A comparative view of the human and animal frame. 1860

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A

COMPARATIVE VIEW

OF THE

HUMAN

AND

ANIMAL FRAME.

BY

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COMPARATIVE VIEW

OF THE

HUMAN AND ANIMAL FRAME.

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BONES OF MAN.

hd.	Head .	Frontal, pariætal, occipital.	fl. pl. oc.
tk.	Trunk .	Vertebral column, vertebra, sternum, pelvis, sacrum.	vc. v. st. pv. sm.
ar.	Arms .	Scapula, clavicle, humerus, ulna, radius, olecranon.	sc. cl. hu. u. r. on.
wt.	Wrist .	Carpal.	c.
ha.	Hands .	Metacarpals, phalanges.	MC. PH.
kn.	Knees .		
lg.	Legs .	Femur, patella, tibia, fibula.	F. P. T. FB.
ft.	Feet .	Os calcis, astragulus, metatarsals, digits.	CS. A. MT. DT.

BONES OF ANIMALS.

hd.	Skull.
tk.	Body.
ar.	Front limbs.
lg.	Hind limbs.
cw. hf.	Claws and hoofs.
cc.	Tail.

PREFACE.

THE object of this work is to give a comparative view of the variations in form of the bony skeleton or framework of those animals most frequently required by the artist, designer, or ornamentist.

English students in art cannot be expected to obtain that facility in design which was so evident in the ornamental works of our continental neighbours at the Exhibition of 1851, without a more intimate knowledge of animal form than can be obtained in London, while we are without a collection of animal skeletons accessible to the mere artistic student. The magnificent Museum of the Royal College of Surgeons, based upon the Hunterian collection, is rich in the most instructive osteological specimens; and by the liberality with which the Council administered their bye-laws, I was favoured, through Professor Owen, with unrestricted access to their museum when, in 1852, I commenced the restoration of the extinct or fossil animals at the Crystal Palace, Sydenham. This invaluable privilege I have gratefully retained until the present time; and now, with the kindly aid of Professor Quekett, have there obtained all the materials for my present publication.

Such liberality on the part of the Council of the College of Surgeons may partly mitigate, but cannot wholly remedy the loss to the public of our national collection of animal skeletons, so indefatigably collected by Dr. J. E. Gray during the last twenty years, but which are now almost inaccessibly buried in the crypt of the British Museum, where, for the want of space, one of the finest collections in Europe is so little known as to be nearly useless to either Science or Art.

These plates have therefore been designed to assist the student in obtaining by *sight* such a general knowledge of the variations in form of the vertebrate skeleton, and its possible action during life, as may enable him to compare it with that of man.

INTRODUCTION.

In addressing the art student through the medium of his eyes, by presenting to him pictures in lieu of words, my desire is to impress him with a strong sense of the unity of design and oneness of plan upon which all animals are constructed—a unity always so apparent and important to the naturalist when comparing and collating any one of the great classes of the Animal Kingdom. It has also been my endeavour to show, by repetition of forms, that one primary pattern was created and fixed by the Almighty Architect in the beginning, and persistently adhered to through all time to the present day. And so perfect was this classific pattern (designed in foreknowledge by omniscient wisdom) that slight modifications of secondary parts fit and adapt the whole to all the changing circumstances that have been, or may become, specific conditions of life to the various groups of beings which constitute subdivisions of the Animal Kingdom.

In the choice of these examples of the skeleton or osseous framework, I have selected such of the most important and familiar animals as are daily required to form some part of almost every artistic combination.

B. Waterhouse Hawkins.

Upper Norwood, S., December 15, 1859.

COMPARATIVE VIEW

OF THE

HUMAN AND ANIMAL FRAME.

PLATE I.

MAN, THE GORILLA, AND THE BEAR.

1. MAN. *Order*, Bimana. *Genus*, Homo.

Vertebral formula—7 cervical vertebræ, 12 dorsal, 5 lumbar, 5 sacral, 3 coccygeal.

2. GORILLA. *Order*, Quadrumana. *Genus*, Troglodytes. *Species*, Gorilla.

Vertebral formula—7 cervical vertebræ, 13 dorsal, 4 lumbar, 5 sacral.

3. BEAR. { *Order*, Carnivora. *Sub-order*, Plantigrada. } *Genus*, Ursus. *Species*, Arctos.

Vertebral formula—7 cervical vertebræ, 15 dorsal, 6 lumbar, 5 sacral, 8 caudal.

MAN, the Gorilla, and Bear are figured in the first plate as examples of the highest forms of the vertebrate skeleton and mammalian class, and therefore best suited to serve as standards of comparison for all the other forms of animal structure, as shown in the nine following plates. All the human skeletons are presented to the student as viewed from the same side as those of the animals in each plate; and the attitudes are made to approximate each other as nearly as possible, without deviating from natural action. This arrangement will facilitate the comparison of the general plan with the position of the bones in each animal, and at the same

time show the special adaptation of the various parts of the limbs to the purposes of locomotion or prehension, as in walking, running, climbing, or swimming.

It is also necessary to give a list of the principal bones in the human skeleton, with letters attached, always indicating the same bone by the same letter, through every figure in all the plates: the vertebral formulary is also given with every skeleton.

The figures of the Gorilla and Bear will show that the much-talked-of resemblance of the Gorilla to Man is not so close as the teaching of zoological affinities would lead the prejudiced observer to expect; but this idea has obtained universal belief in consequence of the comparison having been originally made between Man and very young specimens of the Chimpanzee, and other tailless apes. The approach to the upright attitude of the human body by the usual sitting posture of the Monkey, led the unthinking to believe that the resemblance could be further maintained by the Monkey walking on its hind legs, which none of the larger species can do without the assistance of their front limbs. The Gorilla is here represented as progressing in the attitude most natural to him, while the figure of the Man is also bent forward, as if in the act of ascending a flight of steps: this commonplace attitude of Man is impossible to the Gorilla, who can ascend only with the assistance of his front limbs, or on all fours.

The construction of his hind feet or hands would not allow the Gorilla to balance the whole weight of his body on one foot while he raised the other to the step above, because the *os calcis*, or heel-bone, together with the length of the hind thumb, prevents him from so doing. This is one of the most ordinary movements of Man's body, which the monkey tribe are wholly incompetent to perform; thus proving the existence of an original difference between their construction, and that of Man, which no amount of education or training could ever overcome.

The other numerous distinctions between Man and the Gorilla are so evident that I leave the perception of them to the student, who, in making the comparison, cannot fail to see in the latter the elongated jaws, the tiger-like teeth, the small brain-case (as compared with Man, see Plate X.), the large bony crest, the long and strong processes on the vertebræ of the neck (longer than those on the neck of any other animal), the short thumb, scarcely opposable on the front hand, and the long and widely-grasping thumb of the hinder hand, which is too evidently unfit for walking, to be termed the foot. All these characteristic differences appear to remove much further off, that relationship of the Gorilla to Man, which our chief anatomists have lately so emphatically claimed for him. The Bear is figured in the same plate, for the purpose of comparing the plantigrade with the human foot, which it so closely resembles. The principal point of difference consists in the reversed size of the toes on each of the hind feet, the inner

toe being the smallest in the Bear, and causing that awkward unsteadiness of step when it rises to walk on its hind legs, a position which the Bear can assume more readily, and retain longer than any other of the lower animals. This is in consequence of the close resemblance to Man in the form and arrangement of the bones of the hind limbs, but particularly that of the thigh. On this point, Professor Owen says, in his 'British Fossil Mammals,' p. 97, "Of no other quadruped than the Bear is the femur more likely to be mistaken by the unpractised anatomist for that of the human subject." This implies a nearness of resemblance which the learned professor has not pointed out as belonging to any of the monkey tribe, recent or fossil.

PLATE II.

MAN, AND THE LION.

1. MAN. $\left\{ \begin{matrix} 2. \\ 3. \end{matrix} \right\}$ LION. *Order*, Carnivora. *Genus*, Felis. *Species*, Leo.

Vertebral formula—7 cervical vertebræ, 13 dorsal, 7 lumbar, 3 sacral, 23 caudal.

I HERE give two figures of the Lion, together with the figure of a Man in the attitude of kneeling, for the purpose of bringing the legs of the human figure into a corresponding position with the limbs of the standing figure of the Lion. This typical representative of the carnivora has the bones of the feet well defined, as displayed in both figures in this plate. The front feet have the normal number of five toes, the inner one shorter than the rest, and not touching the ground. They may be readily compared, as regards the number and position of bones, with the human hand, presenting bone for bone in the front feet. The most evident feature of the Lion's foot, as in that of all the Felidæ, or Cat tribe, are the large bony cases, or sheaths, in which the hooked claws are enclosed and preserved, sharp and clean, ready for use. This beautiful adaptation to the special requirements of the Cat tribe gives the appearance of a rounded enlargement at the end of each toe, where a very slight indication of the concealed claw is evident, and that only on the hind feet, where the retractile apparatus is not so much exercised as on the front feet, which in these animals are semi-digitigrade—a very evident and important external character necessary for the artist to notice.* The character of the Lion may be said to be represented by his front limbs, as it is in them that his vast strength, power, and force are concentrated; and many instances are known of the death-blow being given with the front paws only, without any aid from his powerful jaws.

* In Figures 1 *a* and 2 *a* the left foot of the man is placed in the same attitude as the left hind foot of the Lion, in which the *absence* of the equivalent of the *hallux*, first, great, or inner toe, will be at once evident. Also on the right hind foot of the skeleton, No. 2, the abbreviated metatarsal bone is visible (MT); and it may be here remembered by the student, that in all instances where the normal number of five digits are reduced to four, three, two, or one, on either the hind or front limbs of the vertebrata, the reduction always commences with the first or inner toe, called the *hallux;* or if on the front limbs, with the thumb, called the *pollux*. For example, when there are four toes, as on the hind foot of the Lion above, it is the first or *hallux* that is absent; when three toes are the natural number, it is the first and fifth that are minus; or, again, it is the first, second, and fifth that leave the third and fourth to constitute the cloven foot of Camel or Vicuna, until we find the monodactyle of the Horse's foot is the representative of the third or middle toe, or finger of the pentadactylus limb.

1.

2.

3.

1A

2A

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The size and weight of the bones of the front legs, with their corresponding muscles, together with the teeth and jaws, are the characteristic points of the frame of the Lion.

The art student may be here reminded that it is necessary for him to become acquainted with the situation, number, and arrangement of this formidable array of teeth in the jaws of the Lion, which are entirely exposed to view when he is about to attack his prey, and that this uncovering of the teeth is not merely the result of opening the mouth, but is produced by a natural action of the muscles around the mouth withdrawing the lips, and thus clearing the teeth ready for action, necessarily putting his weapons into a condition for use, as expressly as divesting a sword of its sheath.

The hind limbs, slender neck, spinal column, and ribs are only suggestive of the agility which enables this animal to use his front limbs and jaws with such power as to have rendered the figure of the Lion a recognized symbol of strength, power, and destruction.

PLATE III.

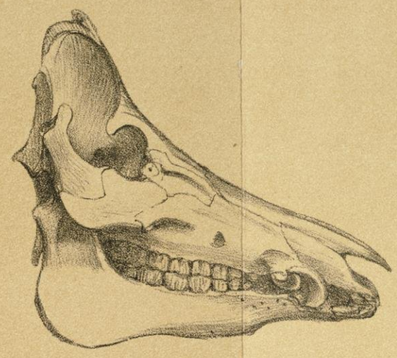
MAN, THE DOG, AND WILD BOAR.

1. Man.
   2. Dog. *Order*, Carnivora. *Genus*, Canis.
      Vertebral formula—7 cervical vertebræ, 13 dorsal, 7 lumbar, 3 sacral, 22 caudal.
   3. Boar. *Order*, Pachydermata. *Genus*, Sus.
      Vertebral formula—7 cervical vertebræ, 13 dorsal, 6 lumbar, 4 sacral, 23 caudal.

In this plate I have availed myself of the attitude of Mr. Gibson's beautiful statue of the Hunter, to exhibit the osseous frame of the Dog in a position easily compared with the limbs of man.

The Dog is a digitigrade * animal, the representative of the genus Canis. The most evident and characteristic features of the skeleton are so far common to all the species, that it would require the acumen and experience of a Cuvier or an Owen to select or determine from a promiscuous heap of bones which belonged to the Wolf, the Dog, the Dingo, or the Jackal. The Dog and all his relatives are digitigrade, with five toes on each front foot; the inner, or *pollux*, is shorter than the next metacarpal, or first tier of bones below those which answer to the wrist. In the majority of instances there are but four toes on each of the hind feet; but domestic breeds vary in this particular, as may be seen on a skeleton of a large Mount St. Bernard Dog, now at the Royal College of Surgeons, which shows five toes on the hind foot, the inner toe, or *pollux* being as well defined as the inner toe in front, and armed with a claw of the same size as those on the other toes. The claws of all the Dog tribe (unlike those of the Cat) cannot be withdrawn; they are without sheaths, and consequently unprotected from the wear resulting from contact with the ground in walking or running. The claws appear to be of little service as weapons, being used chiefly for the purposes of scratching or digging holes in the ground, for the concealment of superfluous food, which the instinct of the Dog induces him to lay by for a future necessity.

* All animals are said to be plantigrade or digitigrade according as they place the sole of the foot more or less upon the ground. A true plantigrade foot is that which presents the entire sole to the ground, from heel to toe, when walking. A digitigrade foot, that which walks upon the tips of the toes: the foot of Man is a perfect instance of a plantigrade foot; also the hind feet of the Bear and Badger among the lower animals. The Hog and Antelope present examples of the digitigrade foot; while in the Cat tribe we have an instance of the intermediate form, as with them the three lower tiers of toe-bones rest upon the ground when standing or walking, and, therefore, may be properly called semi-digitigrade.



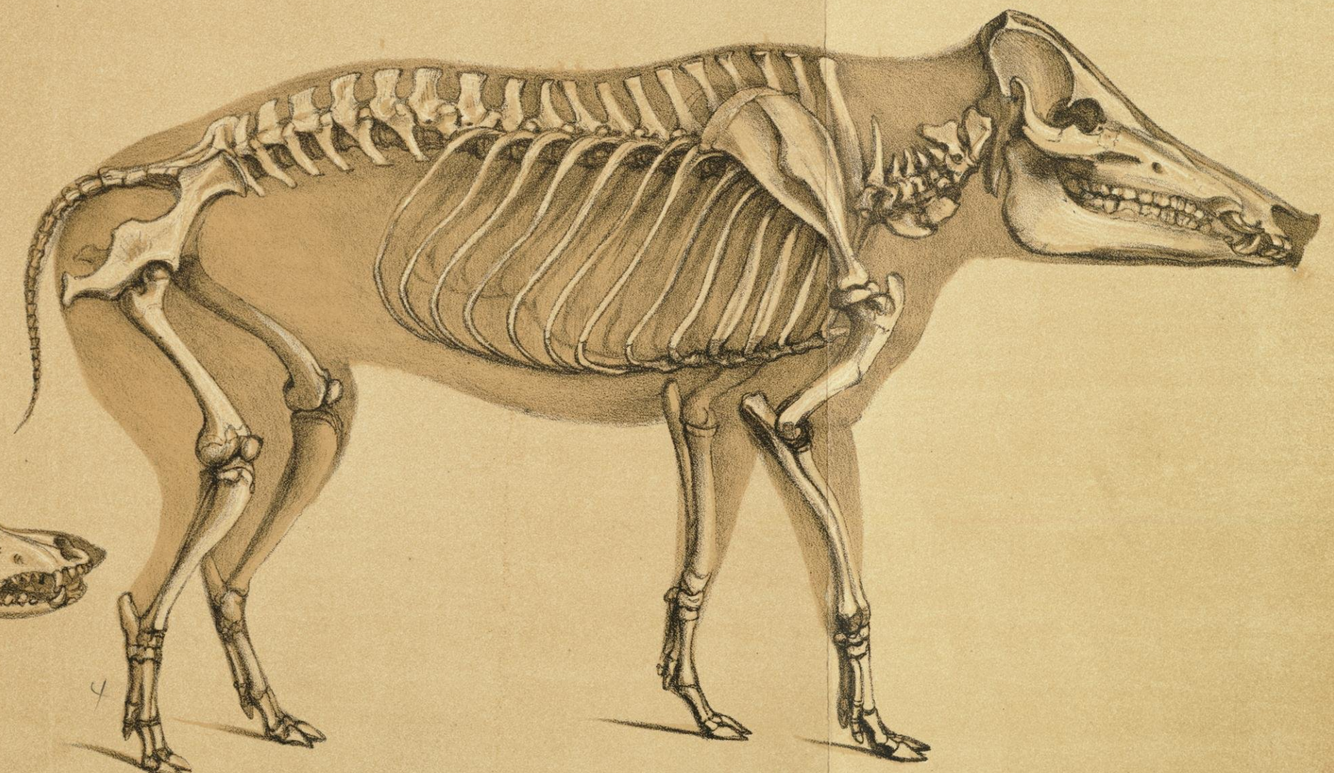


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Figure 3 in Plate III. is the skeleton of the Wild Boar. In the domesticated varieties, the number of dorsal vertebræ are often found to increase to 14, and the lumbar to 7. The natural position of this animal's feet, when standing or walking, more strictly represents the true digitigrade foot than that of the Dog, as it is only the last joint of the two front toes which rests upon the ground; the two hinder toes remain quite clear of it. The feet of this animal are small in proportion to the general bulk of the figure, and size of the head. The facial line in the European variety (Fig. 4) is concave, while that of the Indian Wild Boar is convex, with a round projecting *os frontis*.

The fierce and animated expression of the wild varieties may be ascribed to the effect of the white or sclerotic portion of the eye being so much seen, by reason of the length of the eyelids. The savage expression of the mouth is dependent upon the curve and situation of the tusks, which project laterally from both jaws.

PLATES IV. & V.

RIDER, AND HORSE.

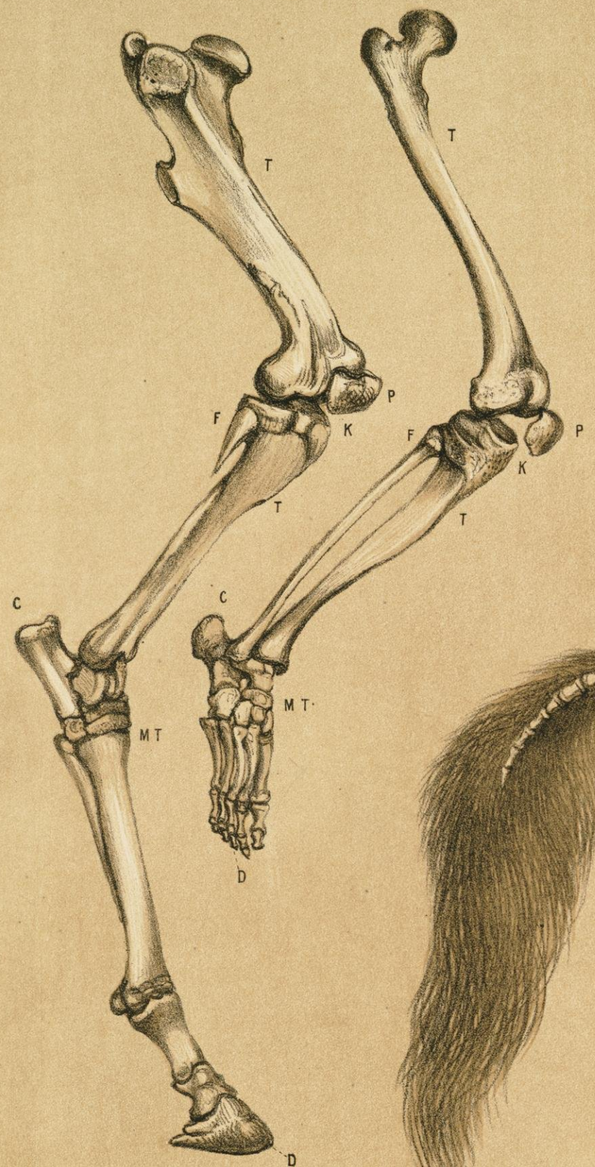
1. Man.

2. Horse. *Sub-order*, Solidungula. *Genus*, Equus.

Vertebral formula—7 cervical vertebræ, 19 dorsal, 5 lumbar, 5 sacral, and 17 caudal.

The universal utility and consequent interest attached to the Horse will account for giving two illustrations of an animal that is one of those most constantly associated with Man, and therefore most frequently required in works of art, pictorial and sculptural. Not more than twenty years ago, Horse painting was considered to require so distinct a course of study and practice, that portrait painters of celebrity, believed themselves absolved from the necessity of understanding the structure of an animal, which was so frequently associated with the most important and necessary portions of their work. This erroneous prejudice was not removed until Mr. F. Grant's correct and life-like equestrian portraits appeared to change the practice, which up to that time formed the necessity for all large pictures of Man and Horse to be the conjoint effort of two painters, thereby weakening the effect, which is always greater when produced by unity of intention, and the action of one mind. The frame of the Horse is composed of a similar vertebral arrangement to that of other Mammals, with eight pairs of ribs directly joining the sternum, which consists of seven bones and an ensiform cartilage.

Having instituted our proposed comparison between the human frame and that of other animals, it may be here observed that the Horse displays many points of special adaptation, particularly in the bones of the limbs, which apparently render their resemblance to the limbs of Man less than those of many other animals; but even this outward dissimilarity is more apparent than real. The same plan rules the arrangement of all the parts which, though lengthened and simplified in the extremities, yet correspond with each tier of bones that constitute the limbs of Man. The Horse's front leg, as shown in the figure, consists of a broad blade bone (sc), or *scapula*, with a strong and thick bone called the *humerus* (hu), to which are attached the bones that correspond with those of the lower arm in Man, called *ulna* (u) and *radius* (r), and which with the *olecranon* (on), elbow joint, go to make up that part of the limb



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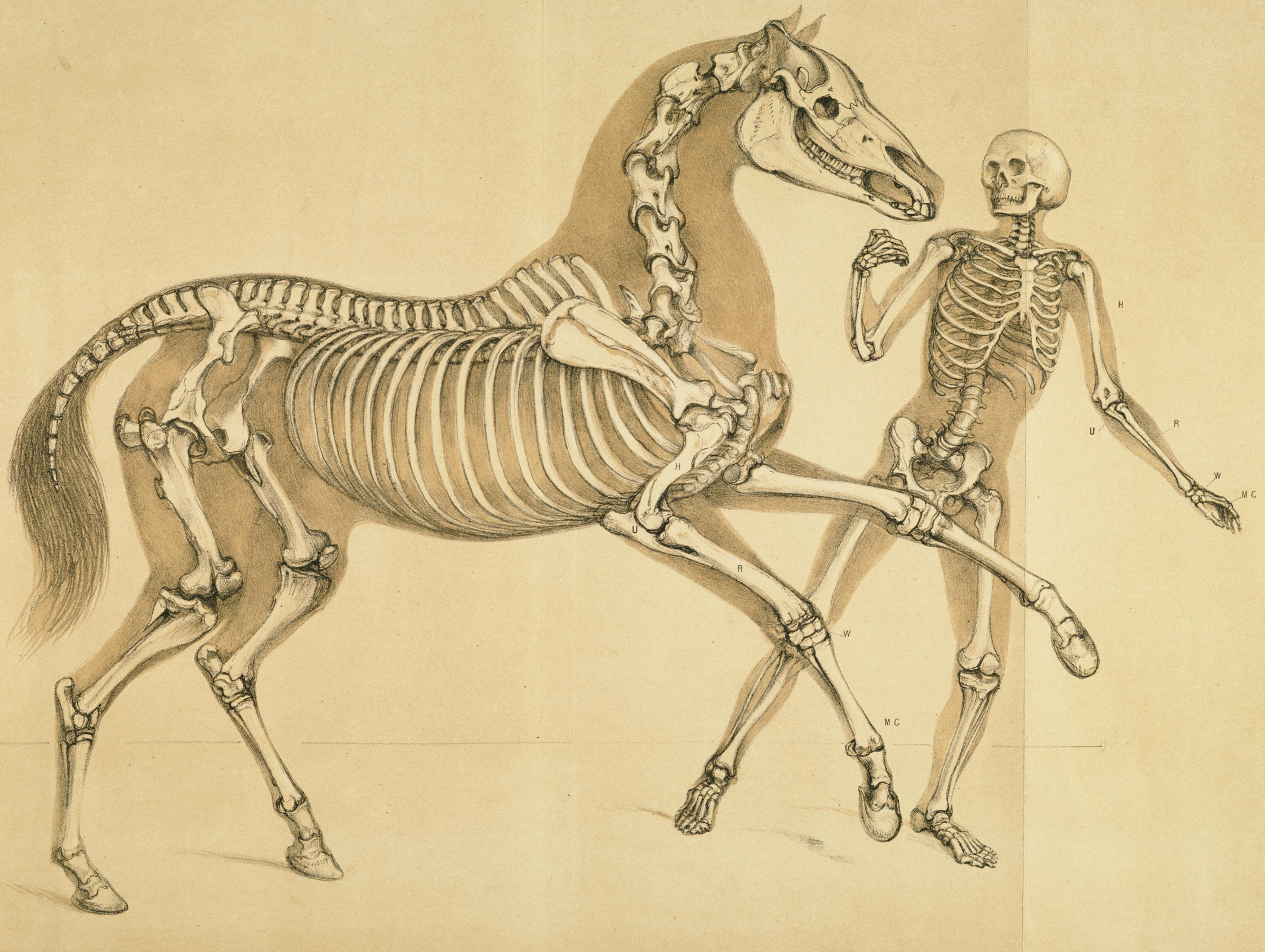

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technically called the fore-arm of the Horse. Here we must have recourse to the technicalities used by equestrians for those parts of the limbs which it is desirable for the art student to identify with their congeners in the limbs of Man.

At the end of the fore-arm, we find the joint, popularly known as the *knee* of the Horse. Without the most vague idea of disputing the fitness of equestrian technicalities, it is desirable that the art student should recognize this joint as homologous or identical with the *wrist* of Man. It consists of the true carpal bones, and only differs in the fact, that it supports one strong cylindrical bone, called the *cannon bone*, which represents the middle one of the series of metacarpal bones that support the fingers in the human hand. The digits in the five-toed foot of the Lion are all represented in the foot of the Horse by one series of single bones, known as the *pastern joint*, from the fetlock to the coffin bone, or central point of the semicircular hoof. On either side of the cannon bone there is a bone tapering downwards, known as the *splint bone;* the inner one is the representative of the metacarpal of the second digit, the outer one represents that of the fourth digit. The bones of the foot of the Horse represent three only of the five digits, or normal number in the human hand. The great pastern answers to the middle or longest finger, while the thumb and little finger have no equivalent in the foot of the Horse.

The marked character of the hind limbs can be closely compared in Figs. 3 and 4, Plate IV., where the bones of the human leg are shown at angles parallel to the hind leg of the Horse: the corresponding letters will explain the identity of the bones. The difference of a third trochanter on the hinder surface of the thigh of the Horse is a strongly marked character, which Professor Owen assigns to that group of animals which he has arranged under the name of Perissodactyles, or those with an unequal number of toes (to which group the Horse belongs), together with the Elephant, Rhinoceros, Tapir, and Palæotherium.

PLATE VI.

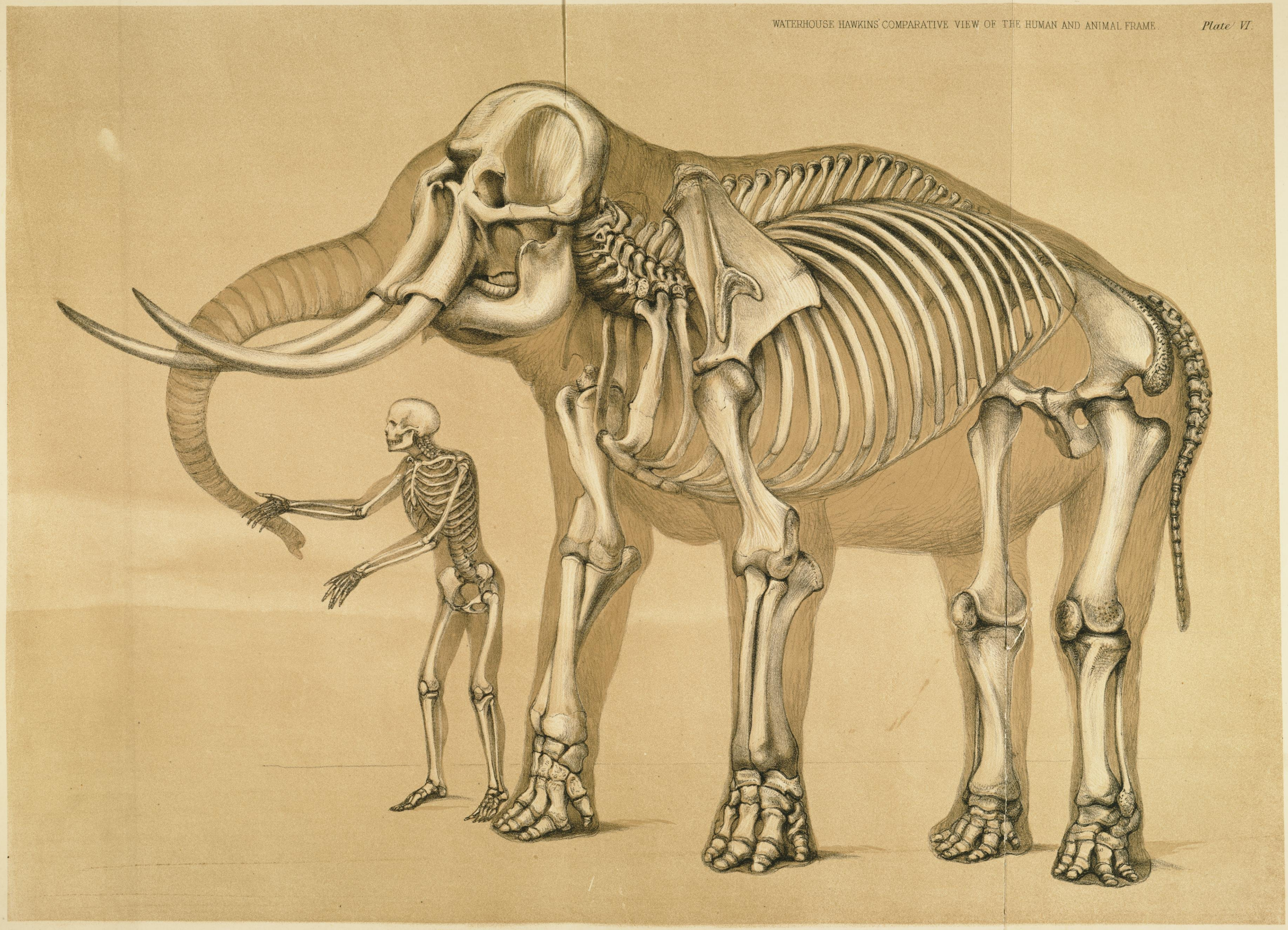
MAN, AND THE ELEPHANT.

UNGULATA. *Order*, Proboscidea. *Genus*, Elephas. *Species*, Indicus.
Vertebral formula—7 cervical, 20 dorsal, 3 lumbar, 3 sacral, 31 caudal.

THE figure, action, and general appearance of the living Elephant are now so well known, even to children, by means of the Zoological Gardens, that it is no longer necessary to give a lengthened explanation of the figure, to convince the most obtuse that the Elephant is not without joints, and is not incapable of lying down, as was the popular belief less than half a century ago. The difference of arrangement in the bones of the leg will be best understood from the figure, Plate VI., when compared with those of the Horse, Plate IV. This difference is observable in the arrangement and number of the bones of the feet, where the five toes are complete, but singularly depressed and shortened into a very small compass as compared with the size of the animal. The *pachydermatous* envelope or *thick skin* enclosing the feet so entirely as to conceal the separation of the toes, has the effect of giving to the limbs of the Elephant the appearance of clumsy cylinders with abrupt terminations. The bulky proportions of the body are characteristic of the vegetable feeding habit of the Elephant. The shortness of the neck, bringing the large head close to the body, renders the general appearance of the Elephant both ponderous and clumsy, curiously contrasting with the refined sense of touch displayed in the animal's dexterous use of that delicately-sensitive organ, the trunk, with which the creature feeds itself, and performs so many of those feats that excite the astonishment of spectators, and afford such evidence of the intelligence and docility of this huge animal when in confinement.

To the artist student, I would observe that a back view of the Elephant is not the best calculated to give an idea of his majestic size, neither is the action of his hind legs likely to add the idea of grace to our admiration of his strength: the situation of the knee-joint induces an outward turn of the toes, with a dancing action of the hind limbs, much more suggestive of drollery than dignity.

Our figure is that of the Indian Elephant, in which the concavity above the nasal bones is conspicuous, in contrast to the convex or projecting forehead of the African species.



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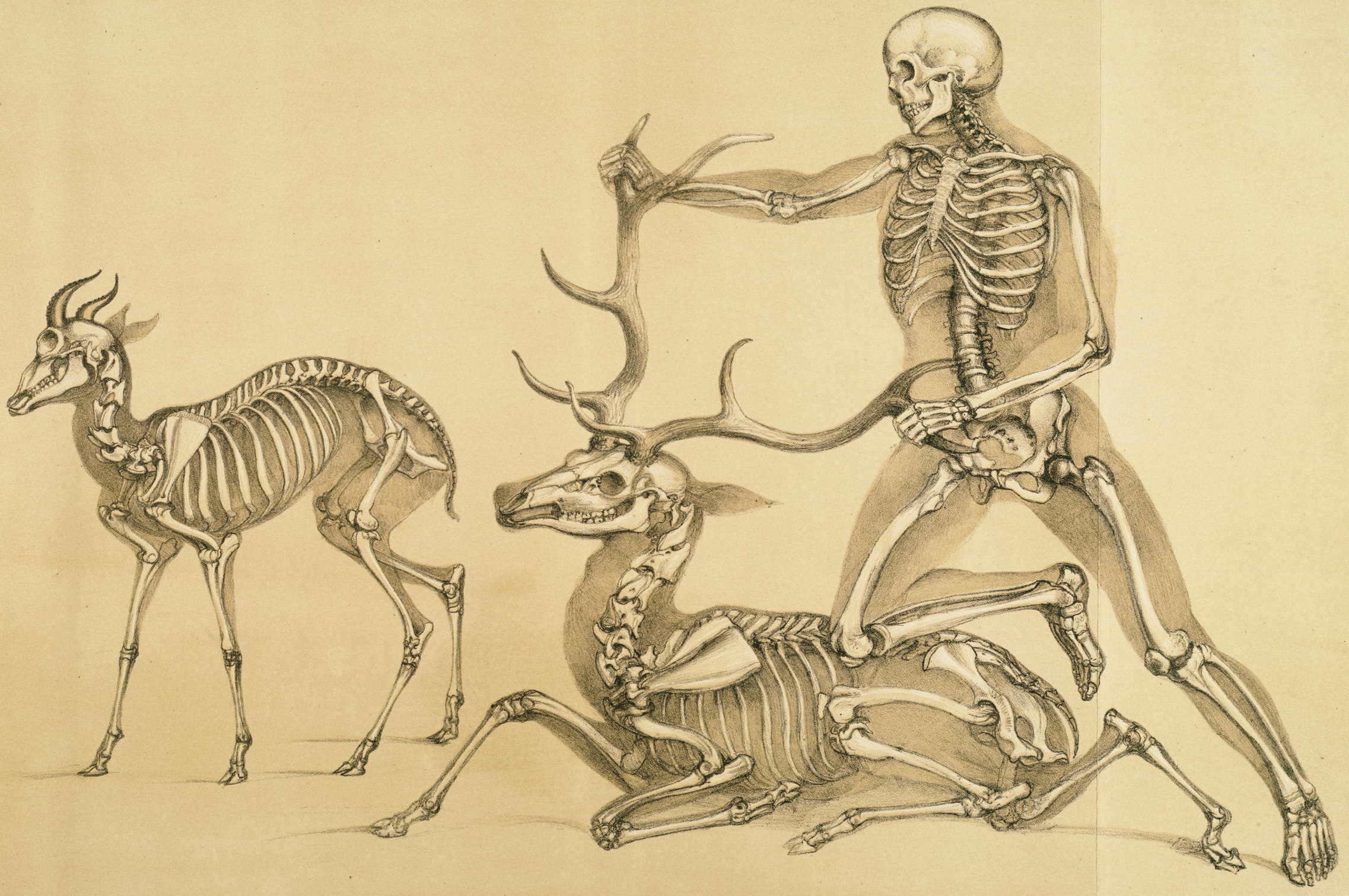

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PLATE VII.

MAN, STAG, AND ANTELOPE.

STAG, RUMINATING ANIMALS.

1. MAN.
   2. STAG. *Order*, Ruminantia. *Genus*, Cervus. *Species*, Elephas.
      Vertebral formula—7 cervical vertebræ, 13 dorsal, 6 lumbar, 4 sacral, 11 caudal.
   3. ANTELOPE. *Order*, Ruminantia. *Genus*, Antilope. *Sub-genus*, Gazella. *Sp.*, Dorcas.
      Vertebral formula—7 cervical vertebræ, 13 dorsal, 6 lumbar, 4 sacral, 14 caudal.

FOR the typical families of the Ruminating Order, I give in Plate VII. the solid and deciduous-horned Stag, and also the persistent hollow-horned Antelope; in Plate VIII., the Cow and the Sheep; and in Plate IX., the Camel, as illustrating a ruminant without horns. In Plate VII. I have adopted the attitude of the Pompeian Hercules for the human figure, to obtain a better correspondence between the limbs of Man in action and those of the Stag.

The slender character of the limbs of ruminating animals may be viewed as the greatest departure from that of the human type.

In the Stag, the Horse, and all other forms in which the original pattern of the skeleton is especially adapted for rapid movement upon dry ground, the bones of the legs are attenuated to the slender capacity of one bone, called the cannon bone; this is of a nearly cylindrical shape, and in the Ruminants is the united representative of the two metacarpal (MC) bones supporting the two middle toes.

The cervical vertebræ are strong and broad in proportion to the weight of horns the animal is designed to carry: the average weight of the horns of an adult Red-deer is 27 lbs. The horns of the Wapiti of America, and the Sambur Deer of India, often attain double that weight. The triangular palmated horns of the Elk or Moose Deer not uncommonly weigh 50 lbs. to 60 lbs.; while the horns of the ancient Irish Elk are often found weighing 90 lbs. or 100 lbs. When it is remembered that the Stag has the most perfect control over these formidable weapons—his horns—balancing and adjusting them at every possible angle by means of the broad tendons and powerful muscles which are placed behind the neck, from the back of the head to the shoulder, the art student will appreciate the difference between the outline of

the flesh and the downward curve of the bones of the neck. This difference between the outline of the flesh and the situation of the bones of the neck, with the cartilaginous summit of the bladebone, and the length of the neural spines of the foremost dorsal vertebræ, may also prove matters of interest to the young deer-stalker, who, in his experience, may have seen more than one goodly buck, though surely hit, yet continue his course apparently unharmed, as, when the aim is too high, the ball may pass through or into the interval in front of the shoulders, above the bones of the neck, without proving immediately fatal.

The structure of the neck and shoulder will be best understood from the figure of the standing Antelope, the arrangement of the parts being like those of the Stag. The limbs of the Antelope are more slender and attenuated in proportion to the body, than the limbs of the Deer, but the general plan of construction is nearly the same.

The Antelope presents to the choice of the artist many varieties of size and contour, all graceful and pleasing. The gentle expression of the head, with the symmetrical curves of the lyrate-formed horns, render them valuable as ornamental accessories to the artist, either painter or modeller. The latter will find the flexible curves of their slender forms well suited to the requirements of metal-work.

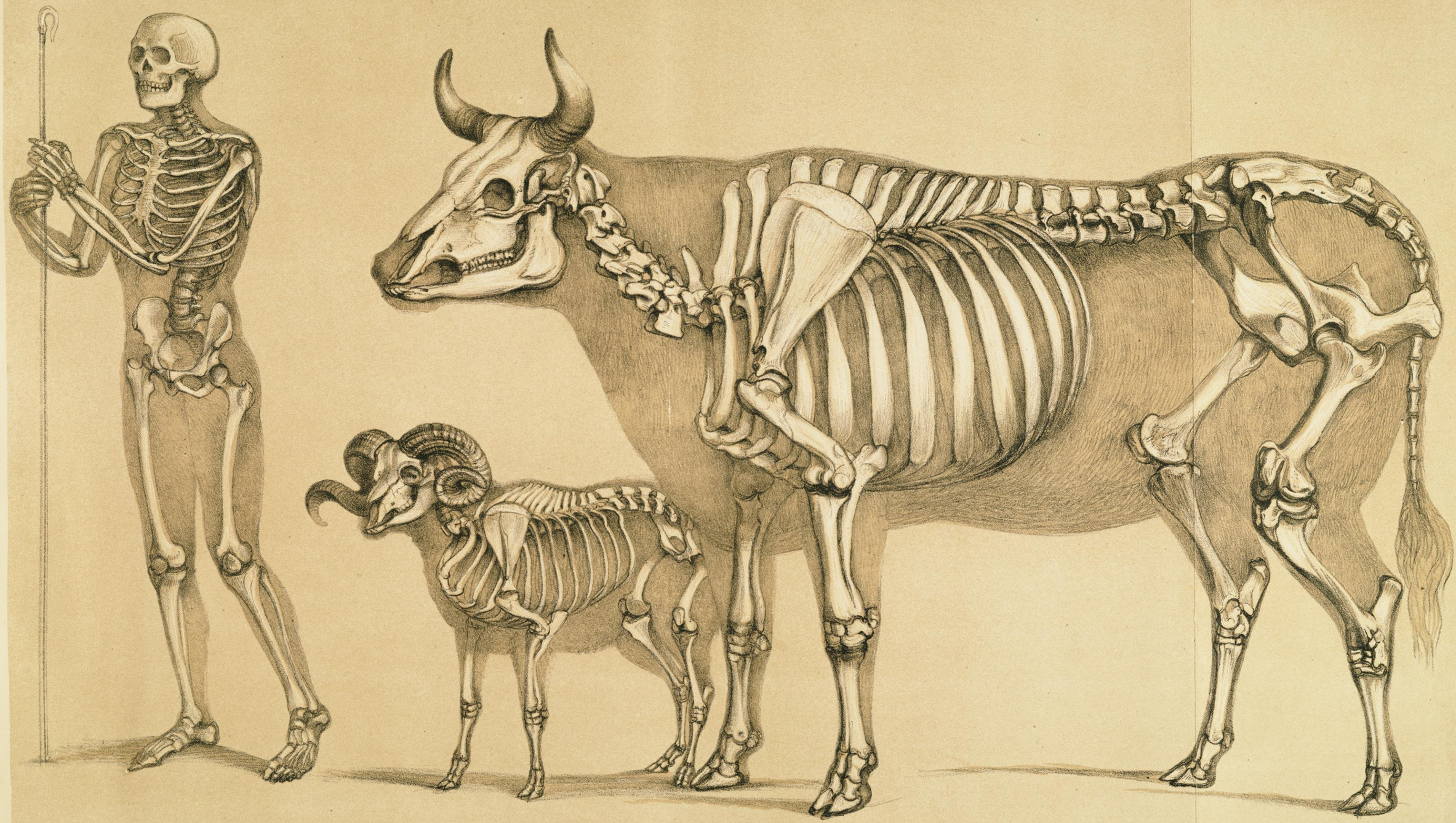

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PLATE VIII.

MAN, COW, AND SHEEP.

1. MAN.

2. COW. *Genus*, Bos. *Species*, Taurus.

Vertebral formula—7 cervical, 13 dorsal, 6 lumbar, 5 sacral, 21 caudal.

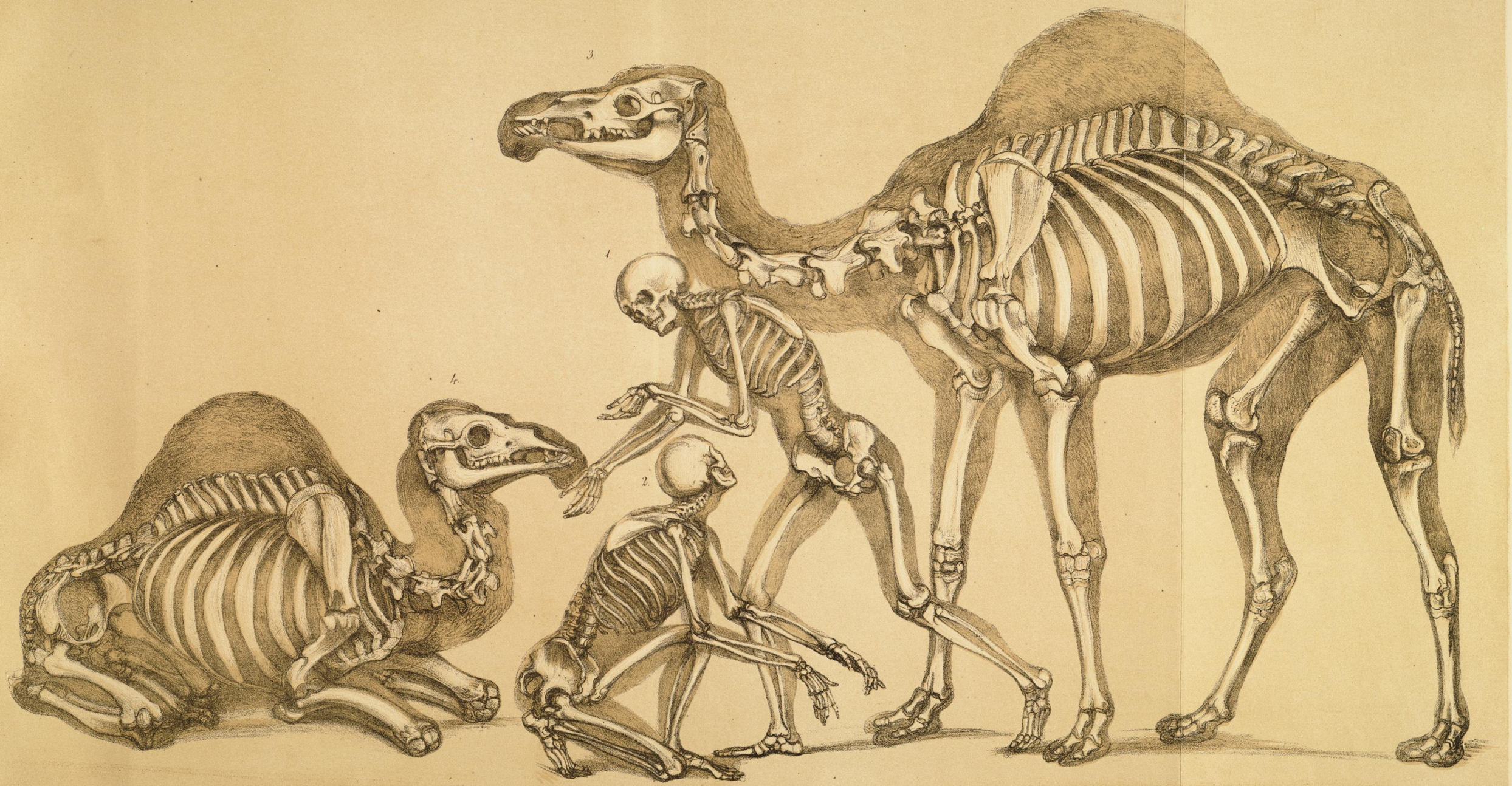
3. SHEEP. *Genus*, Ovis. *Species*, Aries, Ram.

Vertebral formula—7 cervical, 13 dorsal, 7 lumbar, 4 sacral, 10 caudal.

THESE two most familiar types of the Order Ruminantia, or Ruminating Animals, are represented in the present instance by the Cow and Sheep (Figs. 2 and 3). In the Cow we have the large body of the true vegetarian feeders, with comparatively short limbs and cloven feet, possessing peculiarities in construction, to enable these animals, requiring juicy and sapid food, to move with ease among swampy grounds and marsh lands. The large spreading and divided toes, with the broad hoof, are well seen in the common Cow, but attain their maximum of size and utility in the foot of the Bison, where the two hind hoofs, called the false hoofs, also expand, and so present a broad resisting surface to the soft ground in which these heavy animals would sink to an inconvenient depth but for this beautiful provision of Nature. This animal is also enabled to withdraw its foot with greater ease, as the toes (by falling together when the foot is lifted up) occupy so much less space than when presented to the yielding ground. The front bones of the lower leg, or metacarpal and metatarsal bones of the Cow are shorter than the thigh or humerus, and represent the third and fourth digits of the human hand or foot, while the two hinder toes, or false hoofs, as they are sometimes called, stand for the second and fifth. These hinder appendages do not appear in the foot of the Camel, whose natural habitat in dry and sandy plains would render the hard divided hoof of the Cow an impediment under such opposite circumstances. In the Ruminating Camel (Plate IX.), we

find the divided foot, but with nail-like coverings on the upper surface of the toes, the sole being round, soft, and padded, without any receptacles for the loose sand, which, by collecting, would impede its action.

In the wild varieties of the Ox tribe, the neural spines or processes on the dorsal vertebræ, immediately over the shoulder, which constitute the similar elevation to that known as the withers of the Horse, are much longer and higher than in the domestic species; consequently, the back of the Auroch, Bison, or wild Ox, does not present that equal horizontality of line so much admired and insisted on by agricultural patrons of art. A good recollection of the bones of the Sheep (Fig. 3) will at all times greatly assist the artist in the representation of these animals; as, in consequence of their form being much concealed by the wool, it is not possible to make sketches so imitatively as may be done from animals whose points and indications of structure are more externally evident.



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London, Published by Chapman & Hall, 193, Piccadilly.
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PLATE IX.

MAN, AND THE CAMEL.

1, 2. MAN. { 3, 4. CAMEL. *Order*, Ruminantia. *Genus*, Camelus. *Species*, C. dromedarius.
Vertebral formula—7 cervical vertebræ, 12 dorsal, 7 lumbar, 4 sacral, 17 caudal.

ONE of the external characters of the Camel which first strikes the spectator is a certain ungainly lengthiness in the limbs, suggestive of weakness, which makes them appear less harmoniously conjoined with the body, than is the case in the more symmetrical proportions of the Horse. This external character is only apparent, as the bones of the limbs are in reality of equal or greater strength than those of the Horse.

This distinction between appearance and reality may be accounted for by the fact, that those pieces of bone, generally separated in other animals, are anchylosed, or united by growth, throughout their entire length in the limbs of the Camel. The *ulna* and *radius* of the Camel are in one; the *olecranon* is also soldered to the rest of the bone, which is so much arched or curved as to make those parts which may be comparatively called the elbow and the wrist touch the ground when the animal is lying down, see Plate IX. The projecting growth of the *sternum*, or breast bone, forms another peculiar feature, and serves as a support to the fore part of the animal's body, taking off the pressure from the muscles of the limbs, and forward viscera. This accounts for the appearance of the body not touching the ground while the limbs are gathered under it, when the creature is in a recumbent posture, or receiving its load.

The all-important functional centres, for breathing and circulation of the blood, are between two elastic protections, the fatty hump above, and the cartilaginous frame of the chest below. The Camel derives the advantage of this peculiar arrangement when he takes rest without being unloaded. Another external characteristic of the figure of the Camel is the separation of the thigh from the sides of the abdomen, the whole of the hind limb working freely from the head of the *femur*, or thigh bone, to the knee. The *patella* is large and

externally protected by a callosity, which, with the folding of the wrist joint (wt.) of the front leg (equally protected by a callosity like that on the elbow), provides for the animal's habitual method of reaching the ground for rest, by bringing the knee joint (kn.) to the ground: hence the Camel, like the Elephant, is said to kneel so as to receive its burden of travellers or merchandise.

The folding up of the leg of the Man (Fig. 2) shows the relative situation of the thigh and other bones for comparison with the figure of the kneeling Camel (Fig. 4).

1.

1a.

2a.

2.

6.

5.

4.

2b.

2c.

1b.

3.

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PLATE X.

DIAGRAM.

Figure 1. MAN	. { Section of head and spinal column.	Figure 2. GORILLA	. { Section of skull and neck.
„ 1*a*. MAN	. Hand.	„ 2*a*. GORILLA	. Front hand, flesh.
„ 1*b*. MAN	. Foot.	„ 2*b*. GORILLA	. Front hand, bones.
		„ 2*c*. GORILLA	. Hind hand, bones.

Figure 3. Hind foot of Bear.

„ 4. Seal, *swimming paws*.

„ 5. Vicuna, skeleton.

„ 6. Ostrich, skeleton.

THE compound Diagram of the Cerberus-like animal in the centre of Plate X. was constructed to exhibit, by close proximity, the sameness of arrangement and plan which constitutes the original design of the vertebrate skeleton. These three most dissimilar animals—the Seal, the Vicuna, and the Ostrich—have been selected to show the wide difference in the application of the limbs of each, belonging, as they do, to two distinct classes, and three separate orders.

The two mammals, Figs. 4 and 5 (the Seal and the Vicuna), present the same number of vertebræ. The short neck of the Seal (Fig. 4), and the long neck of the Vicuna (Fig. 5), though so different in appearance, are in reality constructed on the same plan, and with precisely the same number and arrangement of bones in both. If the limbs be next compared, though naturally the sphere of action of these animals is so far removed, we yet find the plan and arrangement equally fitted to the short swimming limbs of the Seal, for progress through the water, and the lengthened leg of the Vicuna, suited to move on the hard and dry ground. Again, compare the skeleton of the Ostrich, brought into conjunction with the frame of the Vicuna, which shows the same pattern and arrangement of bones in the legs of the biped bird, as in the quadruped. To make this still more evident, the

hind leg of the Vicuna is figured as supporting the body of the Ostrich, the near leg of which it so closely resembles as not to offend the eye by being made to serve as the apparent support of these two very dissimilar animals.

Thus far the student will have seen that the apparent extremes of external difference may all harmoniously subserve a unity of plan, without any evidence of a necessity for the continuous succession of new creations, or for the opposite grotesque *theory of development*, which implies that the Ostrich might be the grandfather of the Vicuna, or the Seal the progenitor of both.

CONCLUSION.

THESE brief views and summary comparisons between the frame of Man and of Animals closely resembling, yet widely differing from him, must have shown to the student of FORM, the persistence of one original pattern and type throughout; and that the evident plan of construction is a UNITY, upon which are engrafted an infinite number of variations, but that these variations add to the harmonious* fitness of all animals for that place in Creation, which they were originally designed to fill.

In the Diagram, Plate X., there are sections of the crania of Man and of the Gorilla, drawn to the same scale of about one fourth of the natural size, which thus offer a fair comparison of the relative dimensions of the inner true brain-case in each, in proportion to the size and strength of the outer cranium, jaws, and teeth. Without dwelling on the dissimilarity of these vital characteristics, we may next compare, in the same figures, the bones of the neck in each, and consequent difference between the carriage of the head, action, nature, and habits of these two dissimilar creatures.

We may, in the next place, refer to the hands of the Gorilla, which resemble those with which the fore and hind limbs of the rest of the monkey tribe are furnished, and from which they derive the name of Quadrumana, or *four-handed.* The hand with the opposable thumb has been often described as a refined instrument so peculiarly human in its characteristic power, in its finished performance of Man's ingenuity, that its possession by the

* Teleology.

monkey tribe has been considered sufficient to identify these beasts with Man. If Figs. 1*a*, 2*a*, are compared, the difference of proportion will distinctly show the difference of use for which the limbs of these two creatures were created. In Fig. 2*b*, the bones will be found to correspond in number and position. The thumb of the Gorilla is so short that it scarcely reaches beyond the knuckles at the base of the fingers, and can therefore be only clumsily opposed to the elongated fingers, the enlarged bones of which also show that they were designed for the office of a forefoot when not employed in their hook-like prehension, for grasping the trees that form the legitimate habitat of the whole tribe of Quadrumana. Again, compare Fig. 2*c*, and it will be found that the peculiarities of the human foot are still less represented by the hand on the hind leg of the Monkey. In concluding these brief descriptions of the difference between the Monkey and Man, it is hoped that the artistic student will believe that, however frequently he may have seen some eccentric acquaintance transform Man into a Monkey, he must leave it to the transcendental Anatomists to develop (if they can) a Monkey into a Man.

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