Evolution of Horse
SEM- VI, cc- XIV

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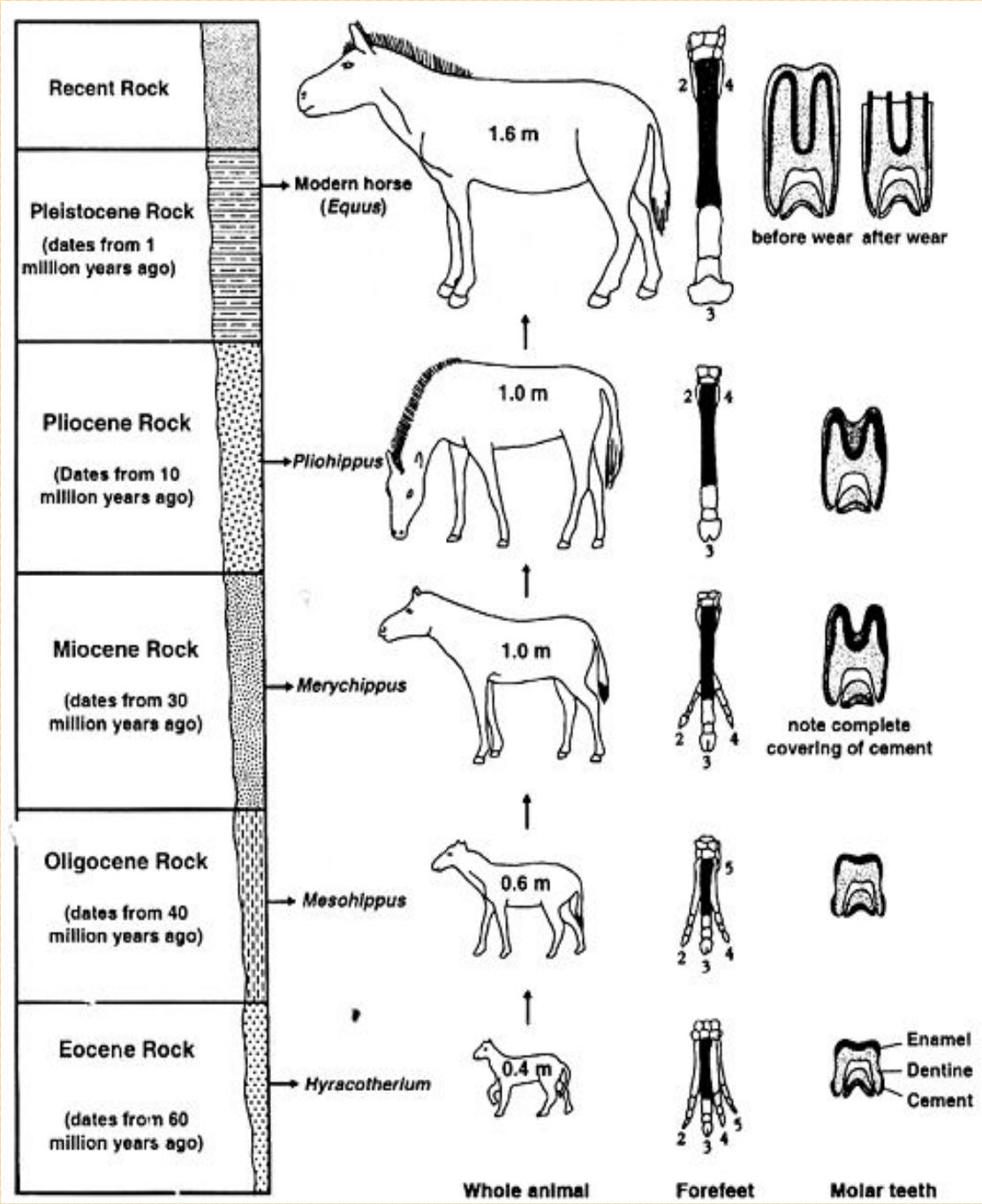
- The evolutionary lineage of the horse is among the best-documented in all paleontology. The history of the horse family, Equidae, began during the Eocene Epoch, which lasted from about 56 million to 33.9 million years ago. During the early Eocene there appeared the first ancestral horse, a hoofed, browsing mammal designated correctly as *Hyracotherium* but more commonly called *Eohippus*, the "dawn horse." Fossils of *Eohippus*, which have been found in both North America and Europe, show an animal that stood 4.2 to 5 hands (about 42.7 to 50.8 cm, or 16.8 to 20 inches) high, diminutive by comparison with the modern horse, and had an arched back and raised hindquarters. The legs ended in padded feet with four functional hooves on each of the forefeet and three on each of the hind feet—quite unlike the unpadded, single-hoofed foot of modern equines. The skull lacked the large, flexible muzzle of the modern horse, and the size and shape of the cranium indicate that the brain was far smaller and less complex than that of today's horse. The teeth, too, differed significantly from those of the modern equines, being adapted to a fairly general browser's diet. *Eohippus* was, in fact, so unhorselike that its evolutionary relationship to the modern equines was at first unsuspected. It was not until paleontologists had unearthed fossils of later extinct horses that the link to *Eohippus* became clear.

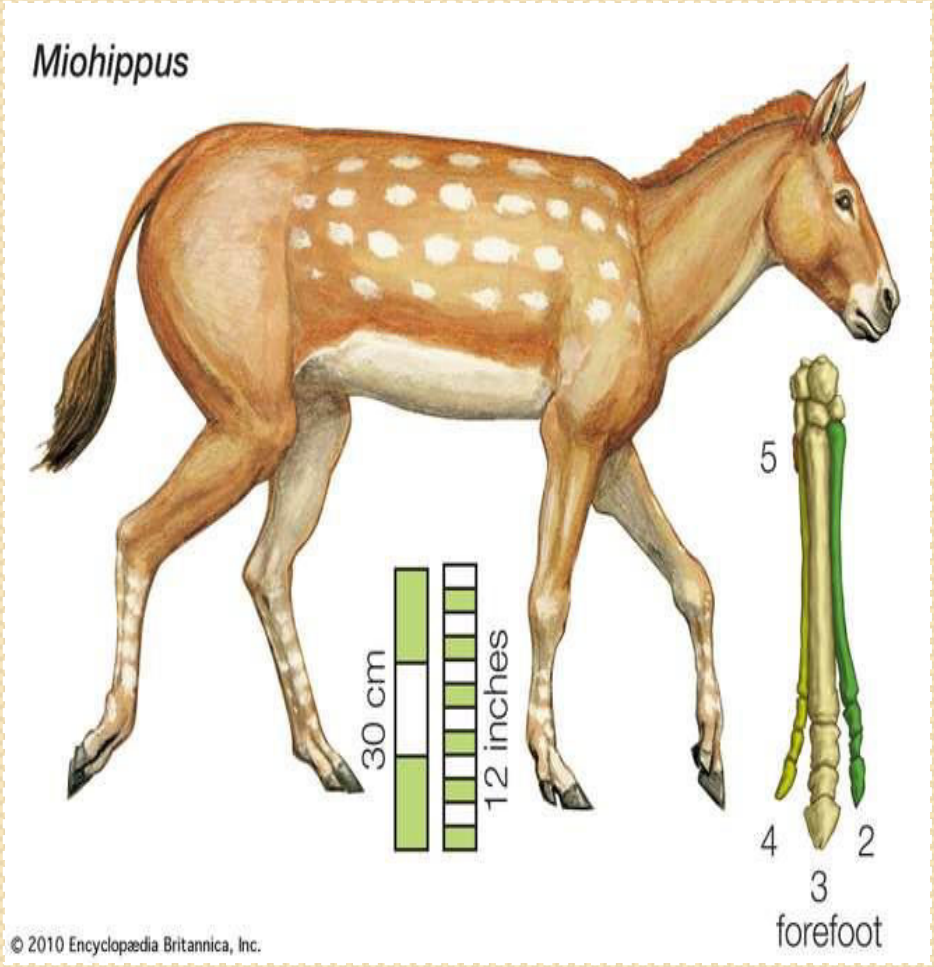
		Fore foot	Hind foot	Molar teeth
Recent Pleistocene Pliocene	 Equus	 One Toe	 One Toe	 Long-Crowned, Cement-covered
Miocene	 Protohippus	 Three Toes	 Three Toes	
Oligocene	 Mesohippus	 Three Toes	 Three Toes	
Eocene	 Protorohippus	 Four Toes		 Short-Crowned, without Cement
	 Hyracotherium (Eohippus)	 Four Toes	 Three Toes	

- The line leading from *Eohippus* to the modern horse exhibits the following evolutionary trends: increase in size, reduction in the number of hooves, loss of the footpads, lengthening of the legs, fusion of the independent bones of the lower legs, elongation of the muzzle, increase in the size and complexity of the brain, and development of crested, high-crowned teeth suited to grazing. This is not to imply that there was a steady, gradual progression in these characteristics leading inevitably from those of *Eohippus* to those of the modern horse. Some of these features, such as grazing dentition, appear abruptly in the fossil record, rather than as the culmination of numerous gradual changes. *Eohippus*, moreover, gave rise to many now-extinct branches of the horse family, some of which differed substantially from the line leading to the modern equines.

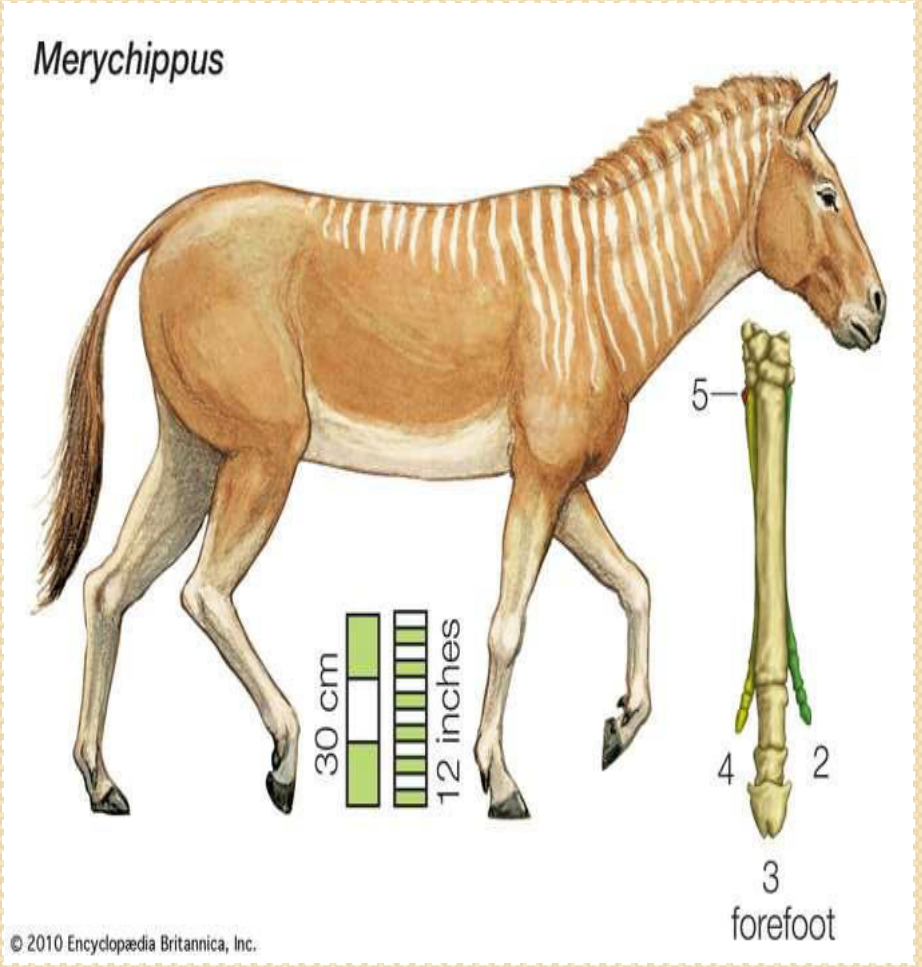
A SPECIMEN OF *HYRACOTHERIUM* DISCOVERED IN THE GREEN RIVER FORMATION AT FOSSIL BUTTE NATIONAL MONUMENT IN WYOMING. *HYRACOTHERIUM*, OFTEN CALLED *EOHIPPUS* ("DAWN HORSE"), IS THE OLDEST KNOWN MEMBER OF THE HORSE LINEAGE.


Recent Rock
Pleistocene Rock
(dates from 1 million years ago)
Pliocene Rock
(Dates from 10 million years ago)
Miocene Rock
(dates from 30 million years ago)
Oligocene Rock
(dates from 40 million years ago)
Eocene Rock
(dates from 60 million years ago)
Modern horse (Equus)
Pliohippus
Merychippus
Mesohippus
Hyracotherium
1.6 m
1.0 m
1.0 m
0.6 m
0.4 m
2
4
3
before wear
after wear
note complete covering of cement
5
Enamel
Dentine
Cement
Whole animal
Forefeet
Molar teeth

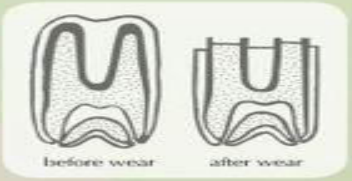
The ancestral horse *Miohippus*, in an artist's conception. Existing toe bones of the forefoot are numbered outward from the centre of the body.



The ancestral horse *Merychippus*, in an artist's conception. Existing toe bones of the forefoot are numbered outward from the centre of the body.



1.60m
Equus Caballus



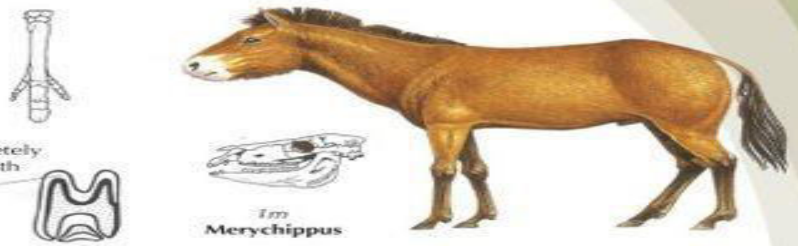
Around 10 million years ago, horse species that maintained a fruit and leaf diet became extinct, and about 4-5 million years later species that had intermediate diets (part leafy and part grassy) also disappeared. Only the grass-eating equids that eventually became the modern day horse (*Equus ferus caballus*) survived.

Recent
1 million years ago

1.25m
Pliohippus

Late Miocene
8 million years ago

> *Understanding the way animals responded to climate change is a major part of the story of life that offers insight into the present day and future. Our study suggests that animals respond to changing climates by a mixture of extinction and evolution.* M. Mihlbachler



1m
Merychippus

Middle Miocene
15 million years ago

tooth completely covered with cement

To better understand how horses' teeth evolved over time due to diet and climate change, researchers ranked the sharpness of the cusps of the molars of fossil horses.

0.6m
Mesohippus

Late Eocene
35 million years ago

0.4m
Hyracotherium

Early Eocene
55-60 million years ago

- ***Equus***—the genus to which all modern equines, including horses, asses, and zebras, belong—evolved from *Pliohippus* some 4 million to 4.5 million years ago during the Pliocene. *Equus* shows even greater development of the spring mechanism in the foot and exhibits straighter and longer cheek teeth. This new form was extremely successful and had spread from the plains of North America to South America and to all parts of the Old World by the early Pleistocene (the Pleistocene Epoch lasted from about 2,600,000 to 11,700 years ago). *Equus* flourished in its North American homeland throughout the Pleistocene but then, about 10,000 to 8,000 years ago, disappeared from North and South America. Scholars have offered various explanations for this disappearance, including the emergence of devastating diseases or the arrival of human populations (which presumably hunted the horse for food). Despite these speculations, the reasons for the demise of *Equus* in the New World remain uncertain. The submergence of the Bering land bridge prevented any return migration of horses from Asia, and *Equus* was not reintroduced into its native continent until the Spanish explorers brought horses in the early 16th century.

Origin of horse domestication

- Archaeological evidence indicates that the domestication of horses had taken place by approximately 6,000 years ago in the steppe lands north of the Black Sea from Ukraine to Kazakhstan. Despite intensive study over a long period of time, many questions remain about the early development of the species as it underwent domestication. One crucial question involves whether domestication was limited to a single location or occurred in multiple areas. Tied to this question of origins is whether domesticated horses spread throughout Eurasia or whether the practice of horse domestication spread to new areas, with local breeders capturing their own wild horses and introducing them to the domestic horse gene pool. Modern genetic techniques have been used to answer these questions, but different regions of the horse genome (that is, the complete nucleic acid sequence of a horse's genetic code) have yielded different answers.


Horse Domestication in Eurasia
5000–4500 BCE
LATVIA
LITHUANIA
BELARUS
RUSSIA
UKRAINE
ROMANIA
BULGARIA
MOLDOVA
KAZAKHSTAN
GEORGIA
AZERBAIJAN
ARMENIA
TURKEY
IRAN
CAUCASUS
BLACK SEA
CASPIAN SEA
SEA OF AZOV
CENTRAL RUSSIAN UPLAND
VOLGA HILLS
Volga
Ural
Don
Dnieper
Dniester
Bug
Danube
Zhayyq
Region of horse domestication
Steppe–Forest-steppe boundary
Modern country names and boundaries given for orientation purposes only
Source: Region of horse domestication from David W. Anthony and Dorcas R. Brown, "Harnessing Horsepower: Horses and Humans in Antiquity" (2007).
0 100 200 300 mi
0 150 300 450 km
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