

# MAMMALIA

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## CHAPTER X

UNGULATA (*continued*)—PERISSODACTYLA (ODD-TOED  
UNGULATES)—LITOPTERNA

### SUB-ORDER 8. PERISSODACTYLA

THESE Ungulates derive their name, which is that given by the late

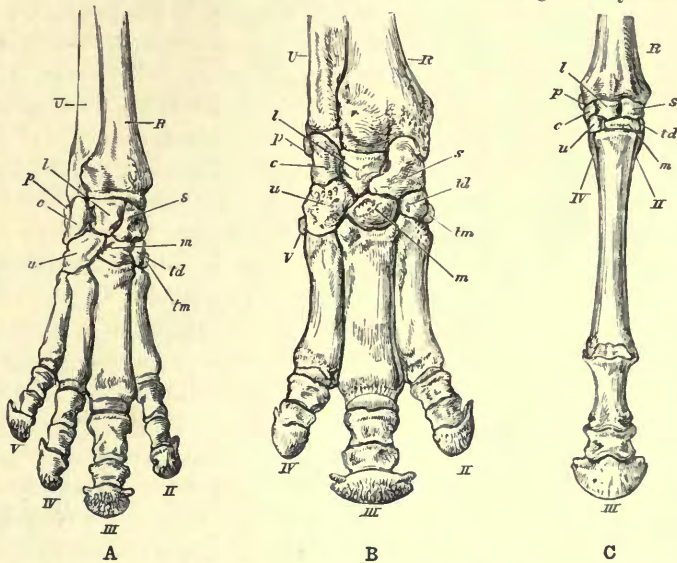


FIG. 121.—Bones of the manus **A**, of Tapir (*Tapirus indicus*).  $\times \frac{1}{2}$ . **B**, of Rhinoceros (*Rhinoceros sumatrensis*).  $\times \frac{1}{2}$ . **C**, of Horse (*Equus caballus*).  $\times \frac{1}{2}$ . *c*, Cuneiform; *l*, lunar; *m*, magnum; *p*, pisiform; *R*, radius; *s*, scaphoid; *td*, trapezoid; *tm*, trapezium; *u*, unciform; *U*, ulna; *II-V*, second to fifth digits; *V* in **B**, and *II* and *IV* in **C**, represented by rudimentary metacarpals. (From Flower's *Osteology*.)

Sir Richard Owen, from the fact that the middle digit of the hand and foot is pre-eminent. As will be seen from Fig. 121, the axis of

the limb passes through the third finger, which is larger than any of the others, and is symmetrical in itself. In this the present group contrasts with the Artiodactyla, where the axis is not "mesaxonic," but where there are two digits, on either side of the axis, which are symmetrical with each other. This arrangement of the limbs is highly characteristic, but appears to be not quite universal. In the Titanotheres, which form a group of the Perissodactyles, the



FIG. 122.—Bones of the manus of Camel (*Camelus bactrianus*).  $\times \frac{1}{2}$ . *c*, Cuneiform; *l*, lunar; *m*, magnum; *R*, radius; *s*, scaphoid; *td*, trapezoid; *u*, unciform. (From Flower's *Osteology*.)

fore-limbs are not quite accurately mesaxonic. Nor on the other hand can all Ungulates which show the Perissodactyle condition be safely included in the present group. The ancient Condylarthra and the Liptopterna show precisely the same state of affairs. But other features in their organisation lead to their separation from the Perissodactyles, of which, however, the Condylarthra are probably ancestors. The Liptopterna on the other hand, which possess even one-toed members like *Equus*, are believed to represent a case of parallelism in development. The number of functional toes varies from four to one. In the ankle joint the astragalus either does not, or does only to a comparatively slight extent, articulate with the cuboid as well as with the navicular bone. Moreover the fibula when present does not as a rule articulate with the calcaneum. In the opposed group of Artiodactyles the precise reverse of these conditions obtains. It is usually stated as part of the definition of this group

that they do not possess horns of the type of those met with in the Cervicornia and Cavicornia. But the strong bony bosses on the skull of many Titanotheres, so curiously reminiscent of those of the not nearly related *Dinoceras* and *Protoceras*, may well have supported horns of the Ox and Antelope pattern.

The teeth of the Perissodactyles are lophodont, more rarely bunodont. The selenodont Artiodactyle form of molar is not met with. The dental formula, moreover, is at least near the

complete one, the more modern forms as usual being the more deficient in numbers of teeth.

The dorso-lumbar vertebrae are as a rule twenty-three; but the extinct Titanotheres are again an exception; for, at least in *Titanotherium*, there are but twenty of these vertebrae—an Artiodactyle character. The femur has a third trochanter. There are so few recent Perissodactyles that an enumeration of the distinguishing characters of the viscera may very probably be useless for purposes of classification. But the living genera at any rate are to be separated from the living Artiodactyles by the invariable simplicity of the stomach coupled with a very large and sacculated caecum. The liver is simple and not much broken up into lobes, and the gall-bladder is always absent. The brain is well convoluted. The teats are in the inguinal region. The placenta in this group is of the diffused kind.

The living Perissodactyles belong to three types only, indeed to three genera only (in the estimation of most), which are the Horses, Tapirs, and Rhinoceroses. But taking into account the extinct forms, they may be divided primarily (according to Professor Osborn) into the four following groups:—(1) Titanotherioidea, including but one family, Titanotheriidae; (2) Hippoidea, including the families Equidae and Palaeotheriidae; (3) Tapiroidea, with two families, Tapiridae and Lophiodontidae; and (4) Rhinocertoidea with families Hyracodontidae, Amyndontidae, and Rhinocerotidae. It is conceivable, according to the same writer, that the Chalicotheres (here treated of as a separate sub-order, Ancylopoda) should be added to the Perissodactyle series.

**Fam. 1. Equidae.**—This family, which includes the living Horse, Zebras, and Asses, as well as a number of extinct genera agreeing with those types in structure, may be defined by the possession of but one functional toe, the two lateral ones being mere splints, or but little more. The molar teeth are hypselodont, and



FIG. 123. — Anterior aspect of right femur of Rhinoceros (*Rhinoceros indicus*).  $\times \frac{1}{2}$ . h, Head; t, great trochanter; t', third trochanter. (From Flower's *Osteology*.)

largely to escape the Tiger, its most formidable foe in those regions of the world. Its quickness of senses enables it also to slip away with rapidity. It can proceed at a great pace when disturbed, and can readily push its way through obstacles. The young animal, like that of the American species, is dark brown with yellowish spots. It is stated by Mr. H. N. Ridley that the young animal lies during the hot part of the day under bushes, in which situation "its coat is so exactly like a patch of ground flecked with sunlight that it is quite invisible." It is interesting to note that here, as with some other animals, it is the young that are especially protected by such mechanisms. Moreover, some of the spots are round and some are more elongated, so that the resemblance to spots of sunlight which come in a direct and in a slanting direction is greatly increased. Even the colours of the adult are not so conspicuous when it is in its native haunts as might be supposed. The breaking up of the ground colour into tracts of two different colours prevent it from striking the eye so plainly as if it were of one colour throughout. "When lying down during the day it exactly resembles a grey boulder, and as it often lives near the rocky streams of the hill jungles, it is really nearly as invisible then as it was when it was speckled."<sup>1</sup>

**Fam. 3. Rhinocerotidae.**—This family is to be distinguished from the preceding by a number of characters, which though not universal are general. In the first place, there are commonly horns, or a horn, consisting of what appears to be an agglomeration of hair-like structures fixed upon a roughened patch of bone on the surface of the nasals. The incisors are diminished or defective, and the upper canines are often wanting. The molars and premolars are alike. The fore-feet are four- or three-toed, but are functionally tridactyle; the hind-feet are three-toed. The skeleton in this family is massive, and the limbs relatively short. The skull, as in the Tapirs, has a confluent orbit and temporal fossa. The upper lip is generally more or less prehensile; the body is as a rule—to which the Pleistocene Hairy Rhinoceros is of course an exception—rather sparsely covered with hair. In this feature the Rhinocerotidae contrast both with the Tapiridae and the Equidae. The family in reality contains but one existing genus, though three have been instituted, viz.

<sup>1</sup> *Natural Science*, vi. 1895, p. 161.

*Rhinoceros*, *Ceratorhinus*, and *Atelodus*. As there are so few existing species the subdivision of animals which agree in so many and such highly-characteristic features seems to be an unnecessary procedure. The existing Rhinoceroses are but a fragment of the total number of known forms from past epochs. The family is very markedly on the wane.

The genus *Rhinoceros* is characterised by its heavy build and thick, almost smooth, skin—smooth, that is to say, so far as concerns the slight development of hair—which is often thrown into folds. There is one or there are two horns on the fore-part of the head, which are, as has already been pointed out, structures *sui generis*, and not exactly comparable with the horns of other living Ungulates. There are three nearly equal toes on both fore- and hind-limbs. The canine teeth of existing species have disappeared; the incisors are, or are not, present; the molars and premolars are three and four in each half of each jaw.

The visceral anatomy of the Rhinoceros has been much investigated so far as concerns the Asiatic forms. A curious feature, which serves to discriminate some of the Asiatic species from others, is to be seen in the small intestine. In *Rh. indicus*<sup>1</sup> this gut is furnished with numerous long cylindrical narrow out-growths "like tags of worsted"; in the allied *Rh. sondaicus* these tags are present, but are flatter and broader; while in the two-horned *Rh. sumatrensis* there are no tags at all, but only smooth valve-like folds. Another mark by which these species can be distinguished depends upon the variation in the presence or absence of certain glands imbedded in the integument of the foot—the so-called "hoof glands." These occur in *Rh. indicus* and *Rh. sondaicus*, but are absent in *Rh. sumatrensis*.

Sir W. Flower<sup>2</sup> studied some years since the skull features which serve to differentiate the existing forms.

In *Rh. sumatrensis* the two long downward processes of the squamosal bone, termed respectively post-glenoid and post-tympanic, do not unite below the auditory meatus. In this the species in question agrees with the African forms but not with the one-horned Asiatic species, where the two processes completely fuse. Again, another character, though perhaps less important,

<sup>1</sup> Garrod, *Proc. Zool. Soc.* 1873, p. 92; *ibid.* 1877, p. 707. Beddard and Treves, *Trans. Zool. Soc.* xii. 1887, p. 183.

<sup>2</sup> *Proc. Zool. Soc.* 1876, p. 443.

is the sloping backwards instead of forward of the occipital crest in all two-horned species, whether African or Asiatic.

The Asiatic Rhinoceroses have, what the African animals have not, functional incisor teeth throughout life. It has been proposed on these and other grounds to separate generically the African and Asiatic forms.

The Asiatic Rhinoceroses include three well-differentiated species, in all of which the skin is much thrown into folds. *Rh. indicus* is the largest form. It is one horned, and has enormous folds of skin at the neck and hanging over the limbs.

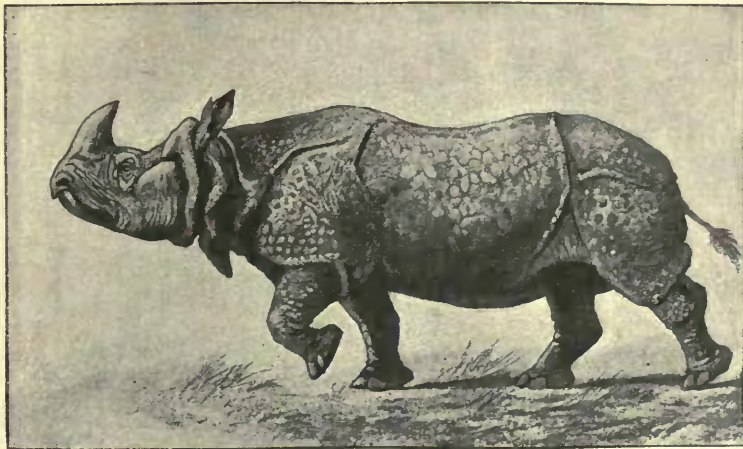


FIG. 130.—Indian Rhinoceros. *Rhinoceros indicus*.  $\times \frac{1}{6}$ .

So like artificial armour is this thick plating, that Albrecht Dürer may be excused for having given the beast the appearance of being actually mail-plated in a sketch which he made of a specimen sent over to the King of Portugal in 1513. This particular beast, one of if not the first sent over to Europe, proved so intractable in disposition that the king sent it as a present to the Pope. But "in an access of fury it sunk the vessel on its passage"! The horn of this and of other species was held until almost our times to have medicinal and other more curious values. So recently as 1763 it was gravely asserted that a cup made of its horn would fall to pieces if poison were poured into it. "When wine is poured therein," wrote Dr. Brookes in the year referred to, "it will rise, ferment, and seem to boil; but when

mixed with poison it cleaves in two, which experiment has been seen by thousands of people." John Evelyn also wrote of a well in Italy which was kept sweet by a Rhinoceros' horn. This species seems to be long-lived, even in captivity; a specimen now to be seen in the Zoological Society's Gardens has been there since the year 1864.

*Rhinoceros sondaicus*, the Rhinoceros of the Sunderbunds, has a much wider range than the last species or Indian Rhinoceros

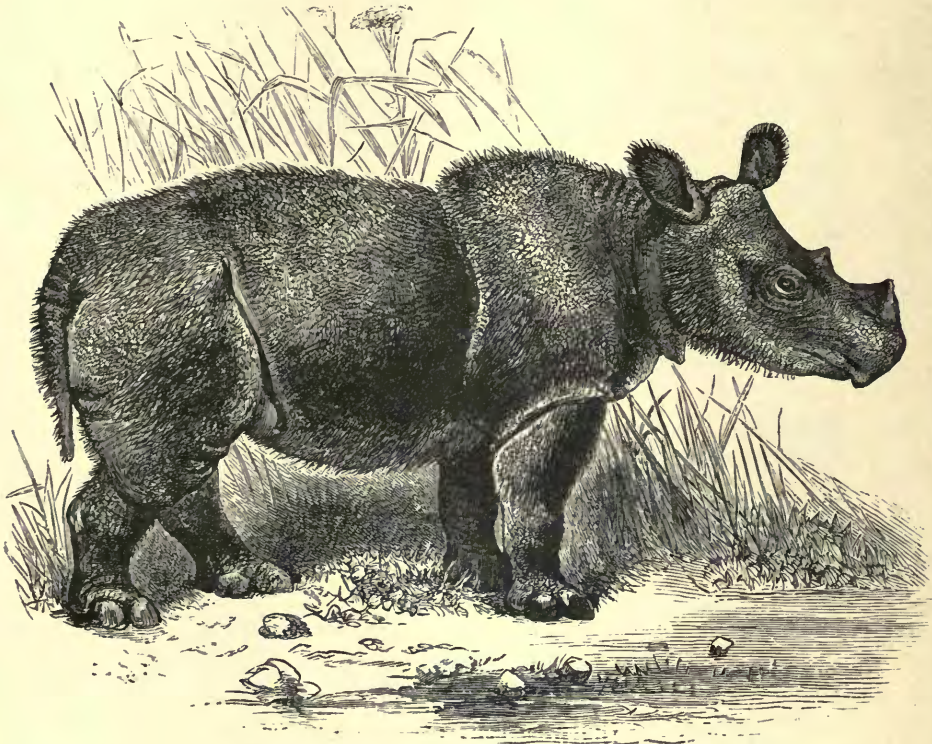


FIG. 131.—Sumatran Rhinoceros. *Rhinoceros sumatrensis*.  $\times \frac{1}{5}$ . (From *Nature*.)

This is unknown out of India itself, and is there limited to a small region; the Sondaic form is found in Bengal and in the Malayan Islands. It is a smaller species, and the armour has a tessellated appearance. The female generally, if not always, is hornless.

The Sumatran species, *Rhinoceros sumatrensis*, is to be distinguished from the last two by its two horns. It is also covered



by a much thicker coat of hairs, which are sometimes blacker and sometimes redder. On account of its two horns it has been proposed to separate it from the other Oriental species into a distinct genus, *Ceratorhinus*. The animal has much the same range as the last species, but extends to Borneo. A variety of this species with hairy ears, from Assam, has been separated as a distinct form, under the name of *Rh. lasiotis*, by Mr. Selater. The animal upon which that species was founded was until quite recently living in the Zoological Society's Gardens.

There are only two certainly-known species of Rhinoceros in Africa. These are the White Rhinoceros (*Rh. simus*) and the

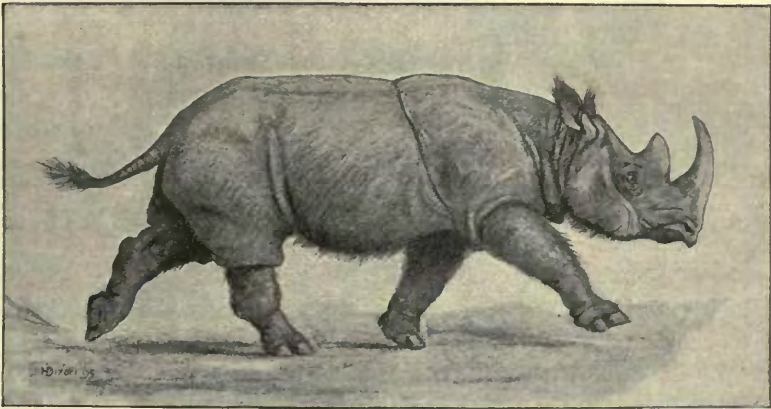


FIG. 132.—Hairy-eared Rhinoceros. *Rhinoceros lasiotis*.  $\times \frac{1}{30}$ .

Black Rhinoceros (*Rh. bicornis*). The origin of the names is not easy to understand, since the "white" animal is, if anything, darker in colour than the Black Rhinoceros. It is stated, however, that in past years the specimens of *Rh. simus* found in the south-west of Cape Colony were "paler and whiter in colour than those in the north-east." At present there are no grounds for distinguishing the species by their colour characters. But they are plainly distinguishable on other grounds. *Rhinoceros simus* has a square upper lip, and in relation to this crops the herbage upon the ground. *Rh. bicornis* has a prehensile upper lip projecting beyond the lower, and in a corresponding fashion feeds principally upon the branches of shrubs. It has been pointed out by Mr.

Coryndon<sup>1</sup> that the calf of *Rh. simus* "always runs in front of the cow, while the calf of *Rh. bicornis* invariably follows its mother." Both animals of course have two horns, and upon the varying proportions of the horns a large number of "species" have been made in the past. It is stated that the longest horn of the "White Rhinoceros" known measures  $56\frac{1}{2}$  inches; while that of

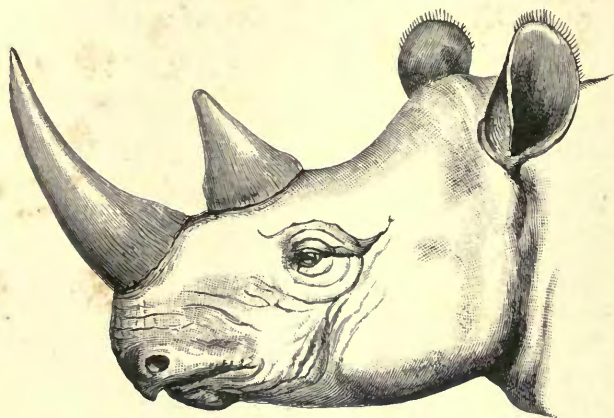


FIG. 133.—Head of *Rhinoceros bicornis*.

*R. bicornis* is shorter, 40 inches being apparently the maximum. But the animal is smaller.

The possible third African species of *Rhinoceros*<sup>2</sup> has been provisionally named after Mr. Holmwood, and is based upon two horns 41 and 42 inches long, which may be abnormal horns of *Rh. bicornis*; but they are thinner and have a smaller pedicel.

**Extinct Rhinocerotidae.**—The existing Rhinoceroses are thus confined to Africa, to certain parts of the continent of Asia, and to some of the large islands lying to the south of that continent. But formerly the genus, and allied genera, had a wider range. As far back as the Miocene we meet with remains of Rhinoceroses closely allied to existing forms. The more ancient forms have, as is natural, more ancient characters. Thus in *Rh. schleiermacheri* of the Miocene, canines appear to have been present. The Miocene *Aceratherium*, primitive in the absence of horns as its

<sup>1</sup> *Proc. Zool. Soc.* 1894, p. 329. See also Mr. Selous' paper in *Proc. Zool. Soc.* 1881, p. 275.

<sup>2</sup> P. L. Selater, *Proc. Zool. Soc.* 1893, p. 514.

name denotes,<sup>1</sup> had also canines and, in one species, six incisors in the lower jaw. This *Aceratherium* had, moreover, four toes in the fore-feet. In the Miocene and later the Rhinoceros existed in Europe and America. There was even a purely northern form, the *Rh. tichorhinus*, which possessed a woolly covering and had the same range as the Mammoth. This Rhinoceros was two-horned.

The post-Pliocene and European *Elasmotherium* was a colossal rhinocerotine creature. This great beast had two horns and a body 15 feet long. Its limbs are not known, and as the teeth are different from those of Rhinoceroses in general, it may not have belonged to this group at all, though Osborn is inclined to derive it from *Aceratherium*, admitting at the same time that the evidence is "decidedly slender." The teeth in fact are like those of a Horse in being hypselodont and prismatic in form. As to the two horns, they were apparently not exactly like those of typical Rhinoceroses; there was an enormous horn posteriorly, supported on a huge boss of bone, and in front of this a roughened spot suggests a smaller or at least a much more slender horn.

It is important to notice that fossil Rhinoceroses belonging to the restricted genus *Rhinoceros* were in Europe invariably two-horned; it is only in India, where they still exist, that one-horned forms are met with in a fossil state.

The Rhinoceroses of America were mostly hornless. *Diceratherium* is an exception; but in many cases it had two parallel not successive horns, and these were, to judge from the slight prominences, but feeble in development, and perhaps hardly exactly comparable with the formidable weapons of the Old-World forms. *Aceratherium tridactylum*, with indications of paired horns, may be ancestral to *Diceratherium*. The American forms have weak and slender nasals in correspondence with the absence of horns; the sagittal crest is retained in contradistinction to the great flattened surface of the skull in the horned Rhinoceroses. *Aceratherium* of both divisions of the globe probably represents the ancestral group of the horned and the hornless forms. This being the case it is highly interesting to note a distinct convergence in the quite

<sup>1</sup> Quite recently, however, a species, *A. incisivum*, preserved at Darmstadt, has been found by Professor Osborn to possess a slight rugosity upon the frontal bones, which probably indicates the presence of a rudimentary horn, and the same author is apparently inclined to place in *Aceratherium* the horned *Teleoceras* (see p. 261).

separate American genera towards the European horned genera. A genus sometimes united with *Aceratherium*, but still differing from it in some points, is *Aphelops* (*Teleoceras*).<sup>1</sup> This animal is more nearly approximated to "the modern standard" of Rhino-

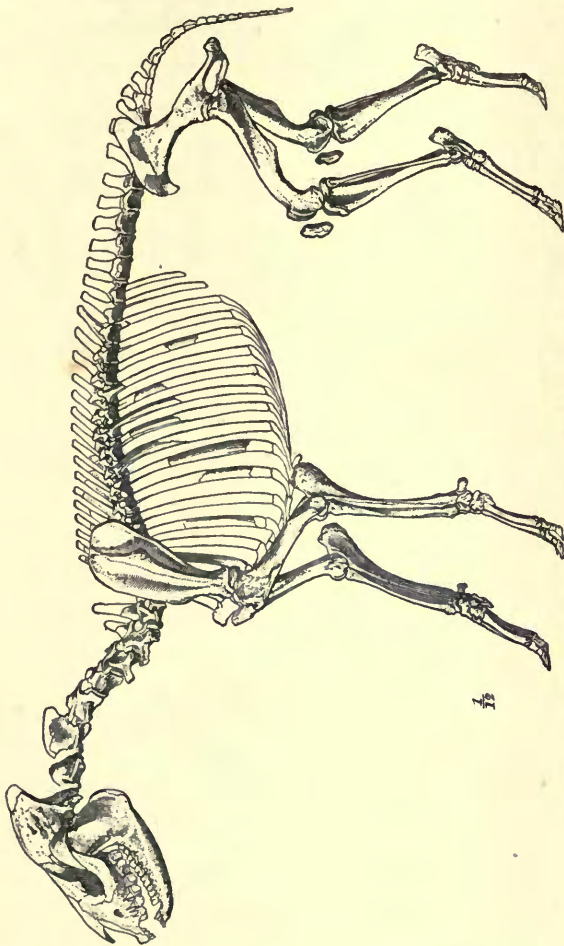


FIG. 134.—Skeleton of *Hyracodon nebrascensis*.  $\times \frac{1}{2}$ . (After Scott.)

ceroses than is its possible ancestor *Aceratherium*. The skeleton in general is more robust, even surpassing that of modern forms, and approaching the *Hippopotamus*. There is a reduction in the upper incisors, which are limited to two pairs, and the lower molars

<sup>1</sup> Osborn, *Bull. Amer. Mus. Nat. Hist.* x, 1898, p. 51.

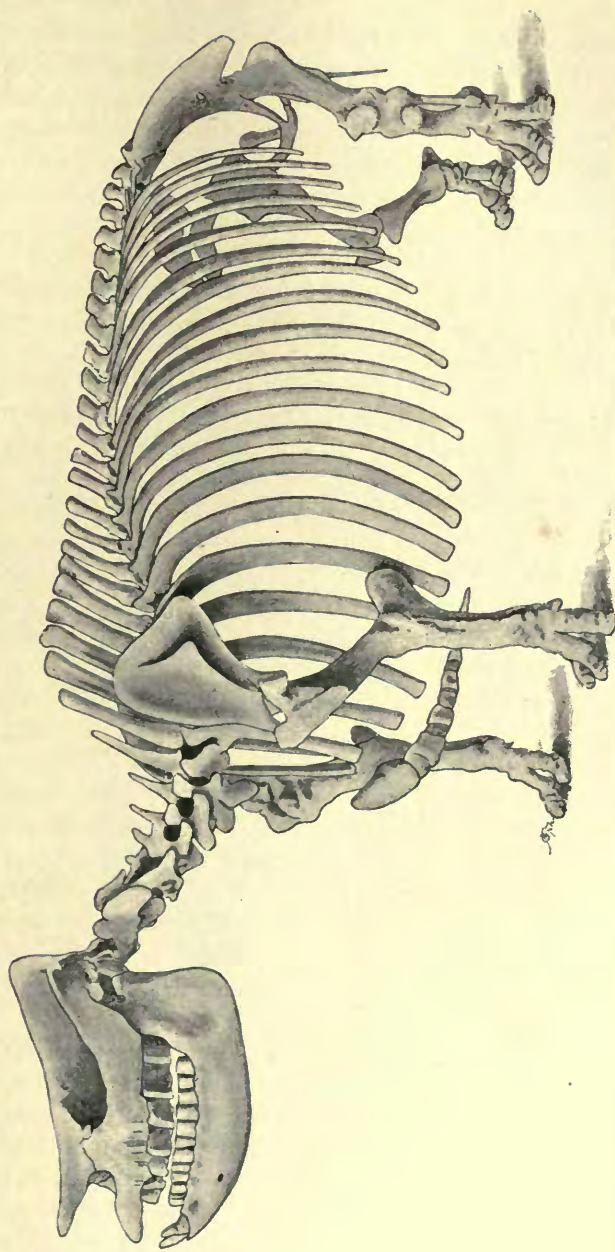


FIG. 135.—Skeleton of *Aphelops* (*Telenceras*) *fossiger*.  $\times \frac{1}{2}$ . (After Osborn.)

are reduced to five. The lower incisors are only two. The sagittal crest is less marked; the fifth digit is reduced to a tiny nodule representing the metacarpus. It had a small nasal horn. There are numerous other details of likeness to modern Rhinoceroses in this creature, which has only community of descent with them from the older hornless forms, such as *Aceratherium* and *Caenopus*. In the genus *Peraceras* the upper incisors are as completely gone as in the living African Rhinoceroses.

The most ancient rhinocerotine types<sup>1</sup> are the Hyracodonts and the Amynodonts. They both date from the Eocene, and became extinct in the succeeding Oligocene. *Hyracodon*<sup>2</sup> (Fig. 134) was "an agile, light-chested, and rather long-necked" type, resembling a Horse in build. There were no horns present, but the hoofs were more like those of the Horses than of the existing Rhinoceroses. These animals were apparently plain dwellers and defenceless, which is held to account for their compact hoofs and outward similarity to a Horse. The genus is Oligocene. The dental formula is  $I \frac{3}{3} C \frac{1}{1} Pm \frac{4}{4} M \frac{3}{3}$ .

It is surmised by Professor Scott that the number of dorso-lumbar vertebrae was twenty-three or twenty-four. The radius and ulna are complete and separate bones, but the latter is somewhat reduced. There are four metacarpal bones, of which, however, the fifth is much reduced. The animal is only three-fingered. The tibia and the fibula are distinct, and show no tendencies towards fusion; but the fibula is much reduced. There are only three metatarsals and three toes. Had this line, which is to be regarded as a side branch of the Rhinoceros stem, not died out, it would probably have resulted, thinks Professor Scott, in monodactyle—very Horse-like types. It is later than the next genus to be described, *Hyrachyus*, of which it is possibly a descendant. An intermediate type, *Triplopus*, appears to bind together *Hyracodon* and *Hyrachyus*.

In *Hyrachyus agrarius* the skull is long and narrow, the facial region being markedly longer than in existing Rhinoceroses. The mastoid portion of the periotic bone is widely exposed upon the outer face of the skull, which is, as has been said, not the case with the existing genus *Rhinoceros*. The dentition is the complete Eutherian dentition of forty-four teeth. The upper

<sup>1</sup> See Osborn, *Mem. American Mus. Nat. Hist.* vol. i. pt. iii. 1898.

<sup>2</sup> Scott, in Gegenbaur's *Festschrift*, ii. 1896, p. 351.

molar teeth are strikingly like those of the genus *Rhinoceros*. The fore-feet are pentadactyle, but functionally tetradactyle;

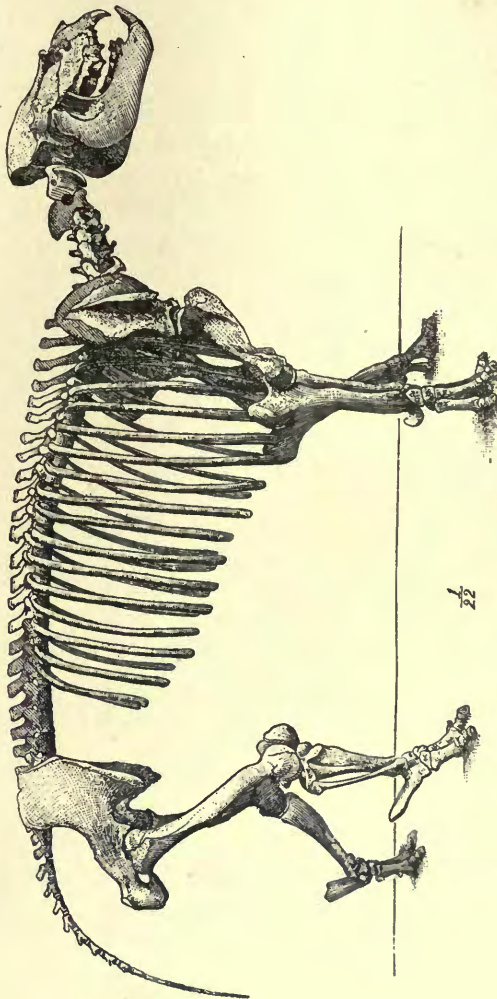


FIG. 136.—Skeleton of *Metamynodon planifrons*.  $\times \frac{1}{2}$ . (After Osborn and Wortman.)

the hind-feet tridactyle. The ulna is less reduced than in *Hyracodon*, and the dorso-lumbar vertebrae are twenty-five.

The Amynodonts were short, heavy types, probably marsh-haunting in habit, and possibly with a proboscis like that of the Tapir. The orbit is higher than it is in the purely terrestrial

Hyracodonts, and it is suggested that when swimming it was raised above the surface as with the Hippopotamus. "This feature," observes Professor Osborn, "with the long curved tusks, undoubtedly used in uprooting, suggests the resemblance between the habits of these animals and those of the hippopotami." There were no horns in the Amynodonts. The face is shorter than in the Hyracodonts, and the mastoid is covered as in recent Rhinoceroses. The canines are very strongly developed into tusks, but the incisors show signs of disappearance. We know of the genera *Amynodon*, *Metamyndon*, and *Cadurcotherium*. All except the last, which is European, are American in range.

**Fam. 4. Titanotheriidae.**—These Oligocene Ungulates, often attaining to large dimensions, are nearly peculiar, so far as is at present known, to the North American Continent, and are at least most abundant in it.<sup>1</sup> Many generic names, such as *Titanotherium*, *Brontotherium*, *Brontops*, *Titanops*, and *Menodus*, have been given to them; but a recent study of the entire material accessible for description or already described has led Professor Osborn to the opinion that there was but a single genus, to which the name *Titanotherium* must be applied. Of this genus there are some thirty well-characterised species, of which the gradual evolution can be traced from the lowest strata of the White River beds where their remains occur. An entire skeleton of *T. robustum* enables us to understand the osteology of these forms and to compare them with other Perissodactyles. This animal was more than 13 feet long, standing some 7 feet 7 inches in height. It seems to have presented during life the aspect of a Rhinoceros with perhaps a touch of Elephant. The skull is not unlike that of a Rhinoceros in general dimensions and shape; but there are a pair of apparent horn cores anteriorly, which are smaller in the more ancient forms and acquire a large size, a forward direction with a divergence of the two in the later forms. A glance at the accompanying figures of skulls (Fig. 137) of early and later Titanotheres will exhibit the changes in this particular which the skulls underwent in the lapse of time occupied by the deposition of these Oligocene beds. The nasals are short in the later, longer in the more early species, such as *T. heloceras* and *T. coloradense*. The zygomatic arch projects much, and is "shelf-like" in the later forms, the skull thus getting an immense breadth, which,

<sup>1</sup> Remains of the genus have been met with in the Balkans.



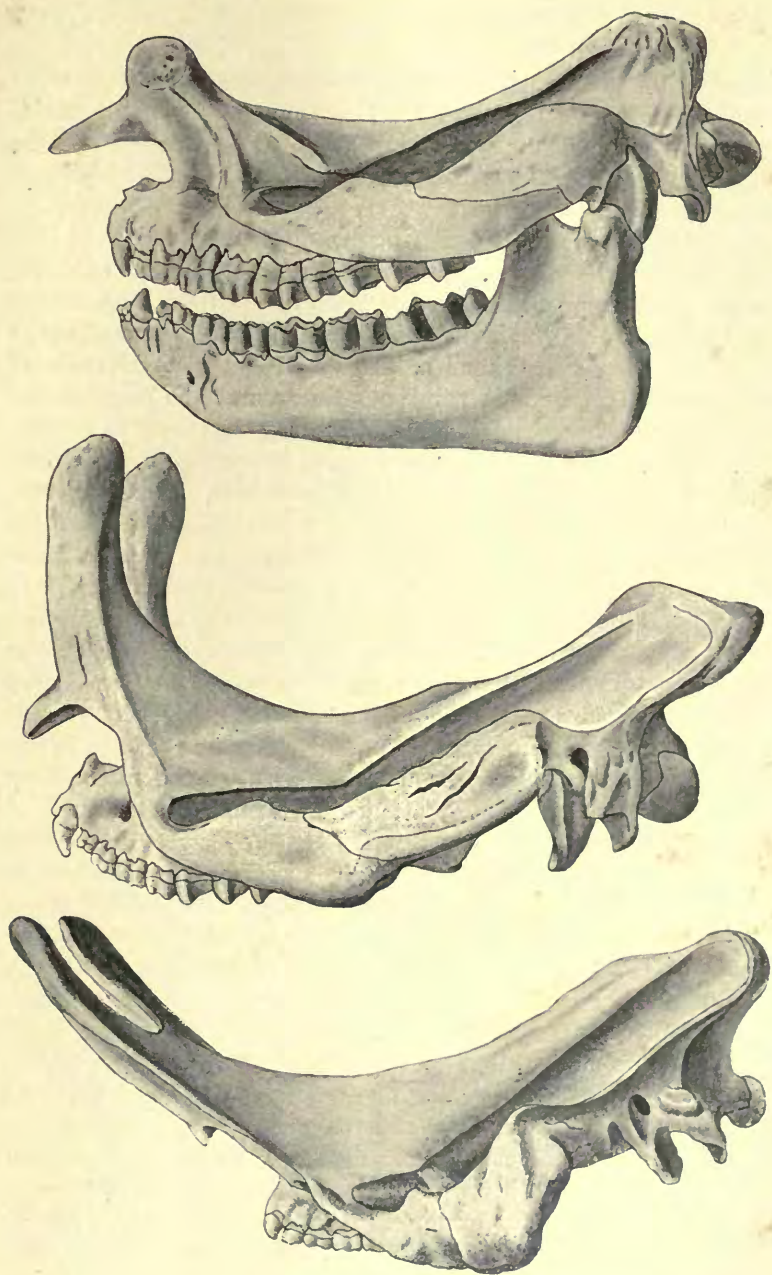


FIG. 137.—Three figures showing the cranial evolution of *Titanotherium*. Upper figure, *T. trigonoceras*; middle figure, *T. elatum*; lower figure, *T. platyceras*. (After Osborn.)

together with the long and divergent horn cores, must have given to the living animal a most bizarre appearance. It is an interesting fact that this animal, though a Perissodactyle, agrees with the Artiodactyla in the nineteen dorso-lumbar vertebrae, of which seventeen bear ribs.

The genus further agrees with the Artiodactyles in the structure of the carpus. The toes of the fore-limb are four, those of the hind-limb three; but while the hind-limb is undoubtedly Perissodactyle in the arrangement of its component parts, the fore-limb shows a hint of an Artiodactyle mode of structure. This limb is paraxonic, the axis of the limb passing between the two middle digits. It may be that this genus represents more nearly than any other Perissodactyle or Artiodactyle the primitive stem from which both have diverged, though, of course, it is not old enough to be very near to the actual ancestor. The molar dentition is the typical one; the incisors seem to vary as to their presence or absence, and, if present, in their numbers. In comparing the older with the more recent forms it is noteworthy that there has been an increase of size exactly as there has been during the evolution of the Camels and some other groups of Ungulates. As already mentioned, the size of the horn cores also increases until it culminates in the extraordinary species, *T. platyceras* and *T. ramosum*, in which these are half as long as the skull, flattened in form, and connected at their bases by a "web" of bone. Arrived at this amount of specialisation the genus *Titanotherium* apparently exhausted its capacities for modification and ceased to be. The many generic names may be explained by sexual differences on the one hand and an incomplete knowledge of connecting links on the other.<sup>1</sup>

*Palaeosyops* is somewhat like a Tapir in build, the skull especially resembling that of the Tapir. As in *Titanotherium* the molar teeth, instead of having an outer wall formed by fused cusps, have a W-shaped outer wall on one side and two or one cusps on the opposite side. It is, moreover, an Eocene form, and in correspondence with its greater age is more primitive in some points of structure, for example, in the absence of horns and in the full dental formula. The fore-limbs are four-toed, the hind

<sup>1</sup> See especially Osborn and Wortman, *Bull. Amer. Mus. Nat. Hist.* vii. 1895, p. 333, and Osborn, *ibid.* viii. 1896, p. 157.

three-toed. It was intermediate between a Tapir and a Rhinoceros in size. It has been shown, too, from casts of the interior of the skull, that the cerebral hemispheres are much less convoluted than were those of *Titanotherium*.

Related to *Palaeosyops* is another primitive Titanother, the genus *Telmatotherium*. This is also Eocene, from the Uinta Basin, the uppermost of Eocene strata. The skull of these creatures was rather elongated, and not unlike that of a Titanother in general aspect. The dentition was complete and the canines not very large. The horns, which acquire so prodigious a development in the later Titanotheres, are just recognisable in at any rate many species of this genus *Telmatotherium*, the name being thus by no means an apt one. Better was that proposed by Dr. Wortman, of *Manteoceras* or "prophet horned." The horns are small elevations upon the frontals just at the junction of these with the nasals, and, indeed, lying partly upon the latter bones. In *T. cornutum* the horns are chiefly borne upon the very long nasals, whose size contrasts with the same bones in the more highly-developed *Titanotherium*. It appears to be quite possible that *Titanotherium* was evolved from the genus *Telmatotherium*.<sup>1</sup>

#### SUB-ORDER 9. LITOPTERNA.

Whether the **Macraucheniidae** should be considered as a separate group of Ungulata is a matter of dispute. Cope placed them in a special order of Ungulates which he called Litopterna. Zittel, on the other hand, regards them as definitely Perissodactyles. One curious point of resemblance to existing Horses is shown—that is the presence of a pit in the incisor teeth. This matter seems to be so important as to need a placing of these forms in the neighbourhood of the Perissodactyles, even of the Equidae; it is so peculiar a character, and apparently so little related to any obvious similarity in way of life, that it seems to mark a special affinity. Not so the fact that in *Macrauchenia* at any rate the orbit was entirely surrounded by bone as in the Horse. We find that condition so frequently acquired in many groups,—a development from an earlier condition where the cavity for the lodgment of the eye is in continuity with the temporal

<sup>1</sup> See Osborn, *Bull. Amer. Mus. Nat. Hist.* vii. 1895, p. 82.

fossa, that it cannot be regarded as anything more than a mark of specialisation. It is, in fact, the case that the *Macraucheniiidae* are in many points specialised, while retaining many primitive features of structure.

The chief primitive features are: the non-alternating positions of the wrist- and ankle-bones; these, of course, interlock in the *Perissodactyles* of to-day and in many extinct families. Then the absence of a diastema in the tooth series, coupled with the presence in *Macrauchenia* of a complete dentition. The small brain may be referred to the same category. *Macrauchenia* must have been a strange-looking animal. It walked upon three toes on each limb; the skull was Horse-like in general form, but the nostrils are removed to a point about as far back as in the Whales or nearly so, the nasal bones being correspondingly reduced. This it is thought argues a proboscis. The humerus is particularly compared by Burmeister<sup>1</sup> to that of a Horse. The radius and ulna though both well developed are fused. The neck is long, and, as in the Camel, the vertebral arteries run inside the neural arches. Since the fore-legs seem to have been rather longer than the hind-legs, though only very slightly, and the neck was long, the animal may have presented some likeness to the Giraffe. It is interesting to note that in the proportions of humerus to ulna this animal is more Lama-like than Horse-like. On the other hand, the proportions of femur to tibia are more Horse-like. The remains of the creature are limited to South America, and to quite superficial deposits. It is evidently a specialised type, and has pursued a course parallel to that of the Horse. Much nearer to the Horse however, but apparently by convergence only, is the genus *Thoatherium*, usually placed in a separate family, the **Protoroetheriidae**. In this creature, which has many archaic characters, the toes are reduced to one in each foot. In an allied form, *Protoroetherium*, we have the two lateral toes diminishing just as in *Anchitherium*.

<sup>1</sup> *N. Acta Acad. Caes. Leop. Car.* xxvii. 1885, p. 238.