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ORIGIN AND HISTORY
OF THE HORSE

ADDRESS BEFORE

The New York Farmers

Metropolitan Club

Tuesday Evening, December 19th, 1905

MR. JOHN S. BARNES, PRESIDING

The New York Farmers

THE first meeting of the season was held at the Metropolitan Club on Tuesday evening, December 19, 1905, the President, Mr. Barnes, presiding. After dinner the President introduced Prof. Henry Fairfield Osborn, who delivered the following address:

“ORIGIN AND HISTORY OF THE HORSE.”

Prof. Osborn—It is unnecessary to say in this presence that the horse is the noblest of the domesticated animals and has been to man the most useful of all the domesticated animals, not barring the cow. In support of this statement you must recall the fact that in certain parts of Asia there are no cattle, and that the people subsist entirely and have subsisted for hundreds if not thousands of years upon the products of the horse, including the milk of the mare, which of course is prepared in the form of kumyss.

Just a few words of introduction to the history of the horse, which is our subject. It is very largely connected with the explorations which we have conducted from the American Museum of Natural History, which began in the year 1891. In 1889 we made in Northeastern Texas the rather remarkable discovery of a considerable number of skeletons of the horse reared in America, that is, of the original North American horse, which became extinct not only before the discovery of the country by the Spaniards, but long before that time. There are no traces of the horse in the Aztec history of Mexico, or in the knowledge of any of the South American peoples, or even in the myths of the American Indian. The animal therefore became entirely extinct in this country, all assertions to the contrary being unfounded.

Our discovery was of five or six of the original American horses, which had previously only been known by portions of the skeletons, and it put into my mind the possibility of a series of explorations which should be especially directed to the subject of the *history of the horse in America*, a subject in which we may feel considerable national pride, because it is highly probable, although not yet absolutely demonstrated, that the direct ancestors of this noble animal came from America before the race became extinct, and that the horse is therefore one of the gifts of America to the world.

This project interested the late Mr. William C. Whitney, and during the three last years of his life he gave a fund which was especially devoted to explorations with this end in view, and among the very considerable number of

the photographs which I shall show this evening you will see several of the specimens which I succeeded in finding by means of the Whitney fund.

The subject of the origin and history of the horse is not a simple one. It is a very complex one, because every scientific problem, like every financial problem, has its method of attack—from a number of different points of view.

The first of the points to consider is that of the horse as the most perfect animal machine among the quadrupeds. Second, we shall see how this machine by purely natural processes evolved from comparatively small and simple beginnings. So we shall follow the evolution of a number of structures which make up this machine, and of the horse as a whole. Third, we shall look at the races, the wild breeds of the family of horses, as they are found in Asia and Africa today, because it is possible that some of these breeds throw some considerable light upon the most interesting of questions, the origin and history of this animal. Fourth, we come to the point where the history of the horse touches the history of man, and that was a turning point in the history of civilization, because, if you will reflect a moment, when man discovered the use of the horse, he discovered a mechanism which he could turn to his service in the same way as we use steam and electricity today. The horse became a means of civilization, of exploration and intercommunication. So, the history of the horse as a useful animal to man comes in as the third or fourth topic.

Finally, we have the question of questions today both from the theoretical or historical point of view, and from the practical standpoint. Has man domesticated the horse from one breed, or have different races of men in different parts of the world discovered this animal and domesticated him independently? In other words, has our domesticated horse a single or a multiple origin? Recent discoveries throw a great deal of light upon this question, and also, as I shall show, a very important light upon the practical question of the breeding of the horse. On these problems discoveries which have already been made throw much light and it is gratifying to know that New York is taking a very prominent part in this research. I am also much indebted to Prof. Cossar Ewart, of the University of Edinburgh, with whom I have had the pleasure of long friendship and with whom I had the privilege lately of a journey through Mexico, with a view of studying the horse there.

Last year a new student of the horse became known to the scientific world, in the person of Prof. William Ridgeway, of Caius College, Cambridge University, England, a Greek scholar and the author of "Social Life in Greece." It was rather surprising to find a Greek scholar taking up this question of the history of the horse, but the matter was cleared up when I learned that Ridgeway was brought up on the finest horse breeding land in Ireland, had always loved the horse, and that some twenty years before in reading some classical allusions to the horses of the Greeks, he became interested in the history of the animal and had been studying it at intervals as an avocation ever since.

The work of these two men, as well as our own researches here in New York, form a tripod of new evidence on which rests the story which we shall now look into.

FIG. 1.

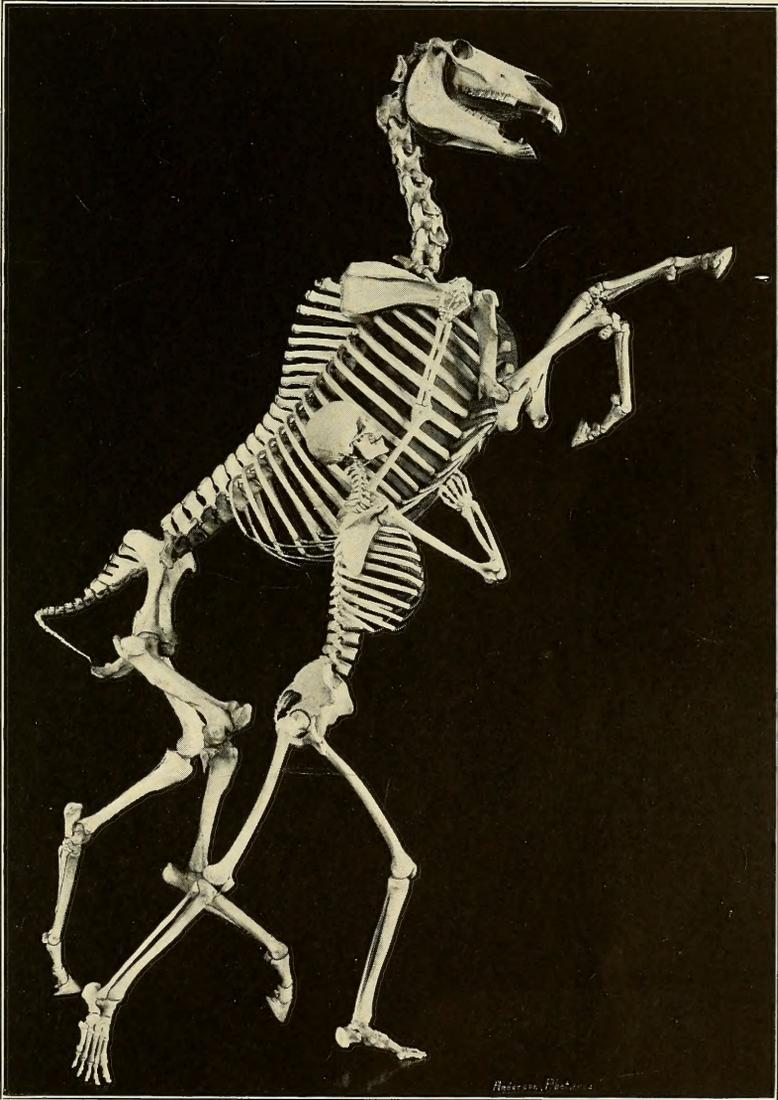


FIG. 1.—Skeletons of Man and of Rearing Horse.

These skeletons as mounted in the American Museum of Natural History, are so placed that the corresponding parts can readily be compared. The group is the gift of the late Mr. Wm. C. Whitney.

FIG. 4.

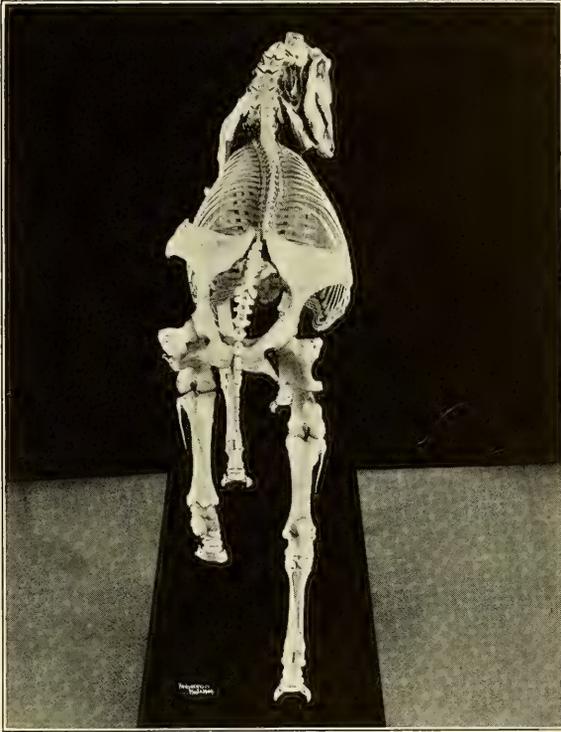


FIG. 4.—The Draught Horse in Action.

The same horse as shown in Fig. 3, from instantaneous photographs taken from the driver's seat, showing the S-shaped curve in the back.

FIG. 2.



FIG. 2.—Draught Horses in Action.

This is a team working to remove the rock and soil in one of the American Museum quarries in central Wyoming.

THE HORSE AS A MECHANISM.

In the mounted skeleton of a rearing horse and man I will call attention to one or two points which may lead to a better understanding of the subject. What is commonly called the knee of the horse, is comparable to the wrist of man. The joint running down from the wrist is the cannon bone, and is comparable to the central finger of man. The hoof of the horse compares with the nail of man, and the lateral fingers, disguised beneath the skin, as splints, correspond to the index and ring fingers of man. Above the hind hoof we have the hock, which corresponds with the heel of man. The elongated or middle toe corresponds to the middle toe in the human foot. These are a few points in the bony anatomy of the horse about which we are more or less misled, owing to the entire dissimilarity of terms. Fig. 1.

You will notice that the wrist of the horse and the heel are greatly elevated above the ground. This, as you know, is for the purpose of giving speed to this animal machine, because the elongation of the lower bones of the limb means that where the upper joints of the limb go at a moderate rate of speed, through the radius of a small circle, the lower joints go at a very high rate of speed through the radius of a larger circle. In the ancestors of the horse this was not the case, because in the very remote ancestors the wrist joint and the hock joint were near the ground.

In the musculature of the horse; I may say that all the muscles of the fore limb and of the hind limb, which in the hand of man serve to turn or rotate the joints of the palm or the back of the hand, have disappeared in the horse, and all those muscles which tend to pull those joints forward and backward in a perfectly direct line or plane of motion, are the ones which have been developed; so that our first point in the movements of the animal is that the horse is a mechanism in which the limbs are, as nearly as possible, confined to a motion in which the plane of direction is fore and aft. To make this possible the joints of those limbs are perfected in a very high degree, and whereas in our wrist or ankle-joint we can move the wrist or ankle in several directions, right or left or up and down, the horse is confined to an up and down movement. We shall look at three or four special types of horse without regard to breed.

We have here a specimen of the Rocky Mountain or Western horse, in the ordinary act of scraping off the surface in order to get down to the bone bearing layers beneath. You will see that this is the typical draft-horse action, a heavy development of the hind limbs, and that the horse is pushing rather than pulling against the collar. In order to perfect this mechanism, which is far more beautiful than you would imagine without very careful study, this English type of draft-horse has been selected as springing from a certain type of wild horse. The draft-horse has rather a low sloping hind quarter, a very heavy neck, great weight of what we call 'bone'—and fetlocks which have no special significance except as a fad in the eyes of horse fanciers. Fig. 2.

I have skeletonized the percheron draft-horse in order to show the beauty of its mechanism. From the side view you will get the impression of the animal straining with the collar against the scapula or shoulder-joint. The thrust

is being now exerted by the right hind foot, testing heel or hock joint again. The left foot is being brought forward. But without another view taken from above you will not appreciate the full beauty of this mechanism. Fig. 3.

When you get above the horse and photograph him, from the seat of the driver, you will observe that the back-bone is thrown into an S-shaped curve, and that the hip on the right side is depressed; you see the significance of this curve; it is in order to bring the head of the thigh bone, which you will remember is exerting the thrust, *as near as possible to the centre axis of the body*. Since the thigh is brought very nearly into the direct fore and aft line with the back-bone, the thrust is transmitted through the back-bone directly to the collar. When the horse takes the next step, the right side of the pelvis will be raised, the left will be lowered; and the head of this thigh will swing around. The back-bone curve will go in the opposite direction, and the thrust will again be exerted as near as possible along the middle line of the axis—a perfect illustration of the mechanism of the draft-horse. Fig. 4.

In the race horse, we have illustrated the necessity of perfection of joint mechanism, because in galloping the body is constantly supported in turn on one foot, there being only a short period of suspension in which all four feet are off the ground. In the periods in which each foot in turn is on the ground there is naturally a great strain. Keep in mind the fact that this foot has evolved from one finger, corresponding to your central finger, and you will see what the process of evolution has done, whereby that finger has become adapted to sustaining the entire weight and forward thrust of this rapidly moving and heavy animal.

In the act of jumping we have a very great strain brought very frequently, especially in landing, upon the fore feet. This is a fact, which is clearly illustrated in the next photograph of one of Trumbull Carey's horses. The horse is coming down on the two fore feet, therefore coming upon the joints of what were the two middle fingers of the hand. Fig. 8.

Here we have an illustration of these feet. If you were to jump to the ground the accident that would most likely happen, if any, would be a slight lateral dislocation or sprain. This is provided against in the horse by a series of tongue and groove joints, two of which are found in the fingers; the third at the elbows, and by the springy universal joint at the shoulder. In other words, nature has taken every provision possible against lateral dislocation or the spraining of the elongated finger; and step by step in the evolution of the horse we can trace the evolution of the three tongue and groove joints in each limb; they become sharper and sharper as time goes on. Fig. 5.

In the extraordinary jumping of Heatherbloom, we have illustrated two principles; first, the power which has been attained in that animal, of getting over very high obstacles—eight feet two inches I believe—and we shall refer later to the fact that in the jumping horse we have a combination of two original ancestral strains of horses, one contributing the element of speed and the other contributing the element of lifting power. Fig. 9.

In a rearing horse we often see the entire weight of a very heavy animal, plus a rider, sustained on a single hind foot—with a great tendency therefore to

FIG. 3.

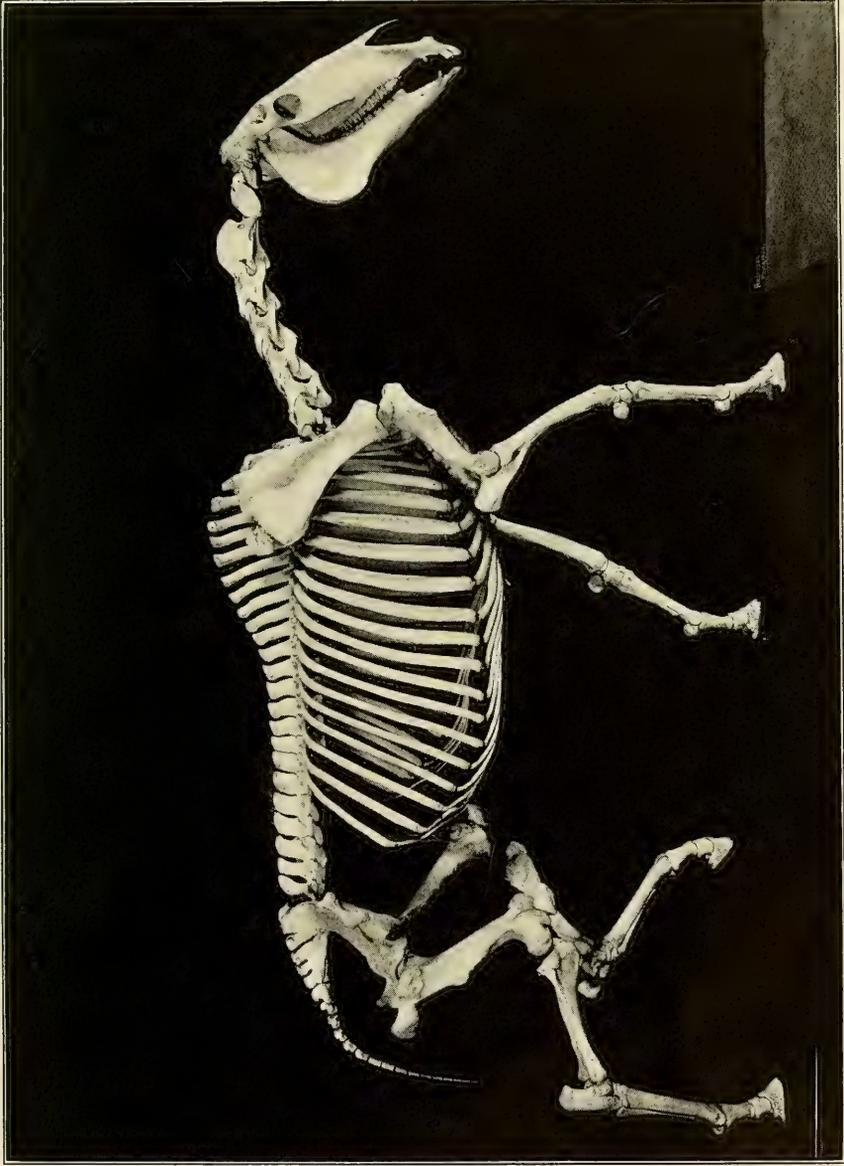


FIG. 3.—Skeleton of the Draught Horse in Action.

This side view of the skeleton as mounted in the American Museum of Natural History, is based on carefully prepared instantaneous photographs showing the position of every joint. The main thrust is being given by the left fore limb and the right hind limb.—Gift of the late Wm. C. Whitney.

FIG. 5.

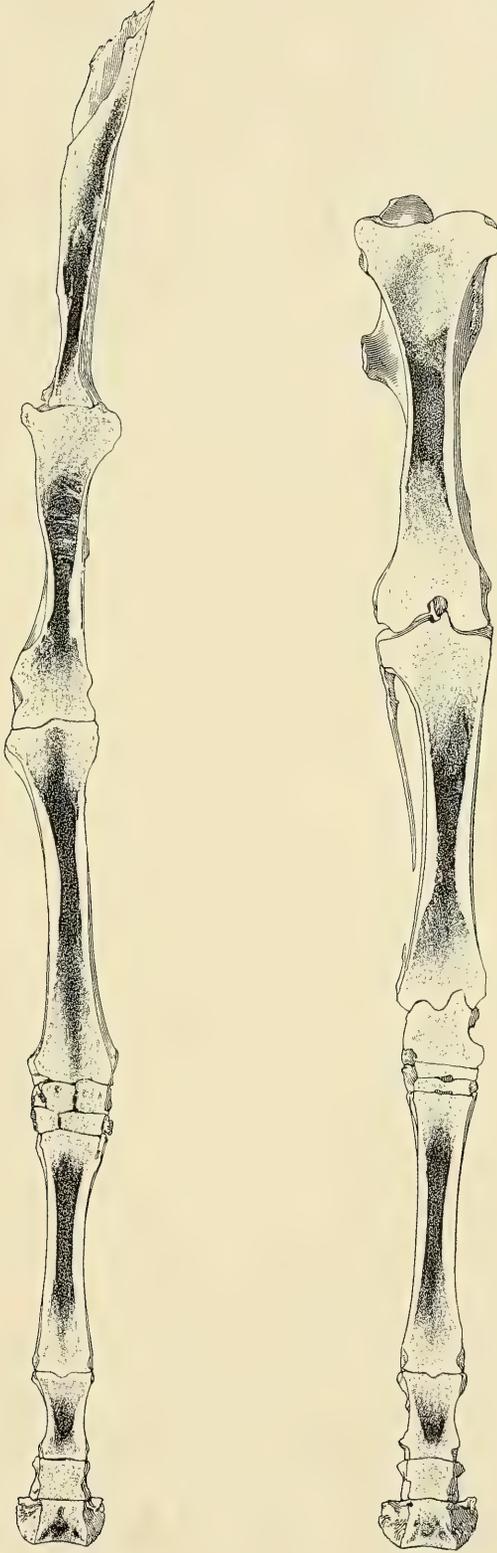


FIG. 5.—Sections of the bones of the limbs.

These sections as mounted in the American Museum of Natural History show the close union by means of several more or less perfect hinge joints, of the bones of the fore (fig. to the left) and hind (fig. to the right) limbs. The centres of the long bones are hollow, containing marrow. The ends of the bones are apparently spongy but are actually made up of delicately arched plates and fibres adapted to withstand the principal strains.—Gift of the late William C. Whitney.

FIG. 9.



FIG. 9.—Rising to the Jump.

The famous jumper "Heatherbloom."
Reproduced through the courtesy
of the Rider and Driver.
Owner, Mr. Willets.

FIG. 8.

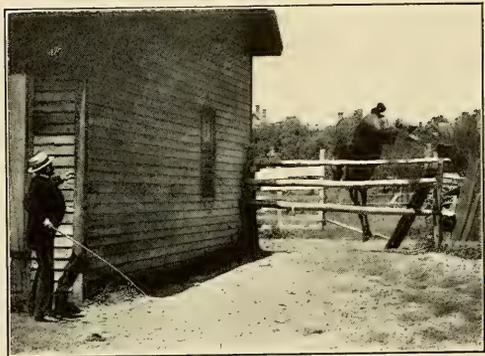


FIG. 8.—Landing from the Jump.

Illustrating the enormous strain
put on the modified central
fingers of the fore limb.

(Reproduced through the courtesy
of Trumbull Carey.)

FIG. 7.



FIG. 7.—A Thoroughbred
Arab Horse.

This is "Nimr" of the Huntington
Stud, directly descended from
the desert Arab "Kismet."

FIG. 6.



FIG. 6.—Type of Lightly Built
Thoroughbred.

"Pretty Polly," an example of the
extreme racing type. To be
compared with Fig. 7.

FIG. 10.



FIG. 10.—Comparison of Ancestral and Existing Horse.

The lower figure is a full size model of the *Eohippus* placed beneath the skull of a modern horse to show that the skull of the modern horse is larger than the entire body of its ancestor.

lateral strain, because there is more or less twist naturally involved upon that limb. Here again we have an illustration of the perfect joint mechanism.

Finally, we again examine the rearing horse as typifying the conquest of the horse by man. The animal is placed with the left foot thrust forward, and you have a comparison between the rigid fore limb of the horse and the movable hand or wrist of man; the man is being brought forward by the charge of the horse, while the horse is resting on the tip of a single toe. (Fig. 1.)

ORIGIN OF THE HORSE.

The explorations for the ancestors of the horse have been in England, France and in western North America. When the small ancestors of the horse were first found in England and France, they were not recognized as such; they were so entirely different from the modern horse, so small and simple in structure. It remained for an American palaeontologist first to recognize, in the rocks in the neighborhood of Fort Bridger, Wyoming, the very first stages in the development of the horse. The credit for that is due to the late Prof. O. C. Marsh and to his talented assistant, Mr. Oscar Harger of Yale University. They carried this type back to what is known as the *Eohippus*, being so known because of its being the dawn of the modern type.

The water and land masses of the earth at that time were quite different from what they are at present. We owe to the aridity of our western country, and the absence of vegetation, the exposure of the ancient rocks in which the horse ancestors are embedded, from British Columbia on the north to Texas on the south. In fact, wherever the beds are upturned, we have a series of exposed rock where it is possible to find the remains of the horse in various stages of evolution, owing to the extensiveness of these exposures and to the absence of vegetation. If our western country were covered richly with verdure, as England and France are, we never should have made the wonderful progress that we have in our knowledge of the ancestry of this animal. The special Eocene localities are chiefly in southwestern Wyoming, where we find the so-called mountain horse or *Orohippus*; in northwestern Wyoming, where we have the dawn horse or *Eohippus*, a little animal about 12 inches in height. These are followed by the more modern types of horse which approach, or are more obviously related to, the existing animal; they are found east of the Rocky Mountains in the region of the Great Plains, from the Swift Current River of British Columbia on the north to Texas and Mexico on the south. These are the principal areas in which fossil horses for the past thirty or forty years have been discovered, and on which we have directed our attack for the finding of more perfect types. Fig. 10.

In the lower photograph we have the so-called *Eohippus*, the dawn horse which was found in the Wasatch exposures of the Big Horn Basin of northern Wyoming, not far south of the famous Jackson's Hole shooting country. This little animal is actually 16 inches or four hands high at the shoulder. A more perfect idea of the size, and one which we can carry away with us, is by comparison with the skeleton above it, which is that of the whippet, or small coursing hound, the breeding of which has been carried to such perfection in England.

The whippet and the four-toed horse are practically of the same size. I made quite a search in the animal kingdom to find an animal exactly of the same size and approximately of the same build, because one of the points that people are most skeptical and curious about is the size in the various steps of evolution of this animal. You will observe that in the whippet the wrist joint is about the same distance from the ground as the wrist joint in the little ancestral horse, not very much higher above the ground than our wrist, if we place our hand upon a table. The heel joint of the Eocene horse is somewhat more elevated than in the whippet. Even at this early stage of its development the horse was firstly an intelligent animal, as we know by the relatively large size of its brain; secondly, a speedy animal, as we see by the delicate formation of its limbs. Another illustration of the small size of this animal is derived from the models, which are based exactly on measurements taken from the little skeleton. This little ancestor could, with a little straining, walk right through the skull of one of his modern descendants. The grouping of these little horses shows that they are by no means devoid of grace. The proportions are modeled from very careful study. The muscles of the limbs are rather those of the hound than those of the modern horse; the skull or head differs from that of the horse in the shortness of the face, and we see a reason for this, when we consider that the horse has evolved as an animal especially to feed always upon the harder grasses. It therefore required a very fine set of crown teeth. It has always been an alert animal, living in the open country, exposed to attack from rather swift types of animals, such as wolves and foxes, and it has always depended upon intelligence and speed to avoid its enemies, because it was obliged at various seasons of the year to wander long distances for its food. Fig. 11.

I had a most amusing experience last year on the occasion of the visit of Prince Fushimi of Japan. His Royal Highness came to the American Museum of Natural History and went around the hall to where the collection of horses was on exhibition. He was very much interested, and we came to the group of these little horses, when it occurred to me that the Orientals on visits of this kind were in the habit of making presents to their guests. So I said "Your Royal Highness, if you will do us the honor of accepting one of these models we shall be very much honored and pleased to present it to you." The Prince looked at the little model for a while and then made a short address to his interpreter. The interpreter drew himself up very straight indeed and addressed me as follows: "The Emperor of Japan is greatly interested in the development of the horse, particularly in the race of Japanese horses. His Majesty is especially troubled by the fact that the small size of the native Japanese horse makes the animal an inferior weight carrier and therefore of less service for cavalry. His Majesty I know will be most pleased to accept this gift of the model of the original American horse, and when he sees what the Americans have done by careful breeding and culture of the animal, I am sure his Majesty will be very much encouraged."

The foundations of some of the modern characteristics of the horse were probably laid down about three millions of years ago, because that is approximately the time when this little Eohippus lived. Now, when we deal in mil-

FIG. 11.

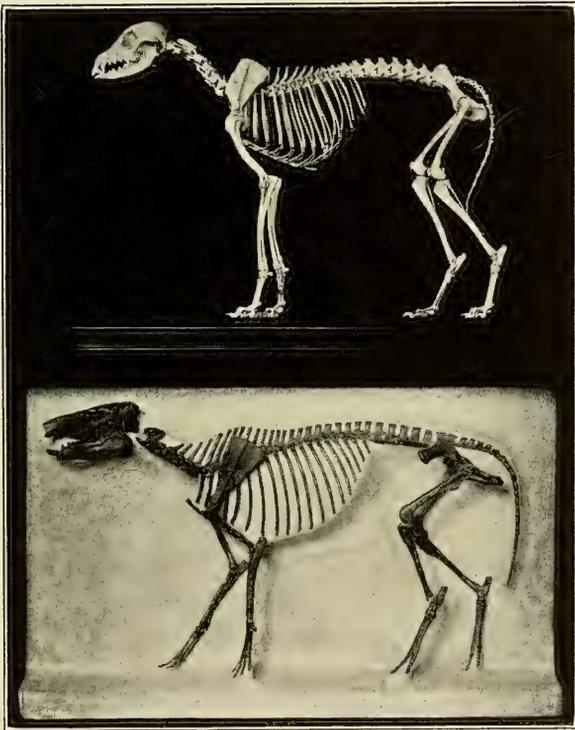


FIG. 11.—The size of the *Eohippus* or “dawn horse.”

The lower figure is taken from the only skeleton known of the *Eohippus* or “dawn horse” as preserved in the American Museum of Natural History. The skeleton of the English coursing hound, the whippet, above it, shows the comparative size of the two animals.



FIG. 12.

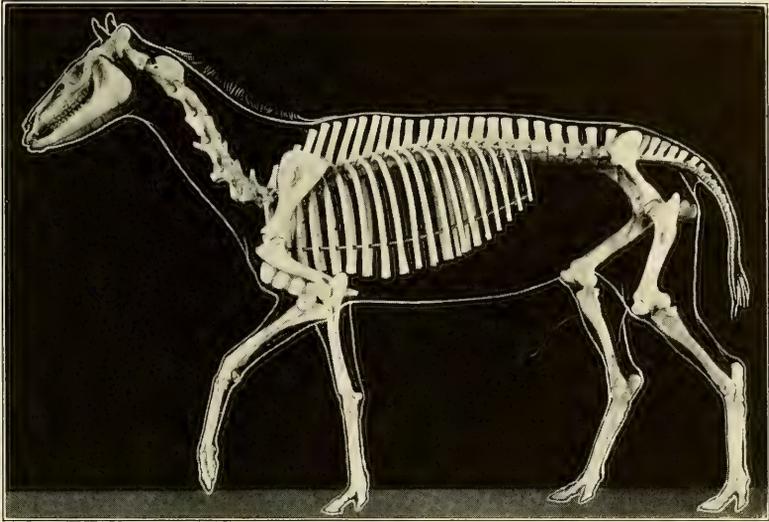


FIG. 12.—The Fossil "Forest Horse."

This forest horse, or *Hypohippus* is found in the Miocene and represents an animal about 10 hands or 40 inches in height, as mounted in the American Museum of Natural History. One of the finds made through the Whitney Fund.

FIG. 13.

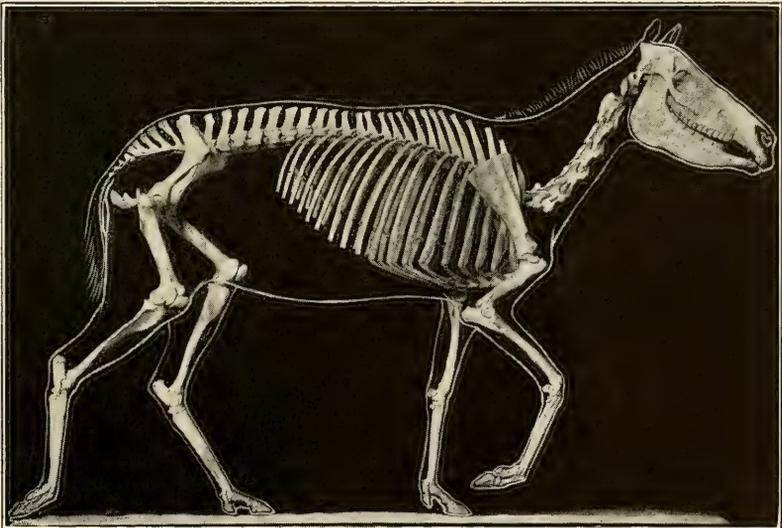


FIG. 13.—The Fossil "Desert Horse."

This skeleton was the most important discovery made through the Whitney Fund. It was 10 hands or 40 inches high and extremely light in construction, with the lateral digits entirely raised from the ground, as mounted in the American Museum of Natural History.

lions of years every one is always a little surprised, and I might say very briefly and parenthetically why we give this as the approximate period. It depends entirely upon the average rate of the deposition of rock, sandstone and gravel, in the mouths of streams of considerable size. In the delta of the Mississippi, for instance, the average rate of deposition in the gulf near land is about one foot in one hundred years; very near land it is much more rapid, and farther out, less rapid. One foot in one hundred years is a rather rapid rate of deposition. There are so many thousands of feet of rock which have been deposited above the remains of this ancestral horse, that we calculate it would require at least three millions of years for their deposit, and that is a rather conservative estimate. At the same time, you must take these estimates with a pinch of salt; that is, not too literally, because there is always a margin of error one way or the other.

Here we have one of the descendants of our little horse which is called the forest type of horse, for the reason that its teeth are rather short crowned, and are adapted to browsing rather than grazing; secondly, its feet are rather of the spreading type, as you see by the fact that the lateral toes (which now begin to start on their long journey toward the degenerated condition which we know as splint bones) still rest upon or near the ground, as seen for example in the right hind foot. This is one of the first horses found with the Whitney fund. The rear view of this animal brings out the fact that the four toes have now given place to three; the median toe is somewhat enlarged, the lateral toes are more like claws, and they only reach the ground when the animal is walking in comparatively soft or marshy places. We therefore imagine that this type of horse was one which, rather than seeking its food in the plains, retained the remote ancestral habit of living in the forests, remaining a browser. Fig. 12.

In the Miocene geological period, half way between the Eocene, which we first looked into, and the present time, the horses are found in Florida, in the plains region east of the Rocky Mountains, in Montana, in certain parts of Europe, in the Italian Peninsula, at the head of the Persian Gulf, and in France. But it is noteworthy that the horses which are found in the old world at this period are of such a structural type that they are excluded from being considered as the ancestors of the true horse; whereas in North America we find three types of horses, the 'forest type' which we have just seen; the second type, the 'desert type' of most beautiful and delicate and graceful build, more like the deer than the horse, which also became extinct; and a third type, transitional between the two, the *Protohippus*, which most closely corresponds to what we believe to be the middle stage in the evolution of the true horse.

Of the 'desert type,' is a horse discovered in northeastern Dakota, in a most interesting way. This animal, as we recognize by the small size of the tusks, was a mare, and with it were found the skeletons of two young horses, with their limbs closely drawn up beneath the body, the skull thrust down between the fore legs in each case, indicating that these three animals had been seeking shelter together either from a sand or wind storm, or from an exceptionally cold wave, and had perished in this position, huddled up, as it were, to protect themselves against some force of nature. Hundreds of thousands of years have elapsed, and these animals were fortunately uncovered by

Mr. J. W. Gidley, one of our explorers, and gave us for the first time a glimpse of this most perfectly developed type of race horse of the remote past, produced by nature, more delicately formed, more swift, in build at least, than the swiftest modern thoroughbred. Fig. 13.

This horse we call the Neohipparion. We see that the wrist is raised above the ground quite as much as in the modern horse; and we have a similar elevation of the hock. The animal differs from the modern horse in its lightness of limb, which is almost deer-like in structure, and in the relatively small size of the face, or abbreviation of the anterior part of the skull.

This series of outlines gives us an epitome or resume of what has happened in the period of which we are taking a brief running history. First, the little original horse (Eohippus); and last the horses found in northeastern Texas or the true American horse, a horse which existed here before the discovery of the continent by man, this is the animal which suggested to us the possibility of obtaining a complete history of the horse in America. A scale of sizes, which gives us the gradual elevation of these types, is as follows:

- 3 hands, the Eohippus.
- 4 hands, the Orohippus.
- 5 hands, the Mesohippus.
- 9 hands, the Protohippus.
- 10 hands the Neohipparion.
- 14 hands, the original American horse.

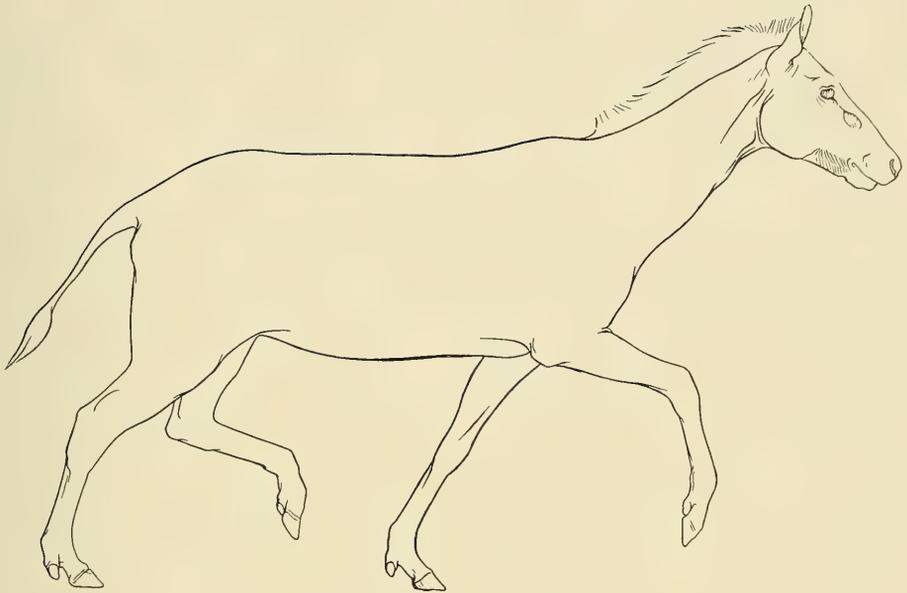
Finally, we have the true American horse, 14 hands high, about the height of a small horse or of a very good sized pony. Fig. 14, 15.

THE HOOFS AND CALLOSITIES OF THE LIMBS.

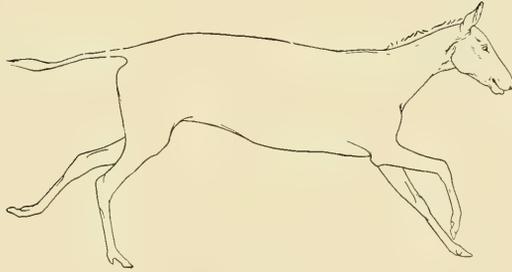
We have been comparing the middle finger of the hand with the foot of the horse, and we have seen how the tip must be modified to receive the impact with the hard ground, because as you know, the best types of horses belong either on rocky or sandy soil; now I shall proceed to show how the nail or claw has been modified into the hoof. Fig. 16.

First let us look at the side view of the fore foot and of the hind foot of an ordinary horse, and also at a sole view of the fore foot and hind foot, in connection with which I might call attention to the fact, known to many of you, that the fore foot is always broader than the hind foot. The rim of the nail, is continuous with the horny outgrowth coming out from the sole. The sole is turned in at this point, and surrounds the softer structure which is called the frog. Now, the crown, rim and sole are all horny tissue, whereas the frog, is all modified softer kind of tissue, which we shall see corresponds with the ball of the tip of the finger; whereas all the rest of the hoof corresponds with the highly modified nail. In a horse which has been shod, the hoof never reaches its perfect condition. Last spring we found the unshod feet of the Mexican horses always with the rim forming a beautiful natural shoe and with a comparatively well developed and springy cushion-like frog. The horse in galloping or trotting does not land on the toe but on the back of the

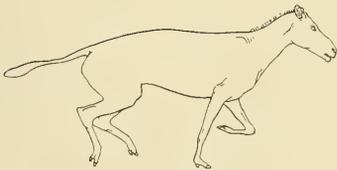
FIG. 14.



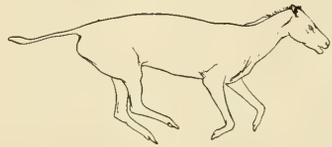
D.



C.



B.



A.

FIG. 14.—Increase in size of the Horse.

- A. The *Eohippus*, the smallest Lower Eocene horse known.
- B. The *Orohippus*, the Middle Eocene horse.
- C. The *Mesohippus*, the Lower Oligocene horse, $4\frac{1}{2}$ hands high.
- D. The *Hypohippus* or "forest horse."

FIG. 15.

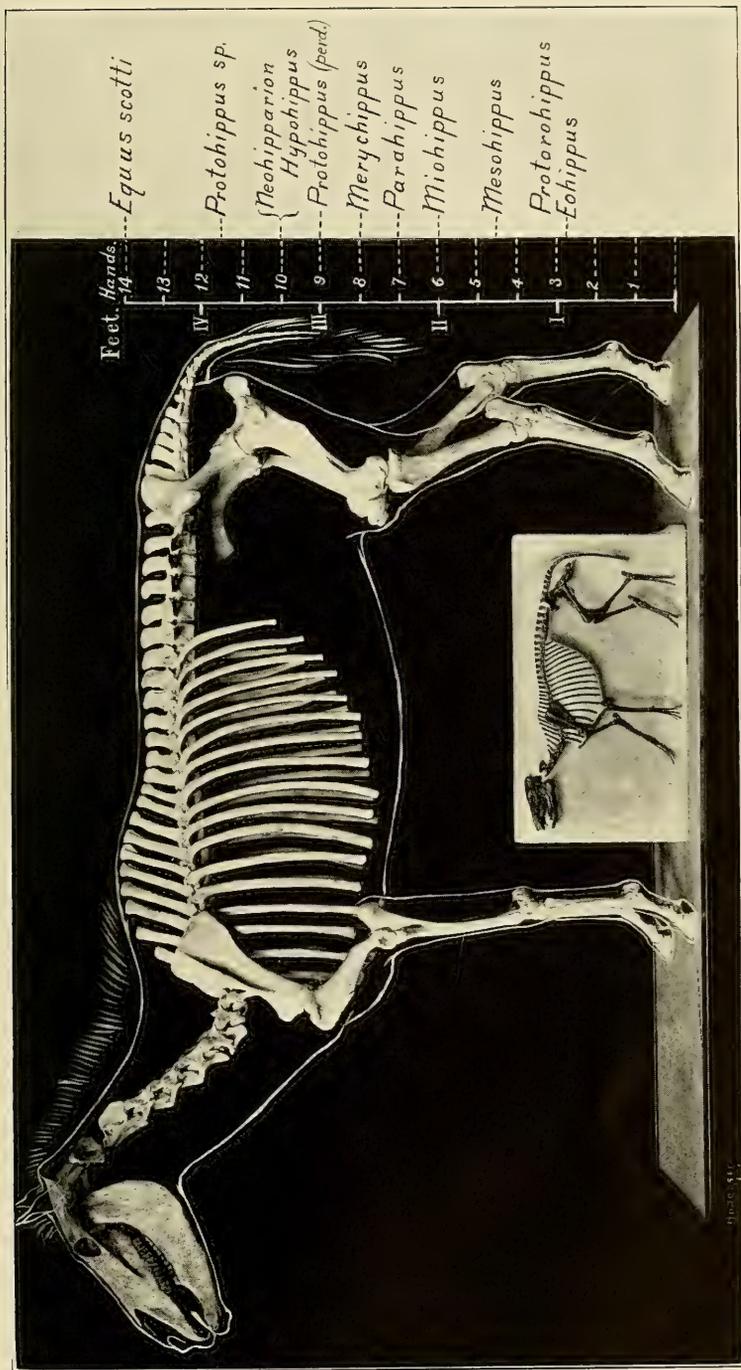


FIG. 15.—Increase in Size of the Horse.

The small skeleton is that of the *Eohippus*, placed beneath the limbs of the original American horse, or *Equus scotti*, as mounted in the American Museum of Natural History. The scale shows the progressive increase in size.

FIG. 16.

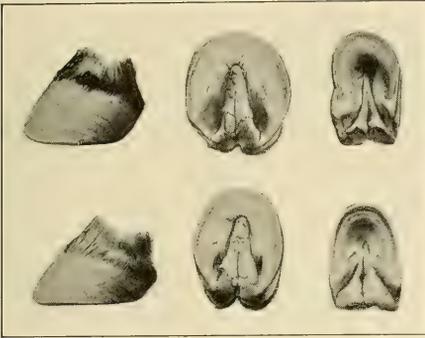


FIG. 16.—The Modified Nail or Hoof.

In the upper row are seen the side and sole views of the fore foot of a horse compared with the fore foot of a zebra. In the lower row the side and sole of the hind foot of the horse compared with the sole of the zebra. In the zebra foot the frog is seen to be expanded and to extend farther backward, while in the horse foot it is more enclosed by the hoof.

FIG. 17.



FIG. 17.—Section of the Fore Foot of a Horse.

This exposes the terminal bones or phalanges of the finger as buried in the fetlock joint and hoof, resting on an elastic pad.

FIG. 18.

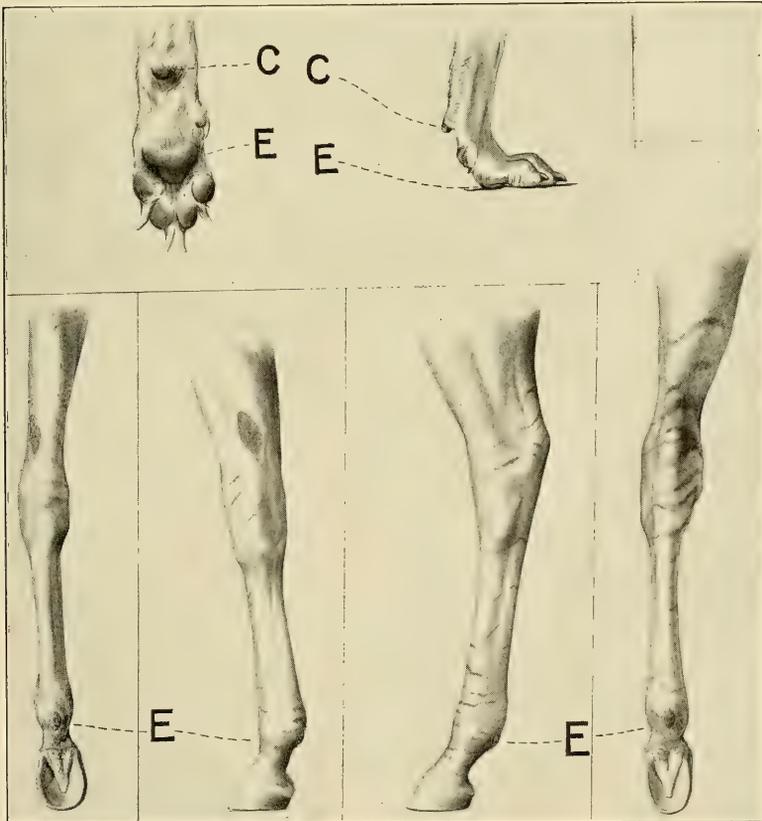


FIG. 18.—The Ergots—C and Chestnuts—E.

Presenting the foot of a deerhound and feet of a zebra to show the relative position of the ergots and of the chestnuts in these two animals. The ergot is at the back of the fetlock joint; the chestnut has moved upward, above its original position, to the inside of the wrist or knee joint of the horse.

foot, or frog and this is designed to break the hard impact of the limb when coming in contact with the ground. Fig. 17.

This adaptation is best illustrated in the foot of the zebra, in which we have a perfectly developed frog which is springy and cushion-like. As a matter of fact, the zebra does land distinctly upon that elastic body; not only so, but it also lands occasionally on the back of the fetlock. Fig. 18.

In the interior of the foot we have removed part of the crown of the hoof or nail, in such a manner as to show the terminal joint of the finger, corresponding with the last bone or third joint of the finger. This bone comes down and rests flatly upon a beautiful elastic cushion which extends beneath its lower surface in such a way as to take off the shock which would naturally be transmitted through the crown, through the sole and through this cushion, so that even without the aid of the frog the shock or impact with the crown is lessened as much as possible. Fig. 17.

I may now mention a comparatively recent discovery of Prof. Ewart's, namely, the true interpretation of the so-called ergots in the fetlocks of the horse, which are found just at the back of the fetlock joint, also of the chestnuts which are found on the inner side of the limb considerably above the knee of the horse. Ewart has recently been demonstrating that beginning with the frog, the ergots and the chestnuts, we have three calloused pads of skin which correspond, looking at the foot of the dog, with the pad which lies at the tip of the foot, with the pad which supports the middle portion of the paw, and with the pad which goes to support the wrist.

These structures to which so little attention has been directed, have been found of late to be very significant as regards the various breeds of horses. The ergots are large in the zebra, which rests on the fetlock joint in rapid speed or on hill sides, when the foot comes to the ground. The ergot is seen in the donkey's foot. In the Arab horse it is greatly reduced, now a vestigial organ, the chestnuts are also small. From these facts we have one of the best means of determining the presence or absence of Arab blood in a horse, because it has been noted that small ergots and chestnuts are a universal characteristic of the Arab breed. On the contrary they are very large in the cart horse, which is the very opposite of the Arab, and very small in the thoroughbred, which is derived from the Arab. One of the first points therefore in order to determine the blood of a horse, is to glance at these vestigial structures. A sign of what we call 'low breeding' is almost invariably found in the presence of very large ergots and chestnuts, and conversely, a sign of high breeding is found in the small or reduced development of those two pads. Fig. 18.

An epitome of the development of the foot is from the four-toed type to the three-toed type; to the type in which the lateral toes are raised entirely off the ground; to a type in which they are still further raised above the ground; to the type of the modern horse, where the fingers persist in their reduced condition of splints. In the modern horse, the splints, commonly uniting with the main cannon bone, become one of the greatest danger points, as the seat of a disease often developed by exercising the horse on very hard ground at a time before those bones have united. This is an interesting

illustration of the general fact that the vestigial organs are apt to cause trouble. Like the vermiform appendix, this is a condition of unstable equilibrium.

We observe that the evolution of the teeth of the horse, terminates in the elaborate crown of the very complex teeth of the modern horse. The dental battery of the modern horse, explains the elongation of the face; at the time when the full set of grinders have reached their maximum of development, before the process of wearing off these crowns has been proceeding for any length of time, in other words, while these permanent grinders are in a perfect condition, a great deal of space is needed for them. This is provided for by the expansion of the face above and of the jaw below, and accounts for the great development of the skull in front of the orbits or eye-sockets in course of the evolution of the horse.

This change extends the age of the horse. The little horse (*Eohippus*) could not have lived much more than eight or ten years, about the age of the whippet. We have just succeeded in securing for our collection a specimen of the horse which has reached an age of over 31 years; in this animal the teeth are worn down so that they are barely half an inch in length; whereas, when in perfect condition the teeth are ~~six~~ ^{3 1/2} inches in length. A horse dies partly from mal-nutrition, owing to the giving out of its very efficient dental battery. The pocketed cropping teeth of the horse are also a process of long evolution, the aged teeth becoming perfectly smooth and less effective. Fig. 20.

DISTRIBUTION AND MIGRATION OF THE HORSE.

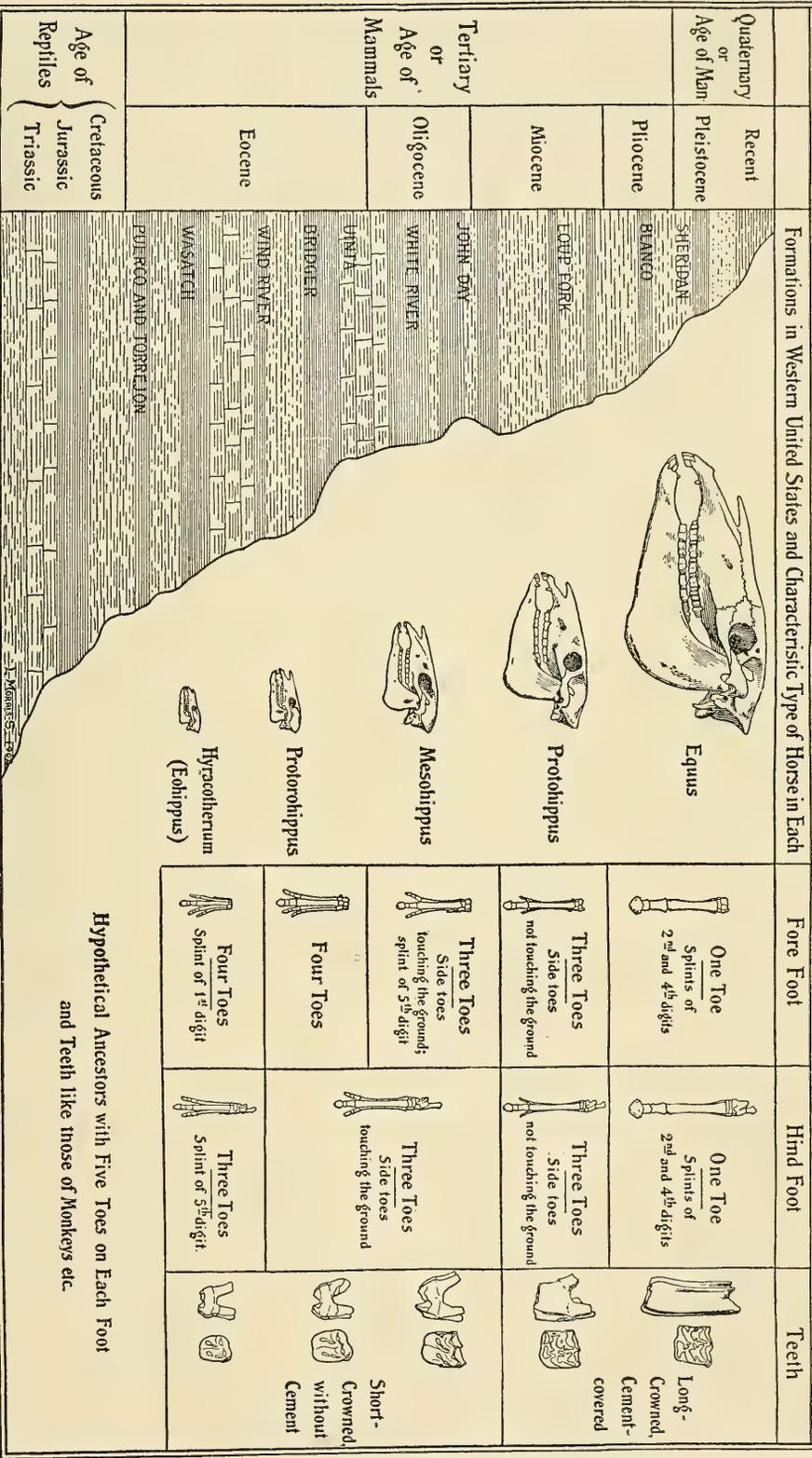
A map of the United States is interesting simply as showing the very wide distribution of the horse on the American continent, and the fact that before the extinction of the horse in America we have evidence, although we have not been able to pursue this evidence to a point of obtaining complete specimens, that the most superb natural breeds of horse, varying from a size far smaller than the smallest modern Shetland, to a size far exceeding that of the largest modern Percheron, were developed by natural processes of breeding and selection on this continent. It seems like a tragedy that at this climax of evolution, which nature had been slowly shaping through such a long period of time, horse life in America should have come to a complete and absolute close with the appearance of the great ice cap from the north and with the onset of the so-called Glacial Period. At the beginning of this period America was thickly populated with horses, extending down into South America. At the end of that period not a single horse remained either in North or South America.

The map represents the condition just prior to the glacial period, in which we find horses of varied type both North and South America and as far north as Escholz Bay on the Arctic Ocean.

After the glacial period, these animals are confined to a region extending from Central Asia over North Africa, down to the southern extremity of South Africa, the entire race having been swept off the Americas.

I am not satisfied that this widespread extinction was entirely caused by the ice age. It seems that we must bring in some other possible agency, and I am at present engaged in studying the epidemic diseases of horses in various

THE EVOLUTION OF THE HORSE.



Hypothetical Ancestors with Five Toes on Each Foot and Teeth like those of Monkeys etc.

As shown in the collections of the American Museum of Natural History from a diagram prepared by Dr. W. D. Matthew. This figure shows the geological section in which the horses occur, increase in size of the skull, and the development of the fore feet, hind feet, and teeth.

FIG. 19.—Epitome of the History of the Horse.

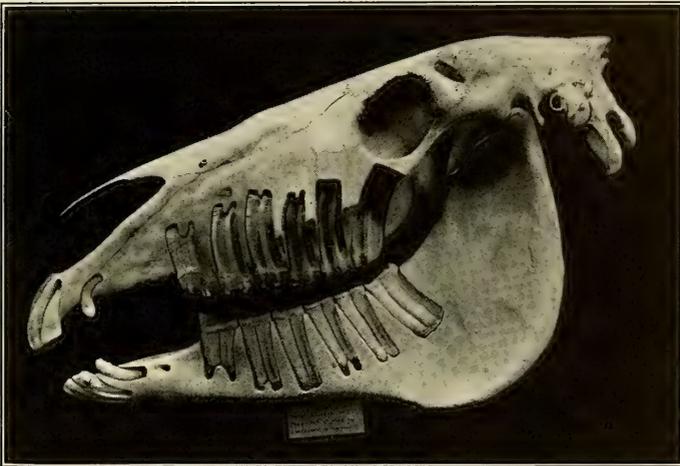


FIG. 20.—Dental Battery of the Horse.

In these three skulls the bony wall has been removed to show the location of the teeth. The middle figure represents the youngest animal, a horse five years old, in which the crowns of the teeth are very long and the roots beginning to develop. The upper picture represents the skull of a horse eight years old, in which the roots have grown longer while the crowns have been reduced by wear. The lower figure represents the skull of an extremely old horse, twenty-seven years old, in which the crowns are almost entirely worn away and the roots have become very long. Marked changes are also observed in the jaw.

FIG. 21.

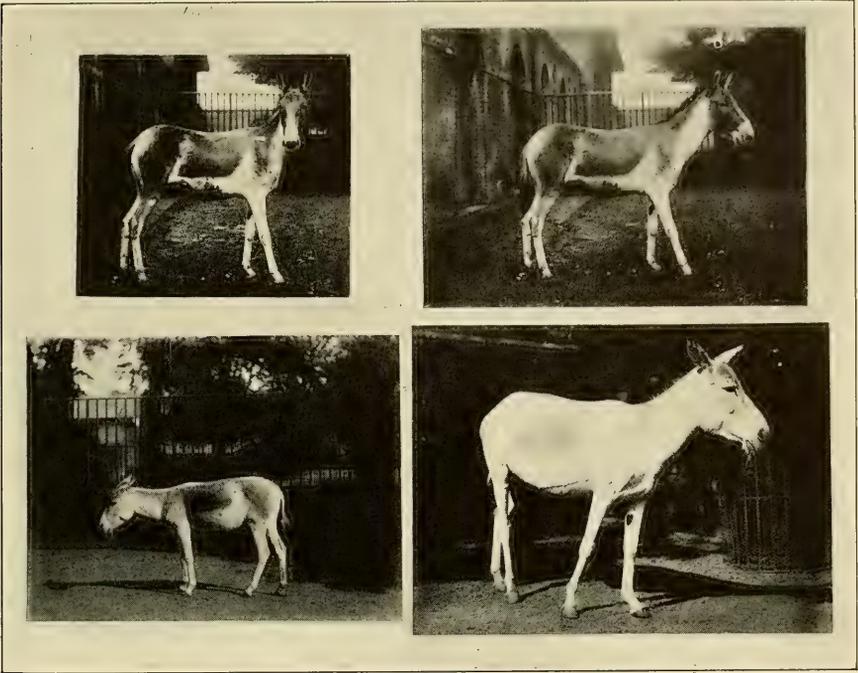


FIG. 21.—The Wild Asses.

The right hand lower figure represents the wild ass of Syria and India. The upper figures represent the Kiang, or wild ass of the deserts of northern Asia.

FIG. 22.

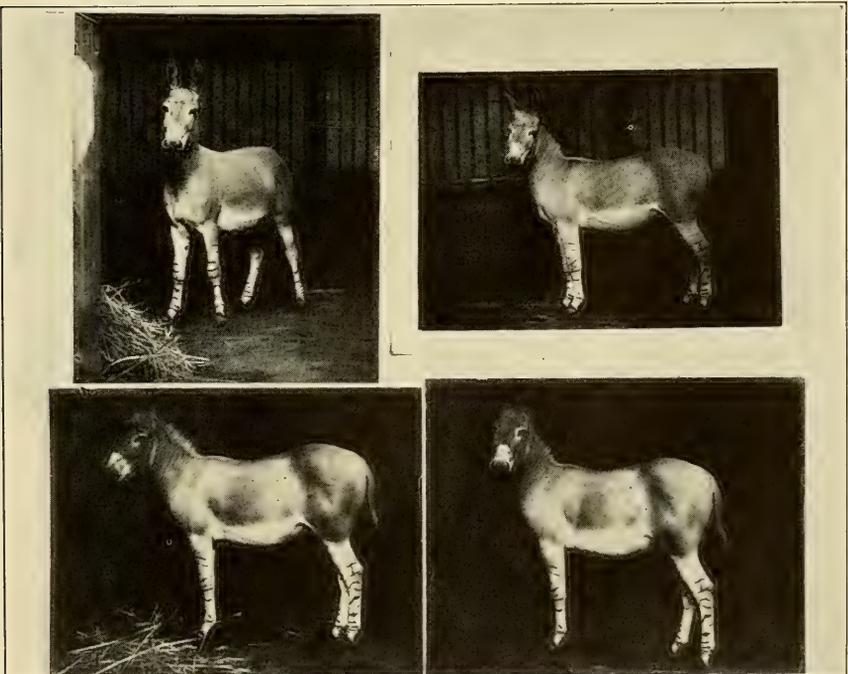


FIG. 22.—The Wild Somali Ass.

This animal is distinguished by the absence of a distinct shoulder stripe and by the presence of very distinct leg markings. It is probably one of the asses which has been domesticated.

parts of the world, such as surra, the horse sickness of India, and the tse-tse or fly disease, the horse sickness of South Africa, and analogous diseases which have been recently discovered, which render horse life in certain regions of Africa impossible. This study is for the purpose, if possible, of finding an adequate explanation of the extermination of the horse south of the glacial belt, which extended only as far south as New York. It is a most remarkable fact that the moment horses were re-introduced into this country and into South America they multiplied with enormous rapidity. Comparatively few horses were brought in by the Spaniards, but the horse bred and multiplied, producing the great herds of mustangs, and also forming the source of the broncho and other wild types of horse in North and South America.

THE WILD ZEBRAS AND ASSES.

We pass for a moment into the region of Central Asia and north-eastern Africa—a region now inhabited by the wild asses of the world. The Abyssinian ass is interesting as the progenitor of the donkey, and of the domesticated asses of the entire world, including in all probability the fine varieties found in Syria. One means we have of establishing this fact is the presence of the cross or shoulder stripe which is common to the domesticated asses, the world over, and also the presence of the back stripe. The Abyssinian ass has a near relative in the Somali ass, distinguished by the presence of a number of horizontal stripes on the limbs, like the zebra. This Somali ass we have in different points of view here in Fig. 22. It seems to me quite possible from observations made among the donkeys in Mexico, many of which have striped legs, that the Somali ass may also have been domesticated and that certain strains may have found their way into the donkey blood of the world. As we pass north, we find the wild Syrian and Indian asses, animals that correspond to the Onager of the ancients, and were highly estimated for food. In Northern Asia we find the Kiang, an ass distinguished by its light colored belly. The color of these animals is a matter to which we have not alluded before, but it is very similar, as we shall see, to the coloring of the wild horses which have been found in the same belt. This coloring is purely protective; the light striking on this brown upper part of the back, and the shadows of the white under surface, tend to harmonize the animal, which has a general earth color, with the adjoining soil. Fig. 21-22.

The home of the zebra, extends from the home of the ass on the north, Somaliland, down to the Cape of Good Hope on the south. Remember that Africa has never been entered—until comparatively recently—from the coast. There are only two gateways to Africa which are free from malaria. One is the north and one is the south. All the coast land is deadly and many expeditions perished in an effort to reach the high healthful spots of the interior, from the coast level. The Dutch, entering through the southern gateway at the Cape, found the first of the zebras, the mountain zebra, a small animal with long ears, a dew lap beneath the neck, and short limbs, the smallest of the zebra tribe. The second of the zebra group is represented by what are called the Burchell zebras, from the fact that Burchell, the English explorer, crossed the Orange River into the regions of the north and found this second type. This

figure represents a pair of the Burchell zebras, of the Grant species, with a dorsal stripe, with brilliant patterns on the flanks, as photographed in the New York Zoological Park. I had the camera placed above, so as to show this remarkable gridiron of the back. Fig. 24.

All domesticated breeds of the horse show, at one period or another in life, either directly or through reversion, that they were similarly striped, so that the probabilities are that the ancestors of the modern horse were striped animals, and we see in a few transition forms how a striped animal can gradually be converted into a non-striped animal. In the true Burchell, inhabiting not a forest region but a sandy open region; the stripes have faded entirely out of the lower limbs; the lateral stripe is paler than the Grant, and the under stripes are becoming broader. Another Burchell, showing the under spaces of the body assuming a ruddy brown tint, which would naturally compare with the bay color of our horses. We observe that this tint harmonizes with the brownish tint of the desert back-ground. In this harmony of color we have the true significance of *the origin of the simple bay coloring of our modern horses*. In the Quagga, so called by the Dutch, the striping has entirely disappeared from the posterior portion of the body and is confined to the neck, while the entire back has assumed a reddish brown hue, like the rich bay of the modern horse. The Quagga is now entirely extinct, having been killed off for food and for its hide.

The third type of African zebra is the so-called Grévy, named after a President of the French Republic, who received one of those animals from the King of Abyssinia. It is interesting that our photograph is from a specimen sent by the King of Abyssinia to President Roosevelt, and housed for a short period en route within the walls of the New York Zoological Park. This animal is the noblest of the zebras, standing 15 to 15 1-2 hands high at the withers. It is finely striped, as compared with the coarse banding of the Burchell or Grant zebras. A similar fine striping is sometimes seen in the foal of the best types of modern thoroughbreds, but it is transitory and fades out soon after birth. A front view of the Grévy, shows the long expanding ears, which are unlike those of any of the existing horses, yet my friend Ridgeway was at one time persuaded that the horse is closely related to this Grévy zebra, an animal, by the way, capable of domestication, and one which will undoubtedly be made use of in the later development of Africa.

In general, the zebra coloring tends to conceal the animal in the surrounding country, and we have as the universal testimony of sportsmen and travelers the fact that the zebra, while the most conspicuous of animals when seen out of its natural surroundings, is one of the least conspicuous when seen in its natural surroundings, especially by daylight, by high sunlight and by moonlight. I had an opportunity a year ago in the park of his Grace the Duke of Bedford, to see three or four of these Grévy zebras standing in the shade of a cluster of oak trees, and I can testify to the fact that they were nearly invisible; at the first glance your eye did not catch them, whereas your eye would have been immediately struck by the presence of black or white horses, or even by a horse of a single uniform bay color.

FIG. 24.

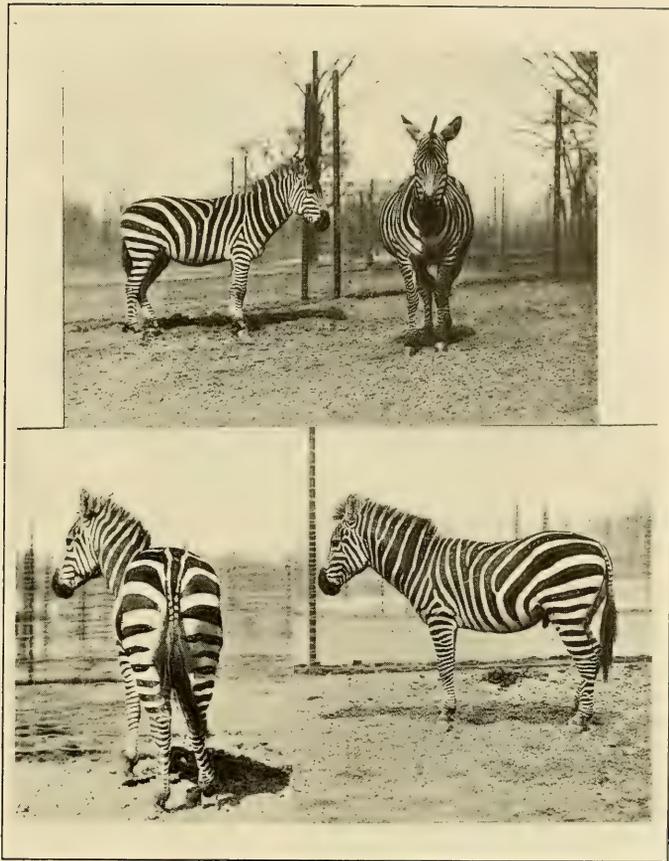


FIG. 24.—Burchell's Zebras.

These are Burchell's Zebras of the Grant Species, photographed in the New York Zoological Park by E. A. Sanborn.

FIG. 23.

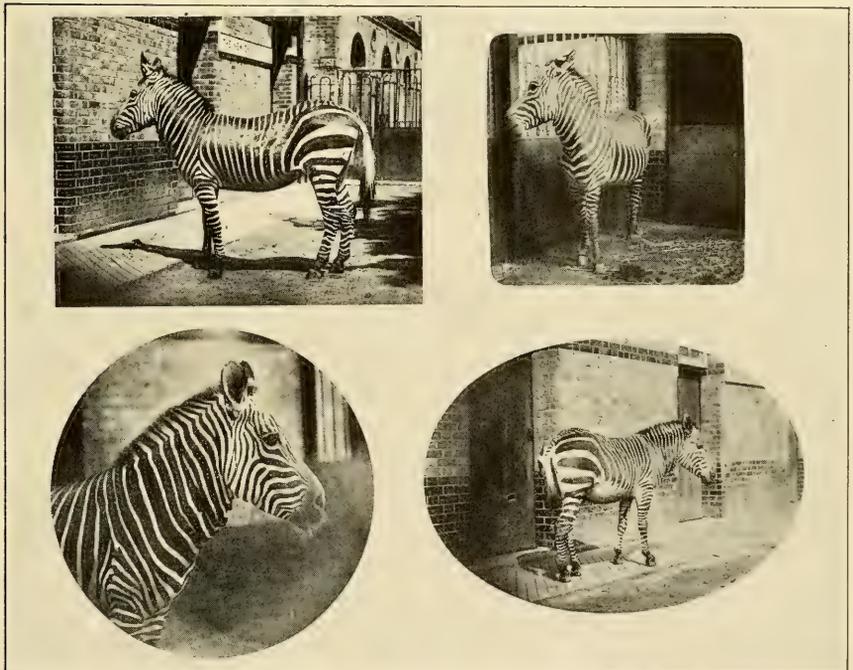


FIG. 23.—The True or Mountain Zebra.

These are the true or Mountain Zebras from southern Africa. Photographed in the London Zoological Gardens.

FIG. 26.



FIG. 26.—Head of the Prejvalsky Horse.
Photographed in the New York Zoological Park by E. A. Sanborn. Note the
absence of forelock and the characteristic wild look of the eye.

FIG. 25.



FIG. 25.—The Wild or Prejvalsky Horse.
A pair of Prejvalsky Horses in the New York Zoological Park, in their
summer coat. Photographed by E. A. Sanborn.

WILD AND DOMESTICATED HORSES.

As recently as 1882 it was believed that the horse itself had become entirely extinct as a wild animal. There were reports of the Tarpan found in eastern parts of North Asia by Marco Polo and other Asiatic travellers. But in 1882 a Russian explorer, discovered a single specimen of a true wild horse. The description was received with incredulity and for a long time it was believed that the so-called *equus prejavskii* was a cross between a Kiang and the Mongolian pony which ranges over this region of Northern Asia. Fig. 25-26.

It proves that the so-called Prejavsky horse is one of the most desired missing links in the history of the horse. We owe it to the scientific spirit of the Duke of Bedford that Carl Hagenback of Hamburg was especially commissioned to capture a number of these wild horses. He started out with a large herd of native Mongolian mares to act as brood mares, and with numerous horsemen, and succeeded in making a great round up of about one hundred wild horses. The adults were too wild to be captured. We owe to the Duchess of Bedford beautiful photographs of the Prejavsky horses and colts as they are now seen, the most beautiful captive herd in existence, in the park of Woburn Abbey. These animals are really very interesting to look at and to watch as they wander through the beautiful park of Woburn Abbey. This happens to be the best type of Prejavsky; there are two other types not so well shaped.

In the absence of hair on the upper part of the tail, which is therefore mule like, in the absence of forelock, in the upright mane and in a number of other characteristics we find points distinguishing these horses entirely from any of the domesticated horses. Every domesticated horse has a forelock.

I spoke of the Prejavsky as giving us a much desired missing link. The link comes in between the natural history of the horse as we have been following it, and the horse as discovered and domesticated by man. A brief outline of man in his relation to the horse falls in the latter part of the so-called Quaternary period, the age in which we live. This is distinguished also as being the period of the mammoth in the northern hemispheres, as the period in which we find first the remains of man. In the older Paleolithic period, so-called from the fact that the stone implements of that period are not smooth, but are left rough on the edges, we find the first proof that man hunted the horse as an article of food. Among the deposits of Solutre in France we find the remains of no less than 80,000 bones of horses in one of the caves, incidentally furnishing abundant proof that man was at that time a great horse hunter. In the next, or Magdalenean period, man became an artist, and in caves of this age we find the earliest drawings known to history. When you first look at these paintings you are rather amused, because they look so crude, but when you try to do the thing yourself, if you are not an artist, or if you ask one of your children to do it, or if you compare them with any of the paintings of horses by Indians, you will see that these paintings while mere outlines have considerable artistic value. Here for example is an animal like a bison; here is a reindeer; here is a mammoth, and here are some horses. These drawings are quite truthful. An upright mane characterizes this horse, a heavy beard

under the chin, and a convex forehead; another horse with an upright mane is smaller in type and has a smaller head. If you will keep these horses in mind, and compare them with the Prejvalsky horses, you will find that the Paleolithic man with crude instruments was sketching on the walls of his caves horses very similar to the Prejvalsky and very true to life. In two little Prejvalsky colts taken in their winter coat in the Zoological Park, we noticed the upright mane, no forelock, the convex face and heavy chin beard, and see the striking similarity to the prevailing type of these Paleolithic pictures.

We believe therefore that in these Paleolithic pictures we have a representation of the northern, clumsy, large headed, type of horse which we generally speak of as the Norseman's horse, which belongs in Northern Europe. When the Achaeans came down and conquered the Mediterranean Greeks; the horses they brought were dun colored, of comparatively little speed, but of great endurance. They constituted one of the foundation strains of the heavy draft-horse of the present day. Fig. 27.

In the intermediate period of the last 70,000 years, the horse has developed a forelock, which is undoubtedly a protection against the weather.

The Shetland is especially illustrative of the general fact that wherever the horse is restricted in its range to an island it is apt to become of diminutive size. The animal, 'Highland Chieftain,' measured only 32 1-2 inches. I secured it through the Whitney fund, and it was the smallest specimen which had been exhibited in Scotland up to that time, four years ago. The animal is now mounted in the American Museum, showing the smallest size of the artificial breed of horse, a fine example in contrast with the larger sizes, the largest specimen of Percheron breed which we have recently secured being 19 hands or 76 inches in height. Fig. 28.

A typical English Shire horse exhibits northern points, in its large ergots and chestnuts, its heavy mane, its heavy forelock and heavy fetlock, heavy tail and heavy winter coat. In all probability this was a product of the Norse type of horse, improved by careful human selection and breeding and crossed with the Southern horse. I must, however, make this point clear—that these types are not directly descended from the Prejvalsky is evident from certain reasons which are somewhat technical; there was rather a sort of first cousinship in the way of relation.

This Celtic pony of Ewart is not an ordinary pony but what we must regard as one of the most interesting and striking discoveries of recent times. It is a new species of horse recently found on the British Isles, partly pure, partly represented by certain strains, on the west coast of Ireland, in the Hebrides, the Faroe Islands and in Iceland. This strain is quite abundant. Prof. Ewart had this pony in his possession for two years before he recognized that he had to do with a distinct species. The fact that it is a distinct species is shown by an additional tooth, by the small size and fine shape of the head, by the small sized chestnuts, the absence of the ergots, and by the very prominent covert brush which covers the upper part of the tail. Altogether we have a type of pony related more closely to the Arab than to the Norse horse, a type which

FIG. 27.

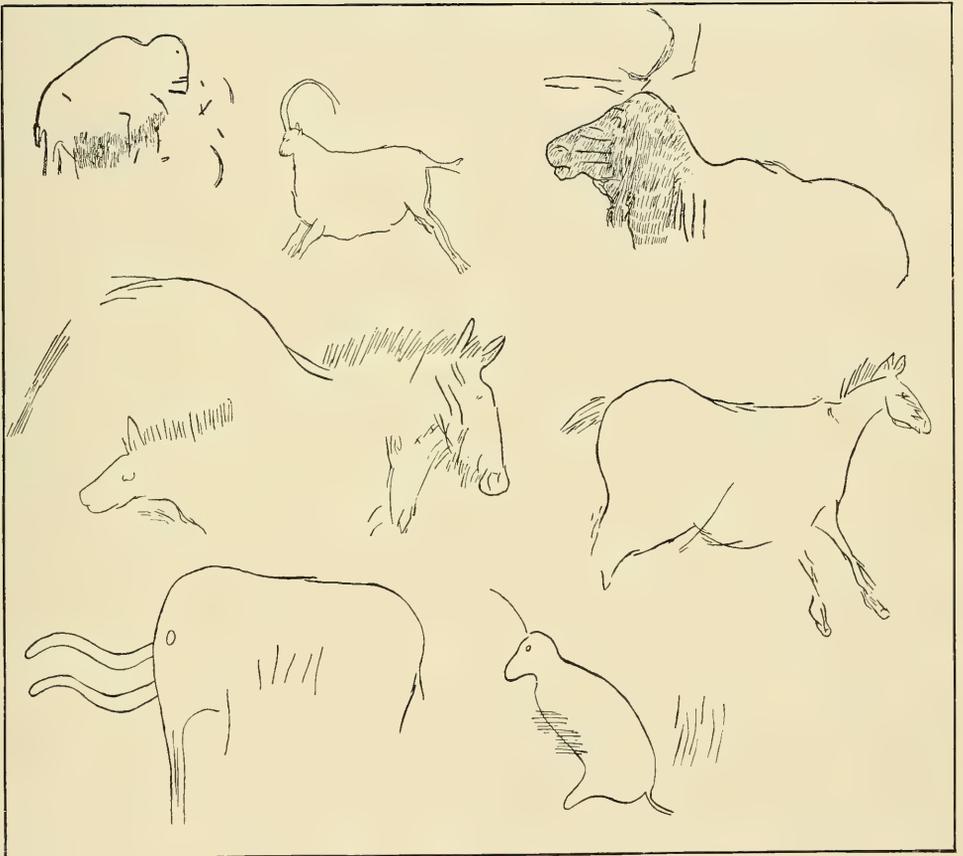


FIG. 27.—Drawings by Palaeolithic Man.

Collection of cave drawings by Palaeolithic man of the Magdalenian period. The two central figures represent horses. The other animals are the reindeer, the ibex, and the hairy mammoth.

FIG. 28.

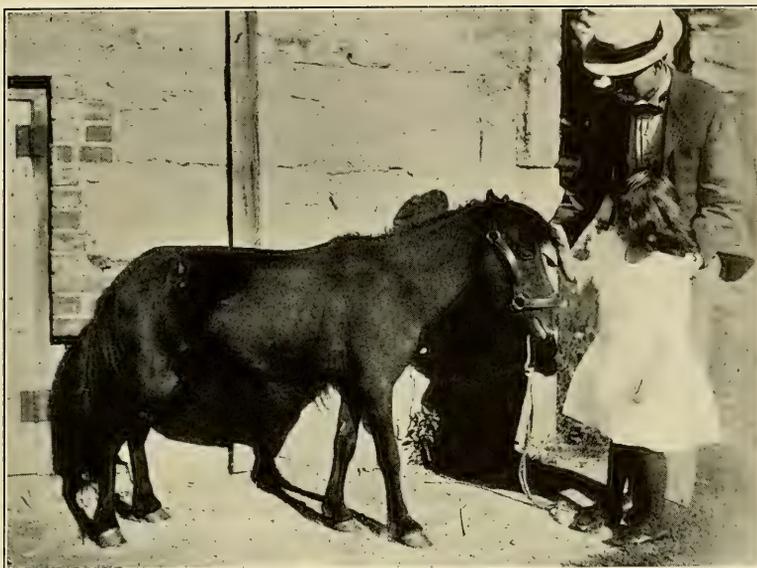


FIG. 28.—A Diminutive Shetland.

“Highland Chieftain,” an extremely diminutive Shetland, which was secured for the collection in the American Museum of Natural History through the Whitney Fund, representing the most diminutive size produced by breeding and adverse conditions of life.

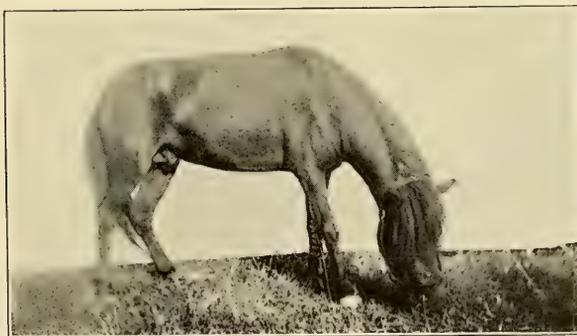


FIG. 29.



FIG. 29.—From a Mexican Hacienda.

The upper row represent typical Mexican horses of the striped dun and Andalusian varieties. To the left of the middle row are two views of the Syrian Arab Stallion belonging to Don Carlos de Zuloaga of Bustillos, Chihuahua. In the lower row are half-bred horses, the get of the Syrian Arab and ordinary Mexican mares.

must have been introduced at a very early period into Europe, gradually drifted north, more or less mingled with the blood of the Norse horse and thus lost to human recognition until very recently, when our attention has been directed to these finer points. The Celtic pony is a very fine hardy animal; in winter it has a finely protected fetlock, and the great tail brush grows out as protection against rain and wind storms. Why are not these ordinary tail hairs? Because they are shed annually, so that they represent a growth of hairs of the back which have come down over the upper part of the tail.

The last topic of the evening is the Arab, the second of the great stock of horses. The pure type of desert Arab, contrary to the general opinion, is a small animal about 14 hands high. The discovery of the Celtic pony is a great discovery, but perhaps a still more important one has been made by Ridgeway, namely, as to the origin of the Arab.

The Arab is a contradiction in terms. It is proved, I think beyond question, that the Arab is not of Arabian but of North African origin and that he has descended from a type of horse now extinct, which at one time was cultivated by the ancient Libyans west of Egypt.

The better known type of Arab is of larger size, and I might say that wherever the Arab is domesticated and fed it attains larger size and rises to 15 1-2 or over 16 hands. Quite a famous horse, was Nimr (son of Kismet) one of the Arabs belonging to the stock of Mr. Huntington of Long Island. This animal unfortunately died, but we have secured the skeleton and it is soon to be exhibited in the American Museum, showing the osteology of the Arab, which is quite distinct from that of the Norse horse. Nimr was a finely bred animal, it had the characteristic hollow or dish-face of the Arab, with a splendid neck and the extreme docility and kindness of temper which distinguishes all members of the Arab breed. Another characteristic is the fast walk, by reason of the so-called extension of the fore limb, which is moved not as in our high-steppers, but is raised slightly above the ground, and then as the hind limbs propel the animal forward, these fore limbs have a way of shooting forward and covered ground without any loss in action. Fig. 7.

Ridgeway has shown that in the early periods of their history the Arabians had no horses but lived only with mules and camels and that they were constantly getting their supplies of horses in from the south or from Asia and Africa. In the intermediate period, apparently, King Solomon did a roaring horse trade by means of animals imported from Africa and sold into Asia. When the Greeks took possession of north Africa they found a superior breed of horses there.

Before and after the Libyan horse became domesticated in large numbers in Arabia, the fine natural north African breed, slightly modified by human selection, came up from the south spreading all over into Asia and into Europe, and gradually modifying the Norse type. All the better horses of Europe therefore are believed to contain more or less of this southern blood. Even as far back as the time of the ancient Gauls, when the wars were on between the Romans and Celts and Gauls, the Gauls were sending south—when they had wealth

enough—to get these superior breeds of horses. Their native horses were of such small size and inferior caliber that they were unable to bear them on horseback; the Gauls were in the first place charioteers, and secondly, riders of horses.

When Hannibal went on his great expedition and took route via Spain, around the Mediterranean and down through Italy, he introduced into Spain large numbers of these north African horses. Undoubtedly the evolution of the fine Andalusian stock is due largely to this African strain. When the Spaniards came to America they brought a few of the Norse type, with stripes and dun color and many of the Andalusian horses, carrying the Arab or Libyan blood.

In the English thoroughbred we have a descendant, modified by human selection, of two types of Arabs, the North African but chiefly the Arabian type. This has been going on from the time of Charles II with more or less fresh infusion of Arab blood to give strength and bulk. One of the swiftest thoroughbreds ever produced on the English turf, Pretty Polly, is a fine example of the finest type of English breed. (Fig. 6.)

During our recent trip to Mexico, Prof. Ewart and myself examined horses expecting to find many traces of the Norse breed. We were quite surprised to find comparatively few; on the contrary, Mexico was full of the descendants, modified of course by their harder conditions of life, of the Andalusian breed, as proved by the various 'Arab' points which I have mentioned and also by the wonderful endurance, carrying and sustaining power, by their ability to thrive with little food and travel great distances. On the hacienda of Senor Martinez del Rio, we found very few dun horses of Norse type, but here and there beautiful ponies with many Arab characteristics—probably direct descendants from Andalusian stock. Going north, we were entertained at the hacienda of Senor Carlos de Zuloaga, and I took a few snap shots in the corrals of this second largest land estate in Mexico—a matter of 1,900,000 acres. Don Carlos has imported from the King of Wurtemberg some very fine stallions belonging, not to the very best type of Arab, but to the large breed known as the Syrian Arab. He has bred these with Mexican mares and has produced thereby one of the most perfect types of horse you can imagine. He has about seven of these half Arabs—very singularly uniform in color and just about of a size, as for instance, the standard, 7 inches around the cannon bone corresponding with the Arab, beautifully proportioned and very agile, and like the Arab, wonderfully playful and docile in disposition.

After a vote of thanks to Professor Osborn for his interesting and learned address The Farmers adjourned.

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