Anatomy of the Indian Elephant

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INTRODUCTION.

Whenever the comparative anatomy of mammalia shall be exhaustively treated, the structure of the existing species of elephants will claim a principal share of attention. They are so distinctly separated from other quadrupeds that an order is required for their sole reception. Yet, though isolated from all other existing species, they bear marks of affinity with more than one group, particularly with Ungulata, Sirenia, and Rodentia. This fact of recent zoology suggests a view which the history of extinct mammalia seems to justify, viz., that the elephants constitute a comparatively primitive type, representing, though perhaps not directly, a now extinct central group, from which the orders above mentioned, and possibly some others, may have been derived. The African and Indian elephants are further remarkable as the largest land quadrupeds now living; nor can the palæontologist, reviewing the land quadrupeds of all past times, so far as they are yet made known, find a trace of any larger form which is not also an elephant. Hence arise some curious physiological and mechanical questions to the student of elephant anatomy. What are the special modifications implied by a weight of perhaps three tons? How nearly do the existing species approach the limits of size fixed by mechanical laws and by the physical properties of animal tissues?

It would be an interesting task to investigate such problems as these, and to discuss the many points of anatomy, morphology, physiology, and palæontology suggested by the examination of a dead elephant. Our immediate purpose is less ambitious. Leaving the greater enterprise to other times, and probably to other hands, we here offer a condensed statement of facts respecting those parts of the structure of the elephant which are at
present least perfectly known. When the time for comparison and inference shall have come, such facts will be found of use.

For the convenience of future students, a list of the principal memoirs on the anatomy of the elephant is subjoined. Some of these require special mention.

1 Blair, Patrick.—The Anatomy and Osteology of an Elephant, being an exact Description of all the Bones of the Elephant which died near Dundee, April the 27th, 1706, with their several dimensions. Phil. Trans. vol. xxvii. p. 53, fig. (1710).


Cuvier et Laurillard.—Recueil de Planches de Myologie, tom. iii.


[External parts only. These were the animals afterwards dissected by Cuvier.]


Moulins, Allen.—Anatomical Account of an Elephant, accidentally burnt in Dublin, 4to, 72 pp. 2 pl. (1682).

Pierre Camper dissected an elephant in the winter of 1774. The work lasted less than three weeks. Camper had subsequently several opportunities of examining elephants of both sexes, and it was his intention to prepare a full anatomical description. He died, however, in 1789, leaving only the plates, an index to the figures, and the titles of the chapters which were to have composed the text. The published description, which is of some value, though by no means full, was drawn up by his son, A. G. Camper. The plates are free and tasteful, without much detail; they contain useful matter respecting the chief visceræ, but only the most meagre notes of mythology.

Hunter's notes are excellent, especially the account of the female generative organs.

Cuvier dissected a male elephant in 1805,¹ assisted by his pupils and by the painter Maréchal. He subsequently dissected two other specimens, a male and a female. The results appear in his posthumous Recueil de Planches de Myologie, published by Laurillard. The plates are not good. We find drawings only, without descriptive text, and the letters of designation are not always rightly affixed. Everywhere the want of the master's eye seems apparent. Though most of the details are correct, it is necessary to warn future students that hardly anything can be taken on trust from these plates. In the present memoir a systematic comparison with our own dissections has been made.

Mayer's dissection is given very briefly. Many of the muscles are merely named. We have found several mistakes of importance in this short account.


Perrault, Cl.—Mémoires de l'Académie Royale des Sciences, tom. iii. part iii. p. 161, pl. xxii. (1734).


Seba, Albert.—Locupletissimum rerum naturalium Thesaurus accurata descriptio, &c., vol. i. tab. iii. Amst. fol. (1734–1765). [Facts of Elephant.]

Serraio.—Opuscoli di vario Argomento. Napoli, 4to, fig. (1766).

Stukeley.—Essay towards the Anatomy of the Elephant (1723).


Suply.—Remarques anatomiques sur un éléphant ouvert au fort Saint-Georges (1715).


Zimmermann, E. A. W.—Beschreibung und Abbildung eines Neugeborenen Elefanten. Erlangen, 4to (1783).

¹ Delenau, "History and Description of the Royal Museum of Natural History," Eng. Trans. vol. i. p. 91.
Vulpian and Philippaux give an excellent description of the heart, lungs, and liver. We have not thought it needful to describe these viscera afresh.

In 1856 the late Professor Goodsir purchased an Indian elephant, and dissected its fore and hind limbs, and the notes of his dissections, unfortunately very imperfect, are published in the Appendix to his Anatomical Memoirs, vol. i. p. 446. As the head and several of the viscera of this specimen had been preserved in spirit in the stores of the Anatomical Museum of the University of Edinburgh, Dr Morrison Watson was permitted by Professor Turner to examine them, and the results of his dissections were published in this Journal.

Our dissections, for the most part, agree closely with Dr Watson's, and had he been able to complete his researches in the same manner, our treatise would have proved superfluous.

A few words may usefully be said upon the mode of dissection. When this particularly awkward subject was offered to us we had no experience or instructions to guide us as to the best way of proceeding. We have, nevertheless, succeeded in preserving all the parts in a nearly unaltered state for three years without immersion in fluid. Any future dissector of a very large animal will do well to inject a preservative solution repeatedly before dismembering the carcase. Afterwards, it is merely necessary to keep the parts in a close-fitting box, lined with lead, and to wrap them in cloths wetted with dilute spirit, or other antiseptic. Occasional change of position is desirable.

Our example was a young female, about five feet high. It was purchased in December 1874 by the Council of the Leeds Philosophical and Literary Society, to whom our thanks are due, not only for permission to dissect the animal, but also for the readiness with which they have provided the appliances of all kinds necessary for such a piece of work.

Muscles of the Fore-Limb.

Pectoralis major consists of two distinct portions. The superficial arises from the forepart of the sternum, and passes nearly transversely outwards, to be inserted about the middle of the shaft of the humerus. It is separated at its insertion by a small interval from the other part of the muscle. A few of the lowest fibres are continued into the fascia of the arm. Pectoralis major is overlaid by masto-humeralis and deltoïd, with which some of its lower fibres are blended. The remaining portion of pectoralis major arises from the posterior two-thirds of the sternum, and passes forwards and outwards beneath the superficial part of the muscle, to be inserted into the humerus along the outer border of the bicapital groove, reaching upwards nearly to the apex of the greater tuberosity.
C. and L—274–5, j; 283, figs. 1, 2, j, j¹; 284, fig. 1, j, j (should be j₁); 285–6, j, j₁; 287–8, j, j₁; 292–3, j, j² (should be j₁).

Pectoralis minor.—Cuvier and Laurillard figure (292–3, j³) a small muscle arising beneath the anterior portion of pectoralis major, and widening considerably towards its insertion into the upper end of the humerus. This is apparently the pectoralis minor of their index. We have not found this muscle.²

Serratus magnus arises by digitations from the 7th, 8th, 9th, and 10th ribs, and from the fascia above them. It is inserted into the inner surface of the apex of the scapula.

C. and L, 276–7 (g), 282, upper figure (g). Represented as arising from five posterior cervical vertebrae, as well as from ribs, 283, figs. 1, 2 (g).

Masto-humeralis arises by two distinct heads, the larger of which is attached by a strong rounded tendon to the basilar process of the occipital bone. The second and thinner head arises by a flat tendon from the mastoid process between the stylo-mastoid foramen and the origin of digastricus. It is inserted into the top and outer side of the tuberosity of the humerus, blending with the anterior part of the deltoid.

C. and L—274–5 (b¹), "cleido-mastoidien ou trachélien;" 276–7 (b¹); 287–8 (b¹) (incorrectly shown as inserted into the first rib); 290–1 (b¹), 292–3 (b¹).

The plates indicate an insertion much lower down upon the humerus than that given above. We cannot reconcile the relations of b¹ to k (masto-humeralis to deltoid) in the different plates.

Deltoides is comparatively thin. It arises from the under surface of a strong fascia, which is attached to the spine of the scapula, and stretches over the shoulder-joint. Part of the muscular fibres pass back to the angle formed by the spine and the unciform process. The remaining fibres arise from the fascia, along a line which extends from the tip of the unciform process to the posterior border of the scapula. The fascia is continued upwards and backwards over the infraspinatus to the borders of the fossa. The deltoid passes downwards, winding over the

¹ Cuvier and Laurillard, Recueil de Planches de Myologie.
² Our notes of the sterno-humeral muscles are, unfortunately, not quite complete, and certain details cannot now be recovered. The parts were cut through, when little beyond a post-mortem examination was thought possible.
tuberosity of the humerus, and is inserted into the outer and
anterior surface of the humerus, immediately below the root of
the tuberosity. Some of its fibres run into the *teres minor*, q.v.

C. and L.—274–5, *k*¹ (we have found nothing exactly corre-
sponding to *k*); 276–7 (*k*²); 283, fig. 1 (*k ?*); 284, fig. 1 (*k*³);
292–3 (*k ?*).

*Subscapularis* arises from the whole internal surface of the
scapula, except at the angles. *Serratus magnus* is inserted into
the superior angle; *teres major* arises from the inferior angle;
while above the glenoid cavity is a surface unoccupied by
muscle, over which the *subscapularis* plays. This muscle takes
origin also from the suprascapular ligament. It is inserted by a
thin flat tendon into the internal surface of the head of the
humerus close to the articulation. The insertion is overlaid by
the *coraco-brachialis*.

C. and L.—283, figs. 1, 2 (n); 284, fig. 1 (n).

*Supraspinatus.*—A thick muscular mass, filling the supra-
spinous fossa, and taking origin also above from the fascia which
covers the muscle. Inserted into the upper border of the tuber-
osity of the humerus. Fleshy throughout.

C. and L.—276–7; 283, figs. 1, 2; 284, fig. 1 (l).

*Infra-spinatus* arises from the posterior surface of the spine of
the scapula, and from the under surface of the unciform process.
Its origin from the bone is defined below by a line drawn from
the tuberosity of the humerus to the junction of the upper and
middle thirds of the posterior border of the scapula. It arises
also from the intermuscular septum between it and *teres minor*,
and from the fascia which covers in the infraspinous fossa above
the level of the unciform process. The muscle converges to a
strong flat tendon, which is inserted into an oblique line along
the outer surface of the base of the tuberosity of the humerus.
Above this line a large and distinct bursa separates it from the
tuberosity.

C. and L, 276–7 (m).

*Ter es minor* arises from the outer surface of the scapula along
the middle third of the posterior margin, and from the intermus-
cular septum beneath the muscle. It is inserted into the neck
of the humerus behind and below *infra-spinatus*, with the lower
border of which some of its fibres are connected. Its tendon is