which form a stripe. The wing-feathers have from four to five rufous spots, not reaching to the shaft. The arm- and hand-wings have whitish margins. The end of the tail has distinct

cross-bands. The lower parts are whitish, with rufous tint and black shaft-spots. Tarsi grey; bill yellow. The not very distinct ear-horns black.

Dimens.—Head 90, bill 30, from the gape 43, wings 320, tail 162, tarsus 61, middle toe 37 mm. long.

Hab. Philippine Islands.

In its dimensions this species comes very near to *Bubo ketupa*. The only specimen of this rare bird as yet known is in the rich Collection of the British Museum.

Genus IV. Strix, *Linn.*

a. *Phodilus*. b. *Strix*. c. *Scelostrix*. d. *Dactylostrix*. e. *Megastrix*.

Diagn.—The nail of the middle toe on the interior margin clearly *pectinated*.

Descr.—The bill projected, near the cere straight, and of light yellowish colour. The ear-orifice square, placed between two skin-flaps, and bounded on the upper and lower margin by a membrane (Pl. LVII. fig. 8, *a a*). The hind ear-lap is as broad as long; the anterior ear-lap or operculum is broadest in the middle of its height. The whole ear-slit begins over the eyes and reaches nearly to the gape, as in *Otus*. The eyes separated by a thick bony wall. No asymmetry. The tarsi slender, and more thinly covered with feathers, more at the bottom than next to the *tibiæ*. The outer toes stronger, and as long as the middle toes. The plumage very much developed, with much down, and finely and elegantly coloured. The eyes always brown.

These birds are spread over all parts of the world. The smaller ones live on mice and little birds; the larger species attack mammalia and birds.

Subgenus a. *Phodilus*, Is. Geoffr.

Diagn.—Wing short. First wing-feather as long as the tenth. Toes naked, scaled, and without bristle-feathers.

1. Strix badia, *Horsf.*

Linn. Trans. xiii. 139; Zool. Res. pl. 37; Temm. Pl. Col. 318.
Phodilus badius, Is. Geoffr. Ann. de Sc. Nat. xxi. p. 201.

Descr.—Smaller than *Strix flammea*, but very near to it in colour. Front, veil, and lower parts white, tinged with rufous ash-grey. On the lower part are two round black spots on each feather. The small feathers on the upper parts rusty-yellow, with round black spots, which on the wings are margined with white. The margins of the wings white, black-spotted. On the inner side of the wing are seven or eight bands. The tarsi pretty thickly feathered, and the nails in comparison very long and strong.

Dimens.—Head 64, bill from the gape 33, wing 213, tail 73 mm. long.

Hab. Java (Horsfield).