AMERICAN MUSEUM OF NATURAL HISTORY.

DEPARTMENT OF VERTEBRATE PALÆONTOLOGY.

REVISED LIST[1] OF CASTS, MODELS, PHOTOGRAPHS, AND RESTORATIONS OF FOSSIL VERTEBRATES.

This Department of the American Museum of Natural History was established in May, 1891, as the Department of Mammalian Palæontology, and was extended to include Vertebrate Palæontology in 1896. The object of the Trustees is to procure a representative collection of the American Fossil Vertebrates from the successive geological horizons of the West for purposes of exhibition, research and publication. The collections are being made readily accessible to students, and placed upon exhibition as rapidly as they are prepared. Such duplicate original specimens as are available for purposes of exchange are offered to other museums.

In order to publish as widely as possible the discoveries of scientific and popular interest and to place the knowledge of them within reach of those unable to visit this Museum, a series of plaster casts of specimens and models, and of photographs of skeletons and restorations has been prepared for sale to, or exchange with, other museums, colleges and high schools.

1. *Plaster Casts of Specimens.* — These are from sharp gelatine moulds, of plaster mixed with gum-arabic, strengthened by embedded rods or wires, carefully finished and accurately colored by a skilled artist, so as to be as nearly as possible fac-similes of the original specimens. The price is based on the actual cost of making, and includes coloring and packing, but not transportation charges. The packing

[1] Revised to January, 1904.

is done in the department, as carefully as possible, but the more delicate casts and models cannot be absolutely guaranteed against breakage.

2. *Models of Extinct Animals.* — These are plaster casts of reduced models (from 1 to 3 feet in length) made by the animal painter and sculptor, Mr. Charles Knight, under direction of Professor Osborn. The casts are made in the same manner as those of specimens and colored under Mr. Knight's personal supervision.

3. *Photographs of Mounted Skeletons of Extinct Animals.* — These are bromide enlargements, 18 x 22 inches, mounted on card, with descriptive labels, from photographs by Mr. Anderson of mounted skeletons in this Museum. These enlargements are not available for purposes of exchange and are sold at $4.00 each.

4. *Photographs of Restorations of Extinct Animals.* — These are bromide enlargements, 18 x 22 inches, on card, with descriptive labels, from photographs of the series of water-color restorations by Charles Knight. These restorations are drawn from the models above mentioned, and in almost every case based upon a careful study of the complete mounted skeleton, made by Mr. Knight under direction of Professor Osborn, and with advice and assistance of other specialists in Vertebrate Palæontology. The bromides are sold at $4.00 each and are not available for exchange.

The models and photographs are copyrighted and are sold upon the express understanding that they are not to be copied or adapted for publication.

Orders should be addressed to the CURATOR.

Payments, either by draft or by postal money-order, should be made to the order of *Treasurer of the American Museum of Natural History.*

HENRY FAIRFIELD OSBORN,
Curator.

W. D. MATTHEW
O. P. HAY
BASHFORD DEAN
Associate Curators.

I. — Casts of Original Fossils and Types.

Casts Nos. 1 and 2. Coryphodon testis (*Cope*).

Fore and Hind Feet.

Am. Mus. No. 258.

This large species of *Coryphodon* was the first described from this country, and is second only to *C. anax* in size. The specimens consist of the left fore and hind feet of the same animal. The casts consist of the 52 podial elements colored

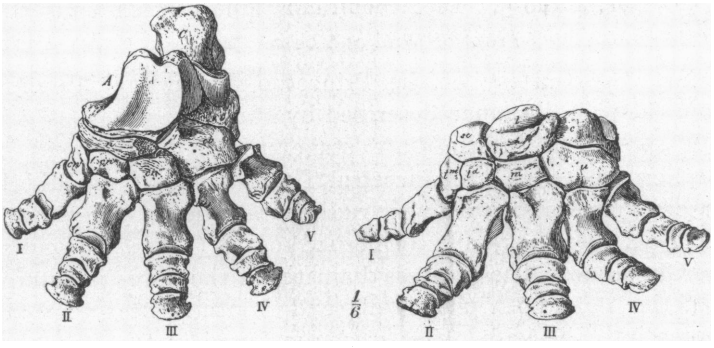


Fig. 1. *Coryphodon testis.* No. 258. Fore and hind feet. One-sixth natural size. Lower Eocene. Wyoming.

and mounted in the natural position upon plaster blocks imitating the matrix. Each piece is complete and can be studied separately.

Price, $20.

Coryphodon radians Cope, Osborn & Wortman, Fossil Mammals of the Wahsatch and Wind River Beds, Bull. Am. Mus. Nat. Hist., 1892, Vol. IV, p. 119; Osborn, A Mounted Skeleton of *Coryphodon radians*, ibid. Vol. X, pp. 81–91.

Coryphodon testis (Cope) Osborn, Evolution of the Amblypoda, Bull. Am. Mus. Nat. Hist., 1898, Vol. X, pp. 189–205.

No. 3. Palæosyops major *Leidy.*

Fore Foot.

Am. Mus. No. 1544.

Cast from the foot of the complete skeleton mounted in the American Museum. This is the characteristic Titanothere of

the Middle Eocene Period (Bridger and Washakie). The foot bones are not cast separately.

The especial interest of the Titanothere fore foot is that it is essentially paraxonic (Artiodactyl) although belonging to a member of the Perissodactyla, with a typically Perissodactyl (mesaxonic) pes. Several other Artiodactyl characters are found in this family, supporting Cope's contention that the Perissodactyla and Artiodactyla should be united in a single order (Diplarthra).

Price, $5.

Nos. 4 and 5. Diplacodon emarginatus *Hatcher.*

Front of Skull and Lower Jaw.

Cast, by courtesy of the Princeton University Museum, from the type specimen described by Hatcher.

It shows the intermediate stage in the development of the horns between the ancestral Titanotheres of the Middle Eocene, hornless or with very rudimentary horns (*Palæosyops* and *Telmatotherium*), and the horned species (*Titanotherium*) of the Oligocene. The greatest diameter of the horns is antero-posterior, and both the nasals and frontals enter to some degree into the base. *Diplacodon* is found in the Upper or True Uinta Beds of the Upper Eocene.

Price, $15.

HATCHER, On a New Species of *Diplacodon*, Am. Nat., 1895, p. 1084, pl. xxxviii.

No. 6. Dromatherium sylvestre *Emmons.*

Type Lower Jaw.

Cast, by courtesy of the Geological Museum of Williams College, from the original.

This classic specimen is the better preserved of the two jaws found by Prof. Ebenezer Emmons in 1854 in the Triassic Coal Beds of Egypt, North Carolina. It is distinguished from the jaw of a reptile by apparently consisting of a single bone, while the teeth begin to show two fangs and multiple cusps prophetic of the mammal type, the Protodonta of Osborn.

Price, $3.

EMMONS, American Geology, Part VI, p. 93.
OSBORN, Proc. Acad. Nat. Sci. Phila., 1886, p. 359.

No. 7. Micronodon tenuirostris *Osborn.*

Type Lower Jaw.

Cast, by courtesy of the Philadelphia Academy of Natural Sciences, from the original there preserved.

This specimen, referred by Emmons to *Dromatherium sylvestre*, was shown by Osborn in 1886 to present important differences, and made the type of a new genus and species. The specimen is so small that the cast is not very perfect in detail.

Price, $3.

No. 8. Periptychus rhabdodon (*Cope*).

Brain Cast.

Am. Mus. No. 3665.

Periptychus, the most abundant quadruped of the Basal Eocene Torrejon Formation, presents a very small brain resembling that of a rabbit.

Price, $1.

No. 9. Pantolambda bathmodon *Cope.*

Brain Cast.

Am. Mus. No. 3957.

The brain of *Pantolambda* was very similar to that of its contemporary *Periptychus*, and gives us the early Amblypod type, ancestral to that of *Coryphodon* and *Uintatherium.*

Price, $1.

10. Giraffe-Camel. Alticamelus altus (*Marsh*).

Hind Limb.

Am Mus. No. 9109.

Upper Miocene (Loup Fork) of Colorado, Am. Mus. Expedition, 1898.

Cast from the hind limb of the specimen in the American Museum Collection. This animal, although a true Camel,

simulated the Giraffe in the extreme elongation of the neck and legs, and equalled it in size, the hind limb being over seven feet long. It is a most instructive example of parallelism, as well in its points of difference from the Giraffe as in the resemblances.

Price, $12.

MATTHEW, Mem. Am. Mus. Nat. Hist., Vol. I, Pt. vii, 1901, p. 429, pl. xxxix.

11. Dissacus saurognathus *Wortman.*

Lower Jaw.

Am. Mus. No. 2454. Type specimen.

Dissacus was the largest and one of the most characteristic Creodonts of the Torrejon horizon of the Basal Eocene. It is believed to have been the direct ancestor of the great *Mesonyx*

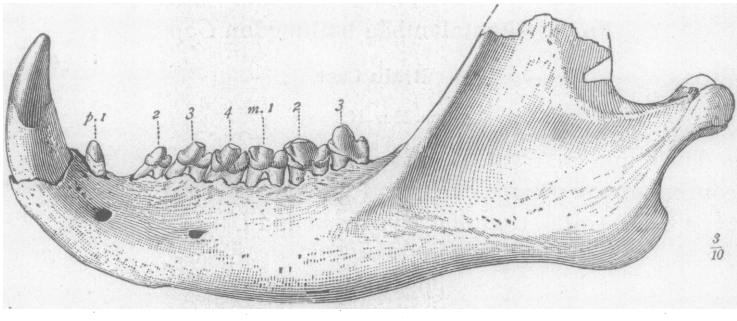


Fig. 2. *Dissacus saurognathus.* Lower jaw. Basal Eocene (Torrejon or Upper Puerco) New Mexico. Three tenths natural size.

of the Middle and Upper Eocene. This very perfect lower jaw, sixteen inches long, is the best specimen of the large species.

Price, $8.

MATTHEW, Bull. Am. Mus. Nat. Hist., 1897, p. 286, fig. 9.

12. Polymastodon taöensis *Cope.*

Lower Jaws.

Am. Mus. No. 968.

A pair of complete rami of the lower jaw. The Multituberculates, a characteristic group of Mesozoic time, reached their culmination in the Puerco or lower horizon of the Basal Eocene, in this species, about the size of a Beaver. The true position of this group of pseudo-rodents is uncertain; they are generally considered, though on very insufficient evidence, to be related to the modern Monotremata.

Price, $6.

OSBORN & EARLE, Bull. Am. Mus. Nat. Hist., 1895, p. 13, fig. 1*c*.

13. Polymastodon attenuatus *Cope.*

Upper Teeth.

Am. Mus. No. 970.

The incisors of one side and premolars and molars of both sides, set in plaster.

Price, $3.

OSBORN & EARLE, Bull. Am. Mus. Nat. Hist., 1895, p. 13, fig. 1*b*.

14. Palæonictis occidentalis *Osborn & Wortman*

Lower Jaws and Front of Skull.

Am. Mus. No. 110. Type specimen.

From the Suessonian (Wasatch) of Wyoming.

This rare and fine specimen, found by Wortman in 1891, supplies another proof of the homotaxy of the Wasatch with the Suessonian of Europe, where the genus is represented by the less perfect specimens preserved in the Paris Museum.

Price, $12.

OSBORN & WORTMAN, Bull. Am. Mus. Nat. Hist., 1892, p. 104, pl. iv.

15. Carnivorous Dinosaur, Allosaurus.

Hind Limb Complete.

Am. Mus. No. 290.

Upper Jurassic (Atlantosaurus or Como beds) of Wyoming, Expedition of 1898.

The limb is seven feet two inches high, as mounted in the natural position, and is almost absolutely complete, the distal

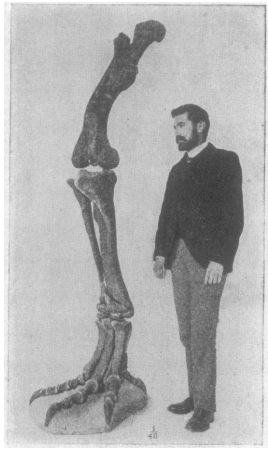


Fig. 3. *Allosaurus* hind limb, from Upper Jurassic of Bone Cabin Quarry, Wyoming.

parts of the fourth digit being perfect, the proximal splint only wanting. Each bone is cast separately—twenty-four pieces in all.

Price, $40.

OSBORN, Bull. Am. Mus. Nat. Hist., 1899, p. 161, figs. 1–4*a*.

16. Patriofelis ferox (*Marsh*).

Fore and Hind Feet.

Am. Mus. No. 1507.

Original from the Bridger or Middle Eocene of Wyoming, Expedition of 1893.

Typical Creodont or Primitive Carnivore foot. Taken from the mounted skeleton in the American Museum Collection.

Displays the broad, spreading foot with blunt, hoof-like claws and very limited play on the joints, common to most of the larger Creodonts. The hind foot is nine inches long.

Price, $10..

OSBORN, *Patriofelis* and *Oxyæna* Re-studied as Terrestrial Creodonts, Bull. Am. Mus. Nat. Hist., XIII, 1900, pp. 269–279.

WORTMAN, Osteology of *Patriofelis*, Bull. Am. Mus. Nat. Hist., VI, 1894, pp. 129–164.

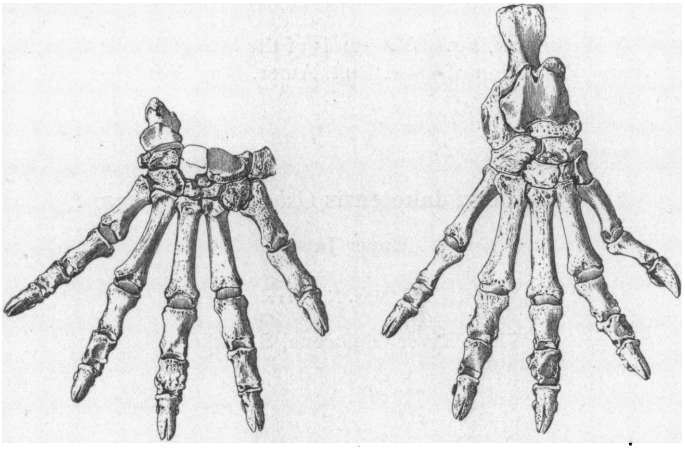


Fig. 4. *Patriofelis ferox* (Marsh). Fore and hind feet. One-fourth natural size.

17–20. Type Specimens of Eocene Tapiroids.

	PRICE.
17. *Desmatotherium guyoti*, upper jaws, type.....	$1.00
18. *Dilophodon minusculus*, lower jaw, type.....	1.00
19. *Isectolophus latidens*, jaw fragments, types.....	1.50
20. *Isectolophus annectens*, jaw fragments, types.....	1.50

Four little-known Tapiroid mammals from the Bridger and Uinta Eocene of Wyoming. The originals are in the Princeton Museum.

SCOTT, *Desmatotherium* and *Dilophodon*, Contributions from the Museum of Princeton College, 1883, p. 51, pl. viii.

SCOTT & OSBORN, The Mammalia of the Uinta Formation, Trans. Amer. Philos. Soc., 1889, pp. 519, etc.

21. Heptodon calciculus *Cope.*

Palate and Complete Lower Jaws.

Amer. Mus. No. 294.

Primitive Lophiodont from the Wind River Eocene of Wyoming. Probably ancestral to the *Colodons* of the American Oligocene.

Price, $7.

OSBORN & WORTMAN, Fossil Mammals of the Wasatch and Wind River Groups, Collection of 1891, Bull. Amer. Mus. Nat. Hist., IV, 1892, p. 127.

22. Colodon dakotensis *Osborn & Wortman.*

Upper Jaws.

Am. Mus. No. 1212.

White River Oligocene, S. Dakota.

Price, $3.

23. Colodon occidentalis (*Leidy*).

Lower Jaws and Fore Foot.

Am. Mus. No. 658.

White River Oligocene, S. Dakota.

This rare Lophiodont is known only by fragmentary specimens. The group is intermediate between Tapirs and Horses in some respects, between Tapirs and Rhinoceroses in others. It left no descendants.

Price, $5.

OSBORN & WORTMAN, Perissodactyls of the Lower Miocene White River Beds, Bull. Amer. Mus. Nat. Hist., VII, 1895, p. 362, fig. 7.
WORTMAN & EARLE, Ancestors of the Tapir from the Lower Miocene of Dakota, Bull. Amer. Mus. Nat. Hist., V, 1893, p. 174, figs. 6 and 7.

24. Systemodon primævus *Wortman.*

Palate and Lower Jaw.

Am. Mus. Nos. 144 and 131.

Suessonian (Wasatch Beds) Wyoming.

Systemodon is the starting point, as far as known, of the Tapir line, and strikingly resembles in most respects the contemporary ancestors of the Horse (*Hyracotherium*, etc.).

Price, $4.

OSBORN & WORTMAN, Fossil Mammals of the Wasatch and Wind River Beds, Collection of 1891, Bull. Amer. Mus. Nat. Hist., IV, 1892, p. 125, fig. 17.

WORTMAN, Species of Hyracotherium, etc., Bull. Amer. Mus. Nat. Hist., VIII, 1896, p. 87, fig. 3.

25. Protapirus validus *Hatcher.*

Skull.

Type specimen (Original in Princeton Museum).

Protoceras Beds, White River Formation (Oligocene), S. Dakota.

Price, $7.

HATCHER, Recent and Fossil Tapirs, Amer. Jour. Sci., I, 1896, p. 162, pl. ii.

26. Protapirus obliquidens *Wortman & Earle.*

Lower Jaws and Fore Foot.

Am. Mus. Nos. 661 and 662.

Protoceras Beds, White River Formation (Oligocene), S. Dakota.

Protapirus is intermediate between the modern Tapirs and their primitive Eocene ancestors (*Systemodon* and *Isectolophus*).

Price, $6.

WORTMAN & EARLE, Ancestors of the Tapir from the Lower Miocene of Dakota, Bull. Amer. Mus. Nat. Hist., V, 1893, p. 165, figs. 2, 3, 4.

27. Oreodon culbertsoni *Leidy.*

Fore and Hind Foot.

Am. Mus. No. 1287. Cast from the mounted skeleton in the American Museum.

Oreodon Beds, White River Formation (Oligocene), S. Dakota.

Shows a very primitive Artiodactyl foot, the fore foot still retaining a rudimentary thumb, and the lateral digits being less reduced than in any of the more recent Artiodactyls.

Price, $6.

Scott, W. B., Beiträge zur Kenntniss der Oreodontidæ, Morph. Jahrb., 1890, pp. 328, 334, pl. xvi, figs. 27, 28.

28. Hyænodon horridus *Leidy.*

Fore and Hind Foot.

Am. Mus. No. 1375. Cast from the mounted skeleton in the American Museum.

Oreodon Beds, White River Formation (Oligocene), S. Dakota.

Hyænodon was the latest and most specialized of the Creodonts or Primitive Carnivores, and the feet are adapted for running, although not so well as in the modern swift-footed Carnivora.

Price, $7.

Scott, W. B., The Osteology of *Hyænodon*, Journ. Acad. Nat. Sci. Phila., Vol. IX.

29. Series of Fossil Horse Feet.

Illustrating the Evolution of the Horse.

The Horses afford the best illustration of the evolution of a race of animals during geological time, commencing in the Lower Eocene as small fox-like animals with several toes on each foot, and ending with the modern Horses, Asses, and Zebras. At least ten intermediate stages are known in the direct line of descent, besides several stages of collateral branches, leading into types which have left no modern descendants. Those of which casts are now ready are:

Stage *b*.—*Hyracotherium craspedotum*. Fore and hind feet. Middle Eocene (Wind River), Wyoming. Four toes and a rudiment of a fifth (1st digit) on the fore foot, three toes on the hind foot. Size of a fox. *Price, $4.*

Stage *e*.—*Mesohippus bairdi*. Fore and hind feet. Lower Oligocene (White River), S. Dakota. Three toes on fore and hind foot, the fourth (5th digit) represented on the fore foot by a short "splint-bone." Lateral toes much reduced, but still touching the ground. Size of a prairie wolf. *Price, $4.*

Stage *f'*.—*Mesohippus intermedius*. Fore and hind feet. Upper Oligocene (White River, Protoceras Beds), S. Dakota. Like *M. bairdi*, but larger. *Price, $5.*

Stage *f''*.—*Mesohippus copei*. Hind foot. Upper Oligocene (White River, Protoceras Beds), S. Dakota. Larger than *M. intermedius*. *Price, $3.*

Stage *h''*.—*Hypohippus equinus*. Fore and hind feet. No. 8407 Middle Miocene (Loup Fork), Colorado. Larger than any of the preceding species; size of Shetland pony. Fifth digit of the fore foot reduced to a little nodular rudiment. Side toes still touch the ground. *Price, $12.*

Stage *i'''*.—*Merychippus sejunctus*. Fore and hind feet. Middle Miocene, Colorado. Fifth digit of fore foot a small nodular rudiment, side toes much reduced, not reaching the ground. Size of 3-months-old colt. *Price, $10.*

Stage *j'''*.—*Neohipparion whitneyi*. Fore and hind feet. Upper Miocene (Loup Fork), S. Dakota. Feet and limbs elongate, proportions like those of the deer. Side toes more reduced than in *Merychippus*, size somewhat larger. *Price, $12.*

30. Series of Fossil Horse Skulls.

Illustrating the Evolution of the Horse.

(Stages corresponding with those in No. 29.)

Those now ready are:

Stage *c*.—*Protorohippus venticolus*. Crushed skull and jaws. No. 4832. From mounted skeleton in Cope Collection. Middle Eocene (Wind River), Wyoming. Short-crowned teeth of primitive pattern. Size of fox. *Price, $4.*

Stage *e*.—*Mesohippus bairdi*. Skull and jaws. No. 1477. From Lower Oligocene (Oreodon Beds, White River), Nebraska. Short-crowned teeth of more horse-like pattern. Size of prairie wolf. *Price, $8.*

Stage *h''*.—*Hypohippus equinus*. Skull and jaws. No. 8407. From Middle Miocene (Loup Fork) of Colorado. Teeth much like those of *Mesohippus*. Size of Shetland pony. *Price, $15.*

Stage *i'''*.—*Merychippus sejunctus*. Skull and jaws. No. 8291. Cope Collection. Middle Miocene (Loup Fork) of Colorado. Long-crowned teeth with cement. Pattern intermediate between *Mesohippus* and *Equus*. Size of 3-months-old colt. *Price, $15.*

31. Pantolambda bathmodon *Cope.*

Fore and Hind Feet.

From mounted skeleton in American Museum. No. 2549.

Torrejon Formation (Basal Eocene) of New Mexico.

Primitive ungulate foot, with five toes, first digit semi-opposable, plantigrade step, wide, loosely joined wrist and ankle-bones (giving much flexibility in all directions at the expense of power), and other characters now preserved chiefly among arboreal mammals. The foot approaches nearly those of the more ancient unguiculates or clawed animals. *Pantolambda* was ancestral to the ancient *Amblypoda* (*Coryphodon* and *Uintatherium*), but only a collateral ancestor of the more recent hoofed animals.

Price, $5.

Osborn, Evolution of the Amblypoda, Bull. Am. Mus. Nat. Hist., X, 1898, pp. 183–188, figs. 9, 10, 12.

32. Series of Fossil Camel Feet.

Illustrating the Evolution of the Camels and Llamas.

Although now found only in the desert regions of Asia, Africa, and South America, the Camel family was of North American origin, spreading to other continents only in the Pliocene epoch, and becoming extinct in its original home

during the Pleistocene. During the Tertiary the race evolved from small deer-like animals, no larger than jack-rabbits, with sharp, pointed hoofs and separate metapodial bones, to their present size and proportions, the metapodials becoming solidly fused together and a large pad on the foot supporting the weight of the body. Collateral lines of descent also existed, one ending in an animal of singularly giraffe-like proportions, although a true Camel (Giraffe-Camel, see also No. 10, on page 5).

Stage *a*. — *Protylopus petersoni.* Hind limb. No. 2564. Upper Eocene (Uinta), Utah. Separate metapodials, lateral digits represented by short splints, pointed hoofs. Size of jack-rabbit. *Price, $5.*

Stage *b*. — *Poëbrotherium wilsoni.* Fore and hind feet. No. 1364. Lower Oligocene (White River), S. Dakota. Separate metapodials, lateral digits represented by small nodular rudiments, pointed hoofs. Size of vicuña. *Price, $5.*

Stage *e'*. — *Protolabis montanus.* Fore and hind feet. No. 9108. Middle Miocene (Loup Fork), Colorado. Separate metapodials, lateral rudiments fused, hoofs pointed. Size of llama. *Price, $6.*

Stage *f''*. — *Alticamelus altus.* (Giraffe-Camel.) Hind limb. No. 9109. Middle Miocene (Loup Fork), Colorado. United metapodials, greatly elongated, hoofs considerably reduced. Size of small giraffe. *Price, $12.*

33. Protoceras celer *Marsh.*

Fore and Hind Foot.

Protoceras Beds, White River Oligocene, S. Dakota.

Protoceras is the largest of a peculiar group of primitive ruminants characteristic of the White River Oligocene. The fore foot has four fully functional digits, but in the hind foot the lateral digits are reduced to small splints. The animal was somewhat smaller than the musk deer, much less

gracefully proportioned, the skull remarkably specialized in the male.

Price, $5.

SCOTT, Osteology and Relations of *Protoceras*, Jour. Morph., Vol. XI.
OSBORN & WORTMAN, Characters of *Protoceras*, etc. Bull. Amer. Mus. Nat. Hist., IV, 1892, pp. 351–372.

34. Type Specimens of Fossil Equidæ.

	PRICE.
Equus complicatus Leidy. Upper molar. Pleistocene.....	$2.00
" *excelsus* Leidy. Upper jaw. "	4.00
" *occidentalis* Leidy. Upper molars. "	2.00
" *pectinatus* Cope. Upper teeth, series. "	5.00
Hipparion speciosum Leidy. Upper teeth. Miocene.....	3.00
" *affine* Leidy. " "	3.00
" *occidentale* Leidy " "	3.00
" *gratum* Leidy " "	2.50
" *montezumæ* Leidy. Upper and lower tooth. Miocene.....	2.00
Merychippus mirabilis Leidy. Upper jaw. Miocene.....	3.00
" *insignis* Leidy. " "	3.00
Parahippus cognatus Leidy. Upper teeth, "	2.50
Parahippus (*Desmatippus*) *crenidens* Scott. Upper and lower jaws. Miocene.....	6.00
Anchippus texanus Leidy. Upper molar. Miocene.....	1.50
Hypohippus affinis Leidy. " "	1.50
Hypohippus (*Anchitherium*) *equinus*. Upper and lower jaws. Miocene.....	6.00
Mesohippus bairdi Leidy. Figured skull and jaws. Leidy, 1869, pl. xx. Oligocene.....	5.00

The patterns of the molars in the above type specimens have been copied with especial care and accuracy on the casts.

35. Phenacodus primævus *Cope.*

Fore and Hind Feet.

Wasatch Formation, Lower Eocene, Wyoming.

The mounted skeleton of *Phenacodus* in the Cope Collection (now in the American Museum) is well known by descriptions

and figures in all textbooks of geology and palæontology. *Phenacodus* is the type of the Condylarthra, a very archaic order of ungulates retaining the primitive form of wrist and ankle articulations, five toes on each foot, and pig-like teeth, and considered to represent very nearly the central prot-ungulate type from which all hoofed animals are descended. The size of *P. primævus* was somewhat less than that of a pig.

Price, $10.

COPE, E. D.,Tertiary Vertebrata, Rep. U. S. G. S. Terrs., Vol. III, B'k I, p. 435, and plates.

OSBORN, H. F., Remounted Skeleton of *Phenacodus*, Bull. Am. Mus. Nat. Hist., X, 1898, pp. 159–164.

36. Euprotogonia puercensis (*Cope*).

Hind Foot.

Torrejon Formation, Basal Eocene, New Mexico.

Euprotogonia was the ancestor of *Phenacodus*, and has a still more primitive type of foot. The five toes are tipped with narrow, claw-like hoofs, and in other characters this foot is

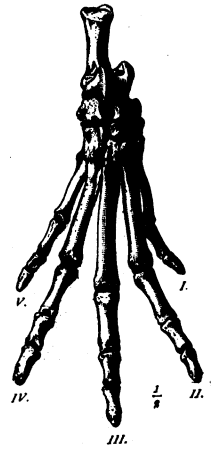


Fig. 5. *Euprotogonia puercensis.*
Hind foot. One-half natural size.

intermediate between the hoofed animals (Ungulata) and clawed animals (Unguiculata), and indicates the derivation

of both from a common ancestor. This species was about the size of a cat, and the cast is taken from an incomplete skeleton in the American Museum.

Price, $4.

MATTHEW, Revision of the Puerco Fauna, Bull. Amer. Mus. Nat. Hist., XI, 1897, p. 305, fig. 12.

OSBORN, Remounted Skeleton of *Phenacodus*, Bull. Amer. Mus. Nat. Hist., X, 1898, p. 159.

37. Stereosternum tumidum *Cope.*

Skeleton.

Upper Permian, near São Paulo, Brazil.

This beautifully preserved skeleton is one of the most ancient and primitive reptiles known, and represents a distinct and very primitive order of Reptilia, the *Proganosauria*, with many characters connecting it with the Amphibia. Skeleton in block, about two feet long, showing all parts except the left fore and hind feet, and with the outlines of the body indicated. By courtesy of the Director of the Geological Survey of Brazil.

Price, $15.

COPE, Contribution to the Vertebrate Palæontology of Brazil, Proc. Am. Phil. Soc., XXIII, 121, 1885; The Carboniferous Genus *Stereosternum*, Amer. Nat., 1887, 1109.

OSBORN, Memoirs Am. Mus. Nat. Hist., Vol. I, Pt. VIII, p. 481, figs. 15–19, and pl. xl, Nov., 1903.

II.—CASTS OF MODELS OF EXTINCT VERTEBRATES BY CHARLES KNIGHT.

Originals presented by J. Pierpont Morgan, Esq.

No. 1. Three-horned Frill-necked Dinosaur. Triceratops prorsus *Marsh.*

The original model was made by Mr. Knight for the National Museum, under direction of Mr. Lucas, and is based on parts of several skeletons there preserved.

Triceratops was one of the last and most remarkably specialized of the Dinosaurs. It was herbivorous, quadrupedal, with elephant-like legs and feet. The skull was of huge size, 6–8 feet long, with long, powerful horns projecting forward, and a great bony frill projecting backward and completely covering the neck. One-tenth natural size. Length of base, 18 inches.

Price, $20.

No. 2. The Duck-billed Dinosaur. Hadrosaurus mirabilis *Leidy.*

The model of this remarkable Dinosaur is based on an almost complete specimen in the Cope Collection, now in this Museum, which will shortly be placed on exhibition as a mounted skeleton. It was found in the Laramie Cretaceous by Messrs. Wortman and Hill, and described by Professor Cope (under the generic name *Diclonius*) in 1883. The animal was thirty feet in length, with a long neck, flattened, duck-like bill, numerous small teeth, small fore limbs, and heavy hind limbs and tail. It was probably of amphibious habits, feeding on soft water-plants. It was covered with a thick, rhinoceros-like hide, parts of which are preserved in Professor Cope's specimen. One-eleventh natural size; length of base, 12 inches.

COPE, Proc. Acad. Nat. Sci. Phila., 1883, p. 97; Am. Nat., 1883, p. 774.

Price, $10.

No. 3. Leaping Carnivorous Dinosaur. Dryptosaurus (Lælaps) aquilunguis *Cope.*

The first Dinosaur described by Professor Cope was *Lælaps aquilunguis* from the New Jersey Cretaceous beds. The model is based upon this fragmentary skeleton and upon the restoration by Professor Marsh of the allied form *Ceratosaurus*.

The Carnivorous Dinosaurs, although smaller than some of the herbivorous kinds, were animals of great size. This species

was about fifteen feet long. According to Professor Cope's views, by which Mr. Knight was chiefly guided in making this and the following restoration, the animal was an active and powerful leaper, and the model, representing two fighting *Lælaps*, carries out this conception. One-seventh natural size. Length of base, 18 inches.

COPE, Proc. Acad. Nat. Sci. Phila., 1866, p. 275; Proc. Amer. Philos. Soc., XXX, p. 240, May, 1892.
MARSH, Dinosaurs of North America, pp. 157–163, pl. xiv.

Price, $20 (2 figures, complete).

No. 4. Naosaurus claviger *Cope.*

From the Permian Beds of Texas. This belongs to the primitive Reptilian order *Pelycosauria* of Cope, but represents a highly specialized side-branch, related to the *Rhynchocephalia* or *Proganosauria* as shown by Baur and Case. The precise object of the extraordinary rigid fin on the back is not known; it was humorously suggested by Cope that it might have been used as a sail. It was, perhaps, chiefly ornamental. Different species of Naosaurs reach from three to ten feet in length, and the dorsal fin reaches a length even greater than that shown in the model. One-fifth natural size. Length of base, 12 inches.

COPE, Proc. Amer. Phil. Soc., 1878, p. 510, and subsequent papers.
BAUR & CASE, Morphology of the Skull of the Pelycosauria, Anatom. Anzeiger, Bd. XIII, p. 109, Jena, 1897.

Price, $12.

No. 5. Cervalces americanus (*Harlan*).

This Pleistocene American Elk was of the size and proportions of the living Moose, but had horns almost as large as those of the Extinct Irish Deer of Europe, and expanded in three planes of growth at right angles to each other. The model is based on a remarkably perfect skeleton found in New Jersey and mounted in the Princeton University Museum.

This skeleton was fully described by Professor Scott, in 1885, as possessing characters intermediate between those of the

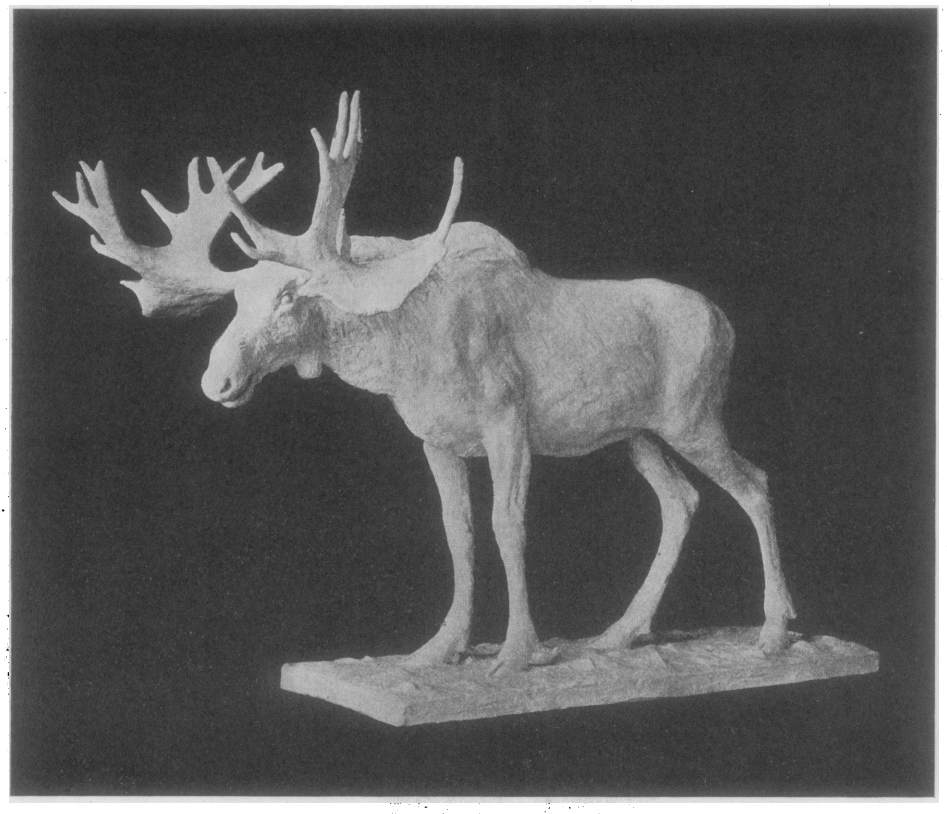


Fig. 6. *Cervalces americanus.* Modelled by Charles Knight from the fossil skeleton in Princeton Museum.

deer and moose. One-fourth natural size. Length of base, 24 inches.

Scott, Proc. Acad. Nat. Sci. Phila., 1885, p. 191. *Price, $30.*

No. 6. Long-horned Titanothere. Brontotherium platyceras (S. & O.).

Based on the mounted skeleton and skulls in the American Museum, and on the monographic studies of the Titanotheres by Professor Osborn.

The model represents a charging Titanothere, and illustrates a chief use of the great horns developed in these animals. One-eighth natural size. Length of base, 25 inches.

Price, $20.

No. 7. Series of Heads of Titanotheres.

This series of five heads represents the evolution and polyphyletic development of the Titanotheres during the Lower Oligocene.

a. *Brontotherium platyceras,*
b. *Megacerops robustus,*
c. *Titanotherium ingens,*
d. *Symborodon acer,*
e. *Diplacodon emarginatus.*

One-sixth natural size.

Price, $5 each; for the set, $20.

No. 8. Restored Head of Dinocyon. Dinocyon gidleyi *Matthew.*

Upper Miocene Epoch, Texas. One-fourth natural size.

Based on the skull and jaws in the American Museum. This gigantic dog equalled the polar or Kadiak bear in size, and resembled them in many external characters. One-fourth natural size.

Price, $5.

No. 9. Sabre-tooth Tiger. Smilodon.

This restoration model is based on a complete mounted skeleton of *S. necator* in the American Museum.

Smilodon, of the Pleistocene epoch, was the latest and largest of the Sabre-tooth Tigers, equalling a polar bear in size, and provided with canines which projected seven inches from the jaw. It ranged through the New World from Canada to Patagonia, and probably preyed on the great ground sloths or other gigantic herbivora of the Tertiary Period, to pierce whose thick hide and heavy fur the enormous canines were well adapted. One-sixth natural size. Length of base, 14 inches.

Price, $15.

III. — Photographs of Mounted Skeletons.

Bromide enlargements from the original negatives. Size, 18 in. x 22 in.

These photographs are taken from the fossil vertebrates in the American Museum, as an exhibition of the Succession of Vertebrate Life in North America. Other skeletons are in various stages of preparation, photographs of which will be added to this series.

The skeletons show the actual form, proportions, and attitudes of these extinct animals as nearly as they can be determined or the preservation of the specimen permits.

The photographs also exhibit the different methods employed in mounting, each method being adapted to the special condition of the fossil. For example, *Cœnopus tridactylus*, No. 11, and *Tylosaurus*, No. 14, are cases where a LOW RELIEF mounting was necessary. *Amynodon*, No. 18, is an instance of the HIGH RELIEF mounting. In some cases the matrix is wholly or partly the original rock in which the fossil was found; in others it is a close imitation of it, made partly by mingling the rock with plaster, thus giving the visitor and student a truer conception of the original embedding. Other animals are mounted in FULL RELIEF, like a recent skeleton, with the aid of concealed, or partly concealed, iron rods. Except when abundant duplicate material is available, each bone is made easily removable for purposes of study, fastened to its mountings by wire ties or by concealed screws and bolts. The mounting is under the direction of the Curator and of Mr. Adam Hermann, Preparator.

Price of the photographs, $4 each.

1. **Metamynodon planifrons** *Scott & Osborn.*

Am. Mus. No. 546.

This aberrant rhinoceros of the Oligocene epoch was discovered by Garman and described by Scott and Osborn in 1887. The mounted skeleton is a composite from materials obtained by the Amer. Mus. Expeditions of 1892 and 1894 in

the Big Badlands of South Dakota. Its length is 9 ft. 7 inches. The general impression is of a very broad, flat skull, with formidable canine tusks; small, but prominent and greatly elevated eye-sockets, and a very broad chest. The fore and hind limbs are quite powerful, but the metapodials are rather slender, especially in the manus. This animal is widely separated from the true Rhinoceros by its four completely functional digits on the fore foot and by the strong development of the canines.

OSBORN & WORTMAN, Perissodactyls of the Lower Miocene, White River Beds, Bull. Am. Mus. Nat. Hist., VII, 1895, pp. 373–375, pll. x, xi.

2. Brontotherium, sp.

Am. Mus. No. 518.

This skeleton represents the largest size and the last stage in the evolution of the Titanotheres, and was discovered by the American Museum Expedition of 1892 in the Upper Titanotherium Beds of South Dakota, absolutely complete as far back as the border of the pelvis. The hind limbs, belonging to different animals, but of the proper proportions, were secured in the same regions of the West in the summer of 1894.

The complete skeleton, about 7 feet 7 inches (M. 2.31) high; 13 feet 8 inches (M. 4.17) long, and 3 feet 10 inches (M. 1.17) broad, probably belongs to an adult female, as we judge from the imperfect development and ossification of the horns, which in males of this period are very long and powerful. An interesting feature of the skeleton is an exostosis and false joint in the centre of the seventh rib, undoubtedly an after-result of fracture.

OSBORN & WORTMAN, *loc. cit.*, pp. 346–352, pll. viii, ix.

3. Hyrachyus agrarius *Leidy*.

Am. Mus. No. 5065.

This is the original skeleton discovered by Professor Cope himself in his explorations in the Bridger Basin (Middle

Eocene) in 1873, and was mistakenly referred by him to *H. eximius*. It was mounted as found, with an incomplete skull, and so figured by Cope in 'The Tertiary Vertebrata.' The American Museum Expedition of 1893 secured a complete skull belonging to this species, and of the proper size, which has been affixed to the skeleton. In order fully to expose the bones, and correct several errors in the original mounting, the entire animal was taken apart and remounted, as here photographed. The animal was about as large as a sheep, and is the oldest known type of Rhinoceros, more directly ancestral to the Hyracodon or Cursorial Rhinoceros of the Oligocene.

COPE, Tertiary Vertebrata, U. S. Geol. and Geog. Sur. Terr's, F. V. Hayden in charge, Final Report, Vol. IV (1885), pp. 657–677, pll. liv, lv, lv*a*, etc.

OSBORN & WORTMAN, Perissodactyls of the White River Beds, Bull. Am. Mus. Nat. Hist., VII, 1895, pp. 367–371.

4. Patriofelis ferox (*Marsh*).

Am. Mus. No. 1507.

This animal was originally described by Leidy from a fragment of the lower jaw. The American Museum Expedition of 1893 procured the complete skeleton, represented in two different animals, in which the skull alone was in an imperfect fragmentary condition, and the teeth, unfortunately, entirely wanting. This animal was as large as a jaguar, and exhibits short, powerful, highly flexed limbs, widely spreading clawed feet, heavy backbone, very deep sagittal crest and small brain case. It is a typical Middle Eocene Creodont, with highly specialized cutting teeth.

WORTMAN, The Osteology of *Patriofelis*, Bull. Am. Mus. Nat. Hist., VI, 1894, pp. 129–164, pl. i.

OSBORN, *Oxyæna* and *Patriofelis* Re-studied as Terrestrial Creodonts, Bull. Am. Mus. Nat. Hist., XIII, 1900, pp. 269–279, pll. xviii, xix.

5. Protorohippus venticolus (*Cope*).

Am. Mus. No. 4832.

This is the famous skeleton described by Cope in 'The Tertiary Vertebrata,' as the four-toed Lower Eocene Horse.

It was found by Dr. J. L. Wortman in the Wind River Beds of Wyoming (Middle Eocene). Since its purchase by the American Museum the entire skeleton has been taken apart and remounted as a walking animal; in the original mounting the animal was represented as pacing. The skeleton is far from perfect, the limbs upon the left side being largely restored, while those upon the right side are complete. The ribs are entirely restored, as is the pelvis. In the remounting of the skeleton these missing parts were studied from the corresponding bones in the well-known form *Mesohippus*.

COPE, Tertiary Vertebrata, pp. 635–647, pl. xlix *a*, *b* and *c*.
WORTMAN, Species of *Hyracotherium* and allied Perissodactyls from the Wahsatch and Wind River Beds of North America, Bull. Am. Mus. Nat. Hist., VIII, 1896, pp. 81–110.

6. Hoplophoneus primævus *Leidy*.

Am. Mus. No. 1406.

The skeleton was procured by the American Museum Expedition of 1894 in the Oreodon Beds of South Dakota, and is one of the most complete fossil skeletons ever found. The only parts missing were some of the processes and spines of a few vertebræ. This animal is characterized by powerful canines protected by a heavy flange upon the lower jaw, and is considered the ancestor of the great Sabre-tooth Tiger *Smilodon*.

RIGGS, Restoration of *Hoplophoneus occidentalis* Leidy, Kan. Univ. Quar., V, 1896, pp. 37–52, pl. i.

7. Palæosyops major *Leidy*.

Am. Mus. No. 1544.

Palæosyops was one of the first fossils found in the Eocene deposits of the Western States. Materials for this mounted skeleton were secured with great difficulty by the American Museum Expeditions of 1893 and 1895 in the Bridger and Washakie Beds of Wyoming. The skull, fore limbs and foot, and a large part of the vertebral column and ribs belong to a single skeleton, and the parts associated with these were put

together after being positively determined as belonging to this species, and as representing individuals of corresponding age. The skeleton is thus believed to represent accurately the original, and there is little restoration, except in the head of the femur. This species is distinguished by the convexity of the forehead, and by the low, flattened cones of the molar teeth, and is not directly ancestral to the later Titanotheres.

EARLE, On the genus *Palæosyops*, etc., Jour. Acad. Nat. Sci. Phila., 1892

8. Phenacodus primævus *Cope.*

Am. Mus. No. 4369.

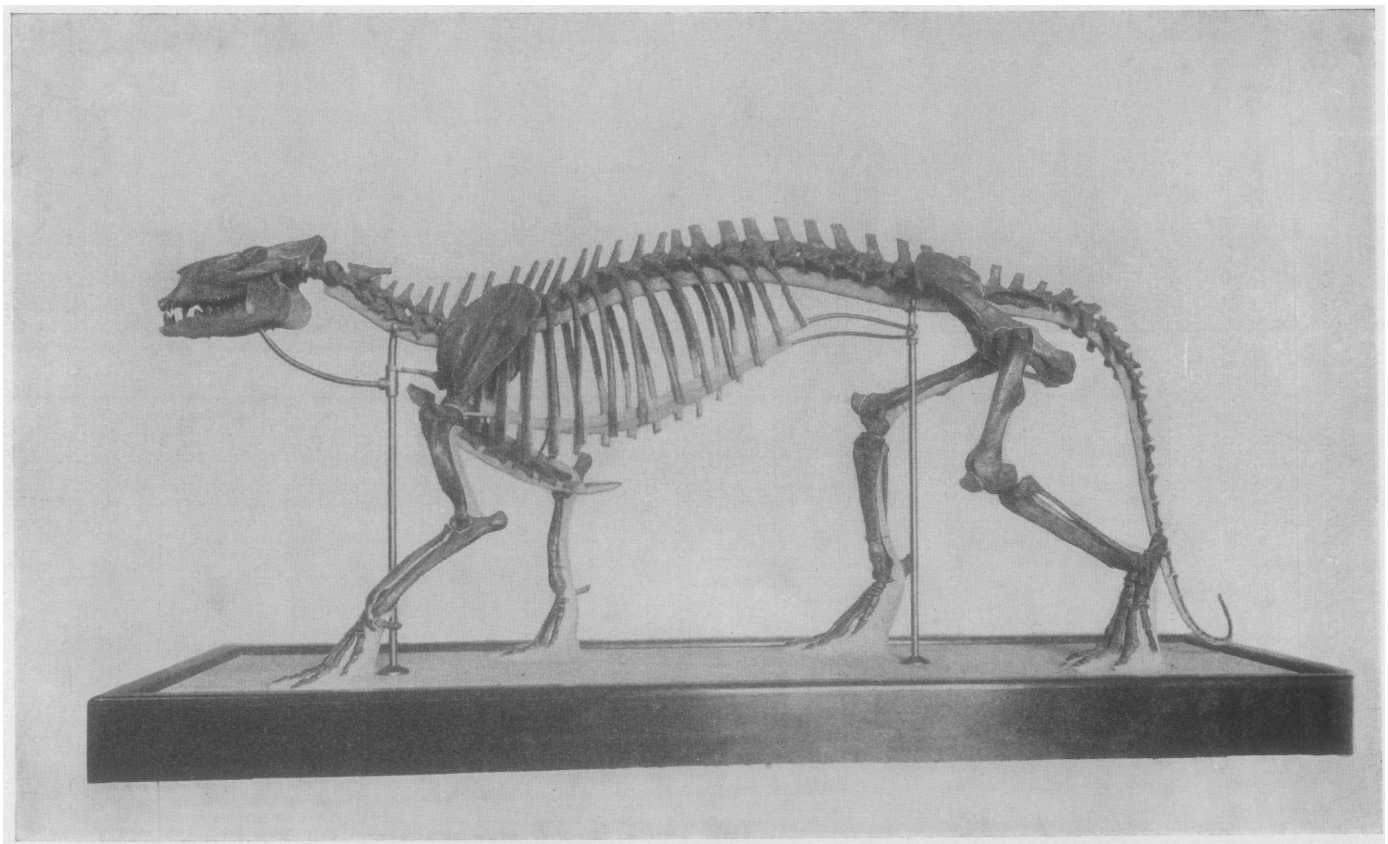
This is the famous skeleton of *Phenacodus* found by Dr. Wortman in the Lower Eocene of the Big Horn Basin, Wyoming, and described by Cope in 'Tertiary Vertebrata' and other publications. It here has an entirely different appearance, and gives us a different conception of the animal from that presented in its original mounting. The skeleton was very largely embedded in the rock, and it required four months of continuous work to remove the limbs, ribs and vertebræ preparatory to remounting. The animal as figured in 'Tertiary Vertebrata' appeared like a plantigrade; it was, however, restored by Sir William Flower in his book upon the Horse as a digitigrade. As here shown, the animal was as digitigrade as the Tapir; the hind limbs are much longer and more powerful than the fore; the tail is of great size. The head, on the other hand, is extremely small, and out of all proportion to the body. It is thus a microcephalic type, in contrast with *Coryphodon*, which is macrocephalic.

COPE, Tertiary Vertebrata, pp. 428–463, pll. lvii*b*–lviii.
OSBORN, Remounted Skeleton of *Phenacodus*, Bull. Am. Mus. Nat. Hist., X, 1898, pp. 159–164.

9. Coryphodon testis *Cope.*

Am. Mus. No. 2865.

Coryphodon is the characteristic large mammal of the Lower Eocene or Wasatch. Its remains are usually found scattered,



28 Fig. 7. Mounted skeleton of *Phenacodus primævus* in the American Museum of Natural History. One-twelfth natural size.

and it was not until 1896 that the Museum Expeditions enabled us to mount the complete skeleton. The animal exhibits a curious mixture of primitive and specialized characters, the former being dominant in the limbs and body, the latter appearing in the skull and feet. The flat-topped skull with slight rudiments of frontal and parietal horns, the spreading, hippopotamus-like front teeth, the short elephantine feet and broad pelvis, are the most noticeable specialized characters. *Coryphodon* was nearly related although not directly ancestral to the Uintatheres (*Dinoceras*) of the Middle Eocene or Bridger Beds.

The skeleton as mounted is composed of a number of individuals of the same species, size and age, collected by the Museum Expedition of 1896.

OSBORN, *Coryphodon radians* Cope, A Complete Skeleton of *Coryphodon*, Bull. Am. Mus. Nat. Hist., X, 1898, p. 81.

Coryphodon testis OSBORN, Evolution of the Amblypoda, *ibid.*, pp. 189–204.

See also MARSH, Am. Jour. Sci., 1893, p. 321.

10. Teleoceras (Aphelops) fossiger (*Cope*).

Am. Mus. No. 2604.

This Rhinoceros was the most abundant large animal of the Upper Miocene of Western America. Its bones are found in some localities (such as the famous quarry at Long Island, Phillips Co., Kansas) in great numbers and remarkably well preserved, but the individuals are not distinguishable. This skeleton, made up of many individuals of appropriate size, is mounted with concealed steel rods traversing the bones and only two visible main supports. The male probably bore a small horn, which was rudimentary or absent in the female. The animal had much shorter legs and a heavier body than any modern Rhinoceros, the principal measurements being: height at shoulder, 4 ft. (M. 1.22); at pelvis, 3 ft. 8 in. (M. 1.12); total length, 10 ft. 3 in. (M. 3.12); greatest girth or chest circumference, 9 ft. 2 in. Its size was about that of the largest living species, except in the height. The neck was

short, the head rather small, the body extremely thick and barrel-like, the belly almost reaching the ground.

OSBORN, Bull. Mus. Comp. Zoöl., XX, p. 92; Bull. Am. Mus. Nat. Hist., X, 1898, p. 51.

WILLISTON, Restoration of *Aphelops fossiger*, Kans. Univ. Quar., 1894, p. 289, pl. viii.

11. Cænopus tridactylus (*Osborn*).

Am. Mus. No. 538.

This skeleton was found by the American Museum Field Party in 1892, and was the first skeleton mounted by the Department; although very complete it is considerably crushed, and has been mounted in low relief. The skeleton as it lay in the rock was doubled over on itself; it has been straightened out and a missing fore limb modelled in plaster, otherwise it is in the position that it had in the rock. The matrix is chiefly plaster, colored and chipped to imitate the surface of the gray sandstone original. Length from tip of nasals to bend of tail, 7 feet 9 inches. The animal was about the size of the living Sumatran Rhinoceros, but was hornless, or with rudimentary *paired* horns on the male.

OSBORN & WORTMAN, Fossil Mammals of the Lower Miocene White River Beds, Bull. Am. Mus. Nat. Hist., VI, 1894, pp. 206–207, pl. iii.

OSBORN, Mem. Am. Mus. Nat. Hist., Vol. I, Pt. IV, Oct., 1899.

12. Phenacodus wortmani *Cope*.

Am. Mus. No. 4378.

This small species of *Phenacodus* was found by Dr. Wortman in the same beds as *P. primævus*. This skeleton was mounted in the original matrix in the Cope Collection, but has been chiselled out of the rock and remounted in low relief, the missing parts of the bones being restored in plaster. Each bone is easily removable for separate study.

COPE, Tertiary Vertebrata, p. 464, pl. xxix*e*.

13. Cænopus occidentalis (*Leidy*).

Am. Mus. No. 1132.

This characteristic Rhinoceros of the Middle Oligocene of the West is ancestral to *C. tridactylus* of the Upper Oligocene, and thus leads to the Dicerathere line. *C. occidentalis* was hornless, somewhat smaller than the living Sumatran Rhinoceros and more lightly proportioned. This skeleton is mounted in full relief.

OSBORN, Mem. Am. Mus. Nat. Hist., I, Pt, III, April, 1898.

14. Tylosaurus dyspelor (*Cope*).

Am. Mus. No. 221.

Upper Cretaceous (Niobrara) of Kansas.

Tylosaurus dyspelor was one of the largest of the Mosasaurs, great marine lizards, distantly related to the living Monitor Lizard (*Varanus*), but adapted to strictly aquatic life. This fine skeleton, found by Mr. W. G. Bourne, is twenty-eight feet long and exceptionally perfect, even the cartilages being preserved. The skeleton is mounted in the original matrix and position.

OSBORN, Mem. Am. Mus. Nat. Hist., I, Pt. IV, October, 1899.

15. Protoceras celer *Marsh.*

Am. Mus. No 1236.

Upper Oligocene (White River, Protoceras Beds), S. Dakota.

Protoceras was the largest of a group of Primitive Ruminants found in the White River Beds, which had two toes in the hind foot, four in the fore foot. The proportions are nearly those of the smaller deer, but with shorter limbs and neck. The male skull bore several bony bosses comparable to the bosses on a giraffe skull instead of true horns or antlers; the

female was hornless. This skeleton is that of a female, and is mounted in high relief.

MARSH, Am. Journ. Sci., 1891, Jan., p. 81; 1893, Nov., p. 407; 1897, Sept., p. 165.
OSBORN & WORTMAN, Characters of *Protoceras*, Bull. Am. Mus. Nat. Hist., IV, 1892, p. 351.
SCOTT, Osteology and Relations of *Protoceras*, Jour. Morph., XI, p. 303.

16. Oxyæna lupina *Cope.*

Am. Mus No. 107.

Lower Eocene (Wasatch), Big Horn Valley, Wyoming.

Oxyæna was a typical Creodont or Primitive Carnivore. Large head, with small brain and long, powerful jaws, short, bandy legs, short, subplantigrade feet, and long tail, are the most marked primitive characters.

This skeleton was pieced together with great labor out of two fragmentary specimens, one found by Dr. Wortman in 1881 and described by Cope in 'Tertiary Vertebrata' (Specimen No. 2), the other found in 1891 and described by Osborn and Wortman in the American Museum Bulletin for 1892. On comparing these two specimens it was found that they belonged to the same individual, and that the skeleton was nearly complete, though broken into innumerable fragments. The skeleton is mounted in full relief, every bone being removable.

WORTMAN, Restoration of *Oxyæna lupina* Cope, etc., Bull. Am. Mus. Nat. Hist., XII, 1899, p. 139.

17. Equus scotti *Gidley.*

17a. Equus scotti and Protorohippus venticolus.

Am. Mus. No. 10612.

Pleistocene, Rock Creek, Llano Estacado, Texas.

This skeleton is one of eight found together by J. W. Gidley of the American Museum Expedition of 1899. It shows as

mounted the zebra-like proportions of this native American wild horse, especially seen in the large head and deep jaws, short barrel, small limbs and feet.

GIDLEY, A new Species of Pleistocene Horse from the Staked Plains of Texas, Bull. Am. Mus. Nat. Hist., XIII, 1900, pp. 111–116; and Revision of American Species of *Equus*, *ibid.*, 1901, XIV, pp. 91–140.

18. Amynodon intermedius *S. & O.*

Am. Mus. No. 1931.

Upper Eocene (Uinta) Utah. Found by A. O. Peterson, American Museum Expedition, 1895.

Amynodon was a collateral ancestor of the large Aquatic Rhinoceros, *Metamynodon*, of the Oligocene epoch, and is largely intermediate, both in size and in characters of the skull and skeleton, between it and the Middle Eocene Rhinoceros. This skeleton is mounted in high relief.

19. Mastodon americanus (*Kerr*).

Pleistocene Epoch, Newburgh, New York.

Remains of *Mastodon* have been found in numerous localities scattered all over the Eastern States and Mississippi Valley, and mounted skeletons are to be seen in several American and European museums. This skeleton was found in a peat bog near Newburgh, N. Y., and is one of the largest; size, 9 feet high, 18 feet long as mounted. The Mastodons differed strikingly from the Mammoths in proportions, as well as in the number and character of their teeth, form of skull and curve of tusks.

20. Platygonus leptorhinus *Williston.*

Pleistocene Epoch, Kansas.

This skeleton is one of nine found together in Western Kansas and described by Prof. Williston in 1894. The proportions and pose of the skeleton at once suggest the living peccaries (*Dicotyles*), from which *Platygonus* differed chiefly in its larger size, more specialized feet and teeth.

21. **Oreodon culbertsoni** *Leidy.*

Oligocene Epoch, Big Badlands, S. Dakota.

Oreodon was first described by Joseph Leidy in 1851, and is the most abundant and characteristic fossil of the Big Badlands. This species is of the size of a peccary, and the skeleton, a composite of two very perfectly preserved individuals obtained by the American Museum Expedition of 1894, shows somewhat similar proportions, but is much more primitive in characters, and in most respects has departed comparatively little from the old ancestral type of the Artiodactyla.

22. **Hyænodon horridus** *Leidy.*

Am. Mus. No. 1375.

Oligocene Epoch, Big Badlands, South Dakota.

This finely preserved skeleton was found by the American Museum Expedition of 1894, and is all one individual, the few missing parts being restored in tinted plaster. *Hyænodon* is the best-known and the most highly developed of the Creodonta, and is found both in Europe and America. This species is about the size of the Tasmanian Wolf (*Thylacinus*), which it resembles to a striking degree in proportions of limbs and feet and in many characters of the skull.

23. **Pantolambda bathmodon** *Cope.*

Basal Eocene, San Juan Basin, New Mexico.

Pantolambda is the most ancient mammal of which the entire skeleton is known. This mount is a composite of several incomplete skeletons obtained by the American Museum Expedition of 1896 in the Torrejon (Upper Puerco) horizon of Northwestern New Mexico. It exhibits the short, crooked legs, five-toed, plantigrade feet, long, heavy tail, arched back, primitive skull, with heavy jaws and small brain case, and many other characters which were the common heritage of the early mammals from their reptilian ancestors.

Osborn, Evolution of the Amblypoda, Bull. Am. Mus. Nat. Hist., X, 1898, pp. 183–188.

24. **Hypohippus equinus** (*Scott*).

Middle Miocene, Pawnee Buttes, Colorado.

This three-toed Horse is not in the direct line of descent of the modern horses, but on a somewhat conservative side-branch. The skeleton is as large as that of a Shetland pony and is mounted in full relief in a walking pose. The head, limbs, and feet are in exceptionally fine preservation. The side view shows best the general proportions of the animal; the view from behind, which best displays the small lateral digits, can also be supplied. *Hypohippus* is closely related to *Anchitherium* of the Lower Miocene, from which it is probably directly descended. This skeleton was found by Mr. Brown of the American Museum Expedition of 1901.

25. **Ichthyosaurus quadriscissus** *Quenstedt.*

Jurassic Period, Holzmaden, Wurttemberg.

This fine skeleton was presented to the American Museum by the Royal Natural History Museum of Stuttgart, through Prof. Eberhardt Fraas. It is of especial interest as showing that the Ichthyosaurs were viviparous instead of egg-laying reptiles. The skeletons of seven young (unborn) Ichthyosaurs can be seen, partly in, partly washed out of the body-cavity.

26. **Portheus molossus** *Cope.*

Upper Cretaceous (Niobrara) of Kansas. Found by C. H. Sternberg.

This great fish is characteristic of the marine Upper Cretaceous chalk formation of Western Kansas. It was related to the modern Tarpon of Florida but of gigantic size, this skeleton being 18 feet in length. The head and tail are especially fine; the ribs and fins are mostly restored in plaster. It is much flattened and is mounted in low relief.

27. **Hippopotamus liberiensis** *Morton.*

The Pigmy Hippopotamus of the West Coast of Africa is a rare species, almost extinct. This skeleton is semi-fossil, and was presented by the Museum of Christiania, Norway.

28. **Ornitholestes hermanni** *Osborn.*

Upper Jurassic (Como), Wyoming.

This beautiful little skeleton, about seven feet in length, represents a little-known group of Carnivorous Dinosaurs adapted for swift running and the seizing of a light and agile prey. The tail is extremely long, slender, and whip-like, the hind limbs long and the feet like those of a bird, while the small fore limbs are modified into remarkable prehensile organs, the first and second digits greatly elongated and opposed, with large curved claws, the third digit small and slender, and the fourth atrophied.

OSBORN, Bull. Am. Mus. Nat. Hist., XIX, 1903, pp. 459–464.

29. **Mesohippus bairdi** *Leidy.*

Middle Oligocene (White River), South Dakota.

This classic species represents an early stage in the evolution of the Horse. It is smaller than the modern Dorcas Gazelle, and has three toes on each foot, the lateral toes slender but reaching to the ground. Vestiges of the first and fifth digits are still preserved in the fore foot. *Mesohippus* is somewhat peculiar in the unusual length of the hind limbs as compared with the fore; in other respects it is intermediate between the four-toed horses of the Eocene and the modern horse.

SCOTT, W. B., On the Osteology of *Mesohippus* and *Leptomeryx*, Jour. Morph., V, 1891, pp. 301–406.

FARR, Notes on the Osteology of the White River Horses, Proc. Amer. Phil. Soc., XXXV, 1896, p. 147–175.

30. **Merycodus osborni** *Matthew.*

Middle Miocene, Pawnee Creek Bed, Colorado.

Merycodus is a collateral ancestor of the modern Pronghorn Antelope of Western North America, but is distinguished by large, branching, deciduous antlers like those of the Deer.

The bony rudiments of lateral toes, present in nearly all deer but absent in all antelopes, are still preserved in *Merycodus*, but exceedingly minute, much smaller than in the deer. The animal was of about the size of the Dorcas Gazelle.

MATTHEW, W. D., A Complete Mounted Skeleton of *Merycodus*, Bull. Am. Mus. Nat. Hist., XX, 1904, pp. —.
See also SCOTT, W. B., Bull. Mus. Comp. Zoöl., XX, 1890, p. 82 (*Cosoryx furcatus*).

IV.—PHOTOGRAPHS OF RESTORATIONS, BY CHARLES KNIGHT.

Presented by J. Pierpont Morgan, and exhibited in the Department of Vertebrate Palæontology. Bromide enlargements from the original negatives. Size, 18 in. x 22 in.

These photographs are from a series of large water colors executed for the American Museum by the animal painter, Mr. Charles Knight, under direction of Prof. Osborn, with suggestions and criticisms by other palæontologists, the object being to increase the popular interest in these extinct animals, and to give a fuller and truer idea of their anatomy and external form than is afforded by the skeleton.

The artist begins each study by preparing a number of models in wax, based upon the actual proportions and muscular indications of the skeleton, and by a series of preliminary sketches, representing different attitudes, habits, and surroundings. Thus the position of all the joints and angles of the feet and limbs is true to life. The lips, nostrils, and gape of the mouth are determined by comparison of the length of the nasals, size of the anterior nares, character and position of the teeth, with similar parts in the remotely related living forms. The eyes are carefully located and proportioned. Up to this point the animal is a fairly correct representation of the original. On the other hand, the shape of the ears, the color and epidermic characters of hair and hide are largely imaginative, except in so far as they are suggested by relationship

to modern allies, as of *Protorohippus* to the Horse, or of *Cænopus*, *Metamynodon*, and *Hyracodon* to the Rhinoceros.

These restorations are copyrighted and the photographs are sold with the understanding that they are to be used only for exhibition purposes, and are not to be copied or adapted for publication.

Price of the photographs, $4 each.

1. Patriofelis, Middle Eocene Creodont.

This animal is based upon studies of the skeleton mounted in the American Museum Collection (No. 1507). The following quotation from an article by Dr. Wortman explains the picture: "The broad, flat, plantigrade feet, with their spreading toes, suggest at the first glance their use for swimming. The eversion of the feet, together with the general clumsiness of the limbs point, moreover, to the fact that the animal was not an active runner. . . . He was perhaps not as expert a swimmer as the seals are now, but was sufficiently active in the water to capture turtles." This is perhaps the least original and successful of the restorations, being modelled somewhat too closely upon the Otter. More recent studies by Osborn have cast much doubt upon the aquatic habits of the animal as indicated by Wortman.

Originally reproduced by Osborn in 'Prehistoric Quadrupeds of the Rockies,' Century Magazine, September, 1896.

WORTMAN, The Osteology of *Patriofelis*, Bull. Am. Mus. Nat. Hist., VI, 1894, pp. 119–64, pl. i.

OSBORN, *Oxyæna* and *Patriofelis* Re-studied as Terrestrial Creodonts, Bull. Am. Mus. Nat. Hist., XIII, 1900, pp. 269–279.

2. Protorohippus venticolus, Four-toed Lower Eocene Horse.

The studies for this animal were based upon skeleton No. 4832, mounted in the American Museum Collection. The very primitive characters of this early stage in the evolution of the Horse are especially seen in the short neck and legs, the heavily muscular part of the limb extending much further down in proportion to the lower leg and foot. The arched

back and short head are likewise striking characters. The striping of the neck and fore quarters is based upon the fact that the young of all modern species of Equidæ show a more

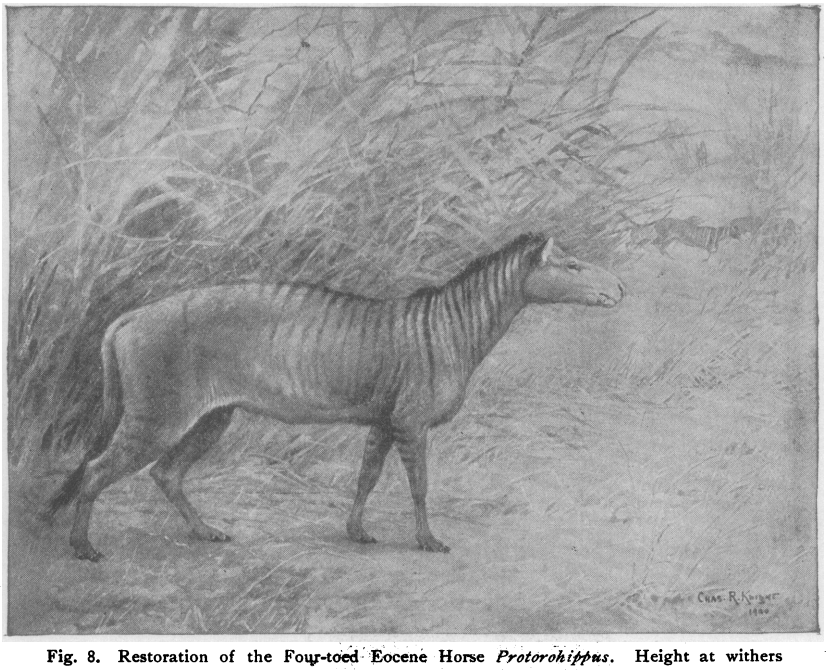


Fig. 8. Restoration of the Four-toed Eocene Horse *Protorohippus*. Height at withers sixteen inches.

or less marked tendency to striping in these parts. The animal in life was about 4 hands, or 16 inches, in height at the withers.

Originally reproduced by Lucas in McClure's Magazine. 1899.

COPE, Tertiary Vertebrata, U. S. Geol. & Geog. Sur. Terrs., F. V. Hayden in charge, Final Report, IV (1885), pp. 635–647, pll. xlix, *a*, *b*, *c*.

3. Cænopus, A Hornless Upper Oligocene Rhinoceros.

The study is based upon the complete mounted skeleton, No. 538, in the American Museum, of *Cænopus tridactylus*. This animal compares in its dimensions and in the general characters of its skeleton with the Two-horned Rhinoceros of

Sumatra; and Mr. Knight's studies for this picture were practically based upon that living type.

OSBORN & WORTMAN, Fossil Mammals of the Lower Miocene White River Beds, Bull. Am. Mus. Nat. Hist., VI, 1894, p. 206, pl. iii.

4. Protoceras, Six-horned Upper Oligocene Ruminant.

The characters of this animal are known from complete female skeletons in the American Museum of Natural History and the Princeton Museum, and a very complete series of male and female skulls, secured by the American Museum Expeditions of 1892 and 1894. As exhibited, there is a wide contrast between the male and female skulls, the latter being entirely devoid of horns. The very marked recession of the nasals has suggested the presence of a long, somewhat expanded upper lip, as in the modern Saiga, while the coloring of the animal is based upon that of the North American Pronghorn Antelope.

Originally reproduced by Osborn in the Century Magazine, September, 1896.

OSBORN & WORTMAN, Characters of *Protoceras* Marsh, Bull. Am. Mus. Nat. Hist., IV, 1892, pp. 351–371.

5. Metamynodon, Aquatic Middle Oligocene Rhinoceros.

The study is based upon the mounted skeleton, No. 546, in the American Museum, and represents the general conception of the animal as aquatic. The opinion as to the aquatic habits of *Metamynodon* was very largely due to the studies made for this drawing in which it became apparent that the very elevated position of the orbits, the widely expanding ribs, and the four complete spreading toes in the fore foot, strongly suggested the general build of the Hippopotamus. This aquatic life is, moreover, consistent with the presence in the same beds of two other types of Rhinoceros, it being improbable that the three types were all land animals.

Originally reproduced by Osborn in the Century Magazine, September, 1896.

OSBORN & WORTMAN, Perissodactyls of the Lower Miocene White River Beds, Bull. Am. Mus. Nat. Hist., VII, 1895, pp. 373–375 pll. x, xi.

6. Elotherium, Giant Upper Oligocene Suilline.

These animals have been depicted from very complete remains in the American and Princeton Museums, and represent the largest type of Oligocene Elothere, namely, the *E. ramosum* of Cope, or *E. imperator* of Marsh. The great flanges below the cheeks for the attachment of the masseter muscles presented peculiar difficulties, and it is possible that they are not here exhibited with sufficient expansion. The head is of enormous size, but the chest is small, and the limbs are comparatively tall and stilted, as here represented. The very remote relationship to the Pig and to the Hippopotamus is suggested in the bristles and in the form of the lips. *Elotherium* is in a general way a sort of dry-land hippopotamus, as *Metomynodon* is an aquatic rhinoceros; in the one case the dry-land type, in the other, the aquatic type, has become extinct.

Originally reproduced by Osborn in the Century Magazine, September, 1896.

MARSH, Am. Jour. Sci., XLVII, 1894, p. 408, pl. ix.

7. Megacerops, Long-horned Lower Oligocene Titanothere.

This group of male, female, and young is based upon skulls belonging to different sexes and ages, in the American Museum Collection, as well as upon the complete skeleton, No. 518, mounted in the American Museum. There is no doubt that the females had smaller skulls, with imperfectly developed horns and narrow zygomatic arches, while the males of the same species had extremely long, recurved horns. The extension of the premaxilla and the overhanging of the nares by the rudimentary nasals indicate that there was not space for a proboscis, but rather a prehensile upper lip, which suggests the same structure in the Rhinoceroses.

Originally reproduced by Osborn in the Century Magazine, September, 1896.

OSBORN & WORTMAN, Perissodactyls of the Lower Miocene White River Beds, Bull. Am. Mus. Nat. Hist., VII, 1895, pp. 346–352, pll. viii, ix.

8. Uintatherium, Six-horned Middle Eocene Amblypod.

The male and female here represented are based upon skeletal material as yet unmounted in the American Museum Collection, also upon the reconstruction published by Professor O. C. Marsh. The structure of the male skull, as here represented, corresponds with the largest type ever found, that of the *Uintatherium cornutum* skull, discovered by Professor Cope himself, and now in the American Museum. There is no indication of a proboscis, nor is there any reason to believe that the bony protuberances bore horns, many of them expanding at the tip, as is never the case with true horn-cores. The tusks, both in male and female, are found chiefly worn upon the posterior surface, a fact which suggests that they were used upon branches in drawing leaves and shrubs into the mouth, as represented in the female figure in the rear. Their chief function was probably as weapons of defence or attack, the exceptionally wide gape of the jaw, as indicated by the position and form of its muscular attachments, giving room for their use in a very effective manner.

Originally reproduced by Osborn in the Century Magazine, September, 1896.

COPE, Tertiary Vertebrata, pp. 569–587, pll. xxxvii–xlii.
MARSH, The Dinocerata, U. S. Geol. Sur. Mon., X, pp. 1–243, pll. i–lvi, 1886.

9. Hyracodon, Cursorial Oligocene Rhinoceros.

This restoration is based also upon material in the American Museum and Princeton Collections. The general conception of *Hyracodon* as a running type was outlined by Scott in 1883. These animals thus presented the widest contrast to the swimming Rhinoceroses, or *Metamynodon*, on the one side, and the low-land or swamp Rhinoceroses, the *Aceratheres*, on the other. The upper molar teeth, however, closely resemble those of the Rhinoceros, and form the motive for the resemblance to this animal, which is given in the face. The trunk and limbs, on the other hand, resemble very closely

those of the primitive horses. Hence the motion characteristic of the galloping horse is given to the skeleton.

Originally reproduced by Osborn in the Century Magazine, September, 1896.

SCOTT, Osteologie von Hyracodon Leidy, Festsch. f. Gegenbaur, 1896, pp. 353–383, pll. i–iii.

10. Mesonyx, Omnivorous Middle Eocene Credont.

This huge animal is represented preying upon the skull of an Uintathere, in order to give some conception of its size. The skull, as represented in the American Museum Collection, No. 1892, is extremely large and armed with very blunt teeth, wearing down in old age, indicating that the animal was omnivorous, or lived partly upon turtles or decaying animal food. The form of this body is derived from a complete skeleton in the Princeton Museum, which has been figured by Scott. It slopes backwards, the posterior quarters being rather small; the tail is extremely long and powerful, the general proportions resembling somewhat those of the Tasmanian Wolf.

Originally reproduced by Osborn in the Century Magazine, September, 1896.

SCOTT, New and Little-known Creodonts, Jour. Acad. Nat. Sci. Phila., IX, 1887, pp. 155–185, pll. v–vii.

WORTMAN, Studies of Eocene Mammalia in the Marsh Collection, Part I, Carnivora, Am. Journ. Sci., XII, 1901, pp. 285, 377, 421; XIII, 1902, p. 39.

11. Palæosyops, Eocene Hornless Ancestral Titanothere.

This animal is based upon the complete skeleton mounted in the American Museum, and is represented as having somewhat the habits of the Tapir, living in low, marshy land, and feeding entirely upon the softer kinds of leaves and grasses, since its teeth are entirely unadapted to hard grasses or the more silicious plants. According to the studies of Earle, the animal was devoid of a proboscis, but had an elongated, prehensile upper lip. The slender fore feet are very similar in proportions to those of the aquatic Rhinoceroses.

Originally loaned for reproduction in Harper's Magazine, 1897.

EARLE, On the genus *Palæosyops*, etc., Jour. Acad. Nat. Sci. Phila., IX., 1892, pp. 267–388, pll. x–xiv, and restoration, p. 314.

12. Mastodon americanus, North American Pleistocene Elephant.

This animal is executed from the skeleton in the American Museum of Natural History, and it is characterized by being partly hairy, in contrast with the extremely hairy northern variety of the Mammoth, and in view of the probability that all the more primitive elephants were coated with hair. It has distinctly the low, flat skull of the African Elephant, whereas the Mammoth had the high, prominent forehead characteristic of the Indian Elephant. The skeleton is also distinguished by enormously large, projecting feet, larger than in any existing species, and by the relative shortness of the limbs, also a primitive feature. This restoration, therefore, while based upon studies of the elephant, exhibits the characteristic proportions which distinguished the Mastodon externally.

Originally executed for reproduction in Harper's Magazine, 1897.

13. Dryptosaurus (Lælaps), Carnivorous Cretaceous Dinosaur.

In this and the four following restorations Mr. Knight was guided largely by ideas and sketches given him by Prof. Cope shortly before the latter's death. They are based upon specimens in the Cope Collection now in the American Museum, and upon restorations by Professor Marsh of related types.

This Dinosaur, represented in the photograph as engaged in combat, was of considerable size, about fifteen to twenty feet in length, and well armed in teeth and claws. Prof. Cope considered that the long hind limbs and heavy tail indicated great leaping powers, in spite of its large size, and the restoration is made in accordance with this idea. *Dryptosaurus* was allied to *Ceratosaurus* of Marsh and to the European *Megalosaurus*.

COPE, Proc. Acad. Nat. Sci. Phila., 1866, 275; Proc. Am. Phil. Soc., XXX, p. 240, May, 1892.
MARSH, Dinosaurs of North America, pp. 157–163, pl. xiv.

14. Elasmosaurus, Long-necked Cretaceous Plesiosaur.

Elasmosaurus was one of the largest of the marine reptiles which inhabited the Cretaceous seas. It was related to the

European *Plesiosaurus*, which it resembled in shape, except in the flattened tail. It is represented in the restoration as capturing a young *Portheus*, one of the large, bony fishes of the period. A skeleton in the Museum of the Philadelphia Academy of Natural Sciences, and another more complete in the Cope Collection (but both lacking the skull), served as the basis for the restoration. The Plesiosaurs differed greatly in the length and flexibility of the neck, as well as in size.

COPE, Cretaceous Vertebrata, U. S. Geol. & Geog. Surv. Terrs., F. V. Hayden in charge, Final Report, II, pp. 75–88.
DAMES, Abh. k. preuss. Akad. Wiss. Berlin, 1895, pp. 75–80; Natural Science, Jan., 1898, p. 48.

15. Agathaumas, Three-horned Cretaceous Dinosaur.

These herbivorous Dinosaurs were of great size and had large heads armed with three horns, and a great projecting crest or frill protecting the neck. The body may have been covered with small bony plates (scutes). This restoration is based on a reconstruction of the skeleton of *Triceratops prorsus* by Prof. Marsh. *Agathaumas sphenocerus* Cope, shown in the picture, is distinguished by the large anterior median horn and small posterior paired horns.

COPE, Amer. Nat., 1886, p. 716; 1892, p. 768.
MARSH, Dinosaurs of North America, Ann. Rep. U. S. Geol. Surv., 1896.

16. Naosaurus and Dimetrodon, Spine-backed Permian Lizards.

These ancient reptiles represent an early specialized branch of the primitive Rhynchocephalians. Their most remarkable character is in the enormously elongated dorsal spines of the vertebræ, with (in *Naosaurus*) or without (in *Dimetrodon*) transverse bars of bone. The restoration is based on a number of incomplete skeletons in the Cope Collection.

COPE, Proc. Amer. Phil. Soc., 1878, p. 512.
BAUR & CASE, Morphology of the Skull of the Pelycosauria, Anatom. Anzeig., Jena, 1897, XIII, p. 109.

17. Hadrosaurus, Duck-billed Cretaceous Dinosaur.

Drawn from the unusually complete skeleton of *Hadrosaurus* (*Diclonius*) *mirabilis* Leidy, in the Cope Collection now in the American Museum. This very specialized genus is found in the Upper Cretaceous of New Jersey and Wyoming. It was herbivorous, and probably amphibious, with long neck and heavy hind quarters. It had a broad, duck-like, horny bill, and back of it a magazine of numerous small, rod-like teeth, not less than a thousand in each jaw, set on end in several close-set rows, and wearing to a tesselated-pavement-like grinding surface. The length was about thirty feet.

The skeleton of a nearly related genus, *Claosaurus*, is mounted in the Yale Museum.

COPE, Proc. Acad. Nat. Sci. Phila., 1883, p. 97; Amer. Nat., 1883, p. 774.

18. Siberian Mammoth or Hairy Elephant.

Unlike the living elephants, the Mammoth ranged into arctic countries, and is here restored with its appropriate environment, taken from the region of the Taku Glacier, Alaska. It was a contemporary of primitive man, and its enormous size is therefore fitly indicated by the contrast with human figures in the background. In this instance the color and texture of the hide is certainly known, from the mammoth carcasses which have been found frozen in the palæocrystic ice of northern Siberia, and parts of which are still preserved in the St. Petersburg Museum.

19. Cervalces, Pleistocene American Elk.

Cervalces was as large as the Moose, but is distinguished by its magnificent antlers, spreading in three directions, outward, upward and forward, and attaining a size and complexity unequalled by any living species. The fine skeleton in the Princeton Museum served as a basis for this restoration, the superficial characters being studied from the Moose.

SCOTT, Proc. Acad. Nat. Sci. Phila., 1885, p. 191.

20. Condylarth or Primitive Hoofed Mammal Phenacodus.

Lower Eocene Epoch.

This is drawn after the famous skeleton discovered by Wortman and described originally by Cope, and as remounted by Osborn.

Phenacodus belongs to the group of Primitive Ungulates from which all the modern hoofed animals are descended. It is in many respects like the clawed animals (Unguiculates) from which the hoofed animals (Ungulates) branched off. Five toes on each foot, pig-like teeth, arched back, short legs, narrow chest, lank sides, long tail, all are characters of the primitive clawed animals still retained by *Phenacodus*, but lost by modern hoofed animals.

OSBORN, Remounted Skeleton of *Phenacodus primævus*, Bull. Am. Mus. Nat. Hist., X, 1898, p. 159.
COPE, Tertiary Vertebrata, pp. 428–463, pl. lvii *b*–lviii.

21. Hornless Amblypod Coryphodon.

A short-footed, hoofed animal of the Lower Eocene Period.

This remarkable animal was related to the huge Uintatheres. It had five very short toes on each foot. The anterior teeth suggest those of the Hippopotamus, but the grinding teeth are entirely different. The neck is short, the body rather long, with many archaic characters. The legs are short and clumsy, the upper joint disproportionately long. The brain is remarkably small. At the sides of the top of the skull are bony projections prophetic of the posterior horns of the Uintathere.

Coryphodon was probably an amphibious animal living in the marshes and rivers bordering the ancient Wasatch Lake. Its large tusks were used presumably in rooting up water-plants; and were also formidable weapons of defense against the larger flesh-eating animals of that period. Its general appearance was unlike that of any modern animal, for, although it combined some characters of such dissimilar beasts as the Bear, Elephant, and Hippopotamus, it had many peculiarities of its own.

OSBORN, Bull. Am. Mus. Nat. Hist., X, 1898, pp. 81–91.

22. Primitive Sabre-tooth Tiger Hoplophoneus.

Oligocene Epoch.

The most striking difference between Sabre-tooth Tigers and the great living cats is in the long, flattened sabre-like upper canine teeth, which in *Smilodon* (Restoration No. 31) were seven inches long. These teeth could pierce the hides of rhinoceroses and other thick-skinned animals common in America in the Oligocene Period, against which the shorter fangs of modern lions would be ineffective. The legs were shorter and more muscular than those of the larger modern cats, the animal more powerful, but by no means as swift-footed.

Scott & Osborn, Bull. Harv. Mus. Comp. Zoöl., 1887, p. 153, pl. i.
Riggs, Restoration of *Hoplophoneus occidentalis*, Kans. Univ. Quar., V, 1896, pp. 37–52, pl. i.

23. Short-legged American Rhinoceros Teleoceras.

Upper Miocene Epoch.

Teleoceras, the last known survivor of the Rhinoceros race in America, was also the largest; and its fossil remains are so abundant in certain localities as to indicate that it lived in great herds upon the plains, like the Bison in more modern times.

The body was as long and heavy as that of the living Indian Rhinoceros, but the legs were so short that the belly nearly reached the ground, giving the animal the squat proportions of the Hippopotamus. The male had a small horn on the end of the nose; the female was hornless.

Osborn, Complete Skeleton of *Teleoceras fossiger*, Bull. Am. Mus. Nat. Hist., X, 1898, pp. 51–59, pll. iv, iv*a*.
Williston, Restoration of *Aphelops fossiger*, Kans. Univ. Quar., 1894, p. 289, pl. viii.
Scott & Osborn, Bull. Harv. Mus. Comp. Zoöl., pp. 92–99, pl. ii.

24. Amphibious Dinosaur Brontosaurus.

Upper Jurassic Period.

In the Reptilian Age, preceding the Age of Mammals, great reptiles were dominant on land and water. The Dinosaurs, or

Giant Reptiles, were the chief inhabitants of the lowlands and marshes. Preëminent in size among these were the Sauropoda, or Amphibious Dinosaurs, a herbivorous group, mostly of gigantic size, from forty to seventy-five feet in length,—the greatest of land animals living or extinct, and exceeded in size only by the modern Whales.

The long neck and small head enabled them to lie concealed in marshy bayous and lagoons, the body generally immersed, the head foraging for food without easily attracting the attention of the great carnivorous reptiles which lived at this time. The long and massive tail was useful both as a support and a propeller.

Brontosaurus was among the largest of the Sauropoda, seventy feet in length and about eighteen feet in height to the arch of the back. The thigh-bone is six feet long, and weighs in its petrified condition 500 to 600 pounds.

MARSH, Dinosaurs of North America, Sixteenth Ann. Rep. U. S. Geol. Surv., 1896, pp. 166–175, pl. xlii (*Brontosaurus excelsus*).
OSBORN, Bull. Am. Mus. Nat. Hist., X, 1898, p. 219.

25. Great Marine Lizard or Mosasaur Tylosaurus.

Upper Cretaceous Period.

This restoration is made from the complete skeleton, thirty feet long, in the American Museum.

The Mosasaurs were carnivorous Sea-Reptiles abundant in the warm, shallow seas of the Upper Cretaceous Period, but not yet found earlier or later. Large flat head, short neck, four paddle-limbs like the flippers of whales, vertically flattened, swimming tail. Length of different species, from twelve to forty feet. Their nearest living ally is the Monitor Lizard (*Varanus*) of the Nile Valley.

OSBORN, A Complete Mosasaur Skeleton, Osseous and Cartilaginous, Memoirs Am. Mus. Nat. Hist., I, Pt. IV, Oct., 1899, pll. xxi–xxiii and text illustrations.
WILLISTON, Kansas Univ. Quar., VIII, 1899, pp. 39–41; Univ. Geol. Surv. Kansas, IV, Pt. V, pp. 83–221, pll. xl–lxxii.

26. Great Irish Deer Megaceros.

Pleistocene Epoch. Europe.

Drawn from the skeleton mounted in the American Museum.

Megaceros exceeded any living deer in the spread of its antlers, in some cases ten or even eleven feet from tip to tip. In size it is about equalled by the Moose, but the proportions were somewhat different, approaching those of the Fallow Deer (*Cervus dama*) to which it was more nearly related. The most abundant and complete remains have been found in the bogs of Ireland, but the animal ranged all over Western Europe. It is not found in America.

27. Primitive Mastodon Trilophodon.

Miocene Epoch.

Based upon a skull and incomplete skeleton in the American Museum, and upon the restored skeleton of *T. angustidens* by Prof. Gaudry. These Miocene ancestors of the Mastodons and Elephants were much less specialized than their later descendants. This is especially seen in the small tusks in both upper and lower jaws, the upper ones curving down, the lower ones straight, and both with an external or anterior enamel band like the incisors of rodents,— in the shorter trunk, as indicated by the characters of the skull, in the limbs of moderate length and toes much less reduced than in the Pliocene and Pleistocene proboscidians.

28. Great Carnivorous Dinosaur Allosaurus.

Upper Jurassic Period.

This great carnivorous reptile was a contemporary of the huge Sauropoda. That it preyed on their carcasses is certain, for the bones are often found fossil with scorings and scratches on their softer surfaces which might well have been made by this animal, and its broken-off teeth, still more frequently found close by, suggest that it was more greedy than prudent in its feasts. But the *Allosaurus* was likewise well adapted in

teeth and claws to attack a living prey, and it is quite probable that this was the enemy from whose attacks the huge *Brontosaurus* sought refuge by habitually burying his great unwieldy body beneath the water, as indicated by the skeleton structure and illustrated in our restoration (No. 24) of that beast.

In the *Allosaurus* restoration Mr. Knight has represented him as preying upon the carcass of a Brontosaur, using the powerful bird-like hind feet in somewhat the same manner as does a vulture or other bird of prey.

29. Amphibious Dinosaur Diplodocus.

(In preparation.)

30. Ichthyosaur, or Great Fish-Lizard.

Jurassic Period.

The discoveries of Ichthyosaurs, with the outlines of body and tail preserved, in the great slate-quarries of Holzmaden in Wurttemberg, as described by Professor Fraas in 1892, have considerably altered our conceptions of this classic fossil reptile. We now know that it had a high, triangular back fin and broad, forked tail, like that of the shark, except that the vertebral column ran into the lower wing instead of the upper wing of the tail. The Holzmaden specimens, worked out with wonderful skill and care by Herr Hauff, give the outlines of almost all parts of the body, so that there is little (except as to color) left to conjecture or inference in this restoration.

Mr. Knight has associated with the old Ichthyosaur a little school of new-born young whose proportions and size are taken from the seven little Ichthyosaur skeletons contained within the body-cavity of the large skeleton in the American Museum.

31. Great Sabre-tooth Tiger Smilodon.

Pleistocene Epoch.

Based on the complete skeleton in the Cope Collection, found in the Pampean formation near Buenos Aires, and now mounted in the American Museum.

Smilodon may well be considered the most terrible of all

beasts of prey. It equalled in size the largest Polar Bear, and was probably of the most savage and ferocious disposition, fearing nothing, and accustomed to prey on the largest and best-defended of the great herbivora. It did not indeed equal the modern large cats in activity, but it far surpassed any of them in strength, especially in the fore limbs and neck. The extraordinarily powerful attachments for the sterno-mastoid and cleido-mastoid muscles indicate the tremendous force with which the great seven-inch upper canines could be driven into the flesh of the prey, while the extremely wide gape of the jaw, indicated by the form and arrangement of its muscular attachments, gave free play for these powerful weapon-teeth.

The relatively small and low hind quarters and short, small tail give the *Smilodon* an appearance quite unlike the modern great cats, and the characters of skull and neck vertebræ indicate that it carried its head low, and was little able to raise it.

In Preparation.

32. Oxyæna lupina.
33. Platygonus leptorhinus.
34. Oreodon culbertsoni.
35. Poëbrotherium wilsoni.
36. Hyænodon horridus.
37. Cynodictis gregarius.
38. Dinictis squalidens.
39. Pantolambda bathmodon.
40. Hypohippus equinus.
41. Elephas imperator.
42. Ornitholestes hermanni.