

Evolution of horse (CC-14, unit-7)

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1 Scientific classification :

❑ Scientific classification

❑ Kingdom: Animalia

❑ Phylum: Chordata

❑ Class: Mammalia

❑ Order: Perissodactyla

❑ Family: Equidae

❑ Genus: Equus

❑ Species: E. caballus

2 Historical background :



Historical background In the 1870's, the paleontologist O.C. Marsh published a description of newly discovered horse fossils from North America. The sequence of horse fossils that Marsh described (and that T.H. Huxley popularized) was a striking example of evolution taking place in a single lineage. Some years later, the American Museum of Natural History assembled a famous exhibit of these fossil horses, designed to show gradual evolution from "Eohippus" (now called Hyracotherium) to modern Equus. Such exhibits focussed attention on the horse family not only as evidence for evolution per se, but also specifically as a model of gradual, straight-line evolution, with Equus being the "goal" of equine evolution



3 Timescale and Horse Family Tree :

Recent 10,000 years ago
to present

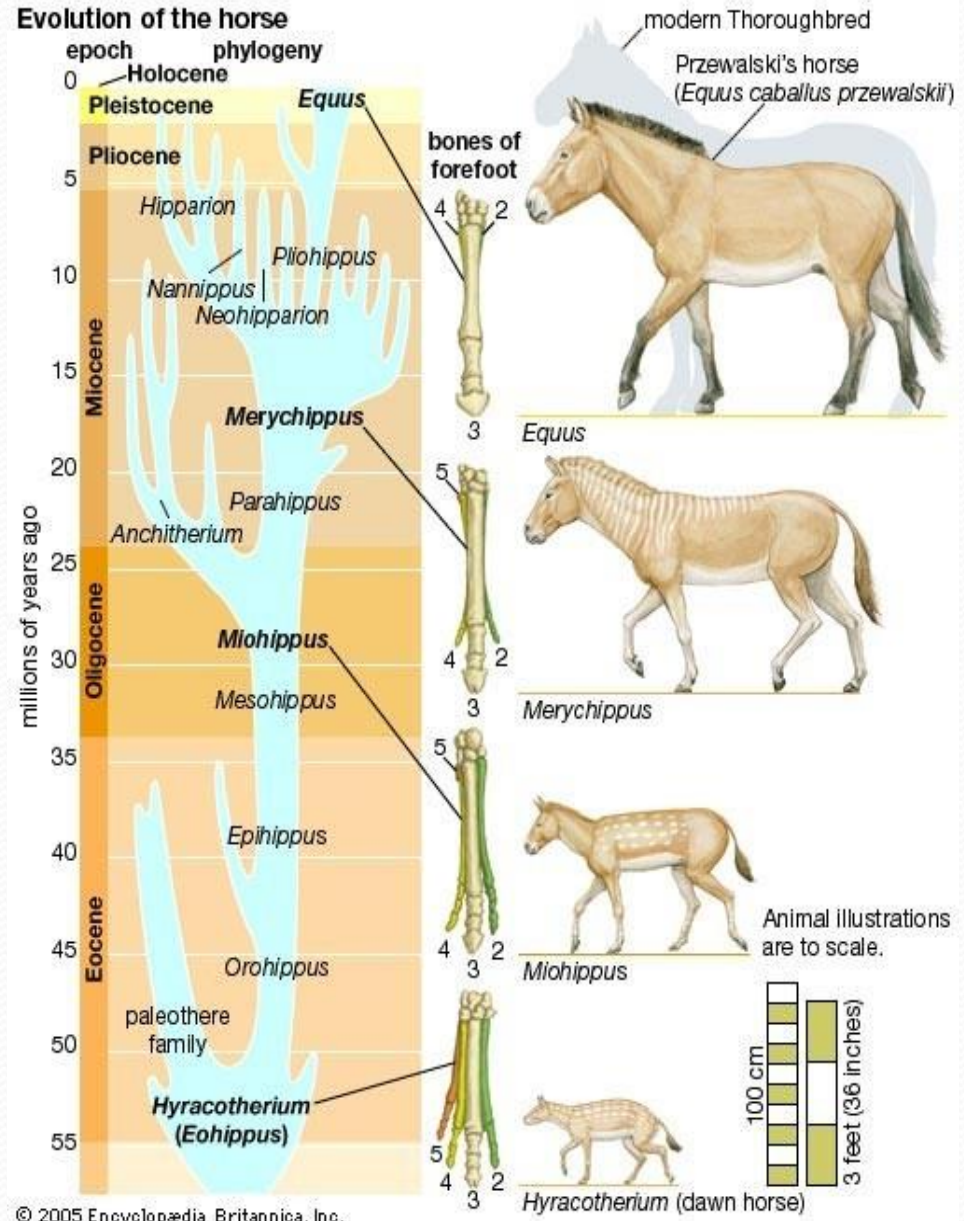
☐ Pleistocene 2.5-0.01 My

☐ Pliocene 5.3-2.5

☐ My Miocene 24-5.3

☐ My Oligocene 34-24

☐ My Eocene 54-34 My



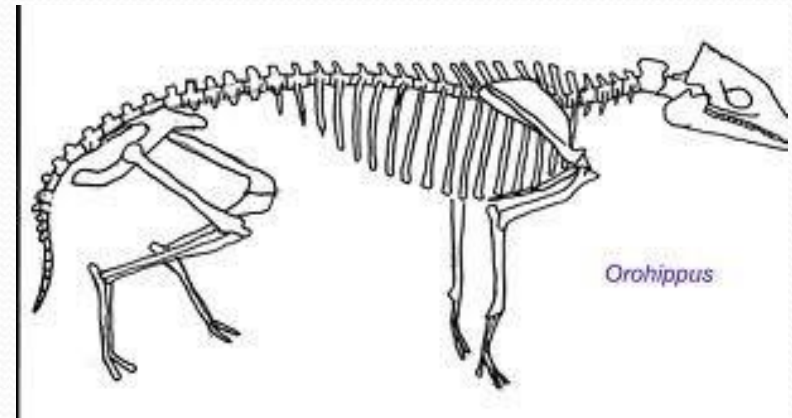
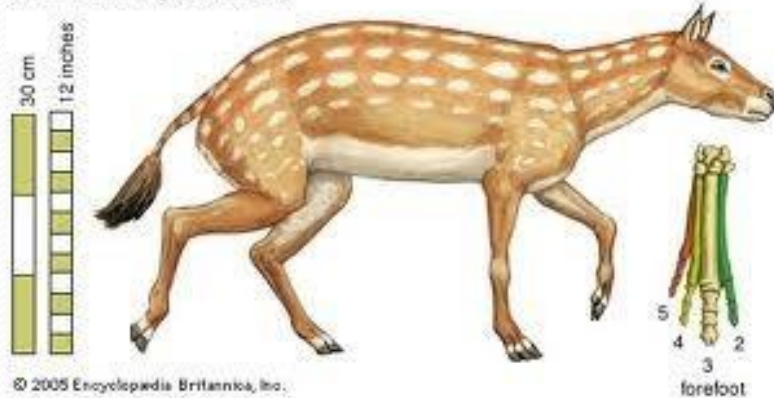
Small Eocene Horses :

? Hyracotherium

? Orohippus

? Epihippus

dawn horse (*Hyracotherium*)



Hyracotherium :

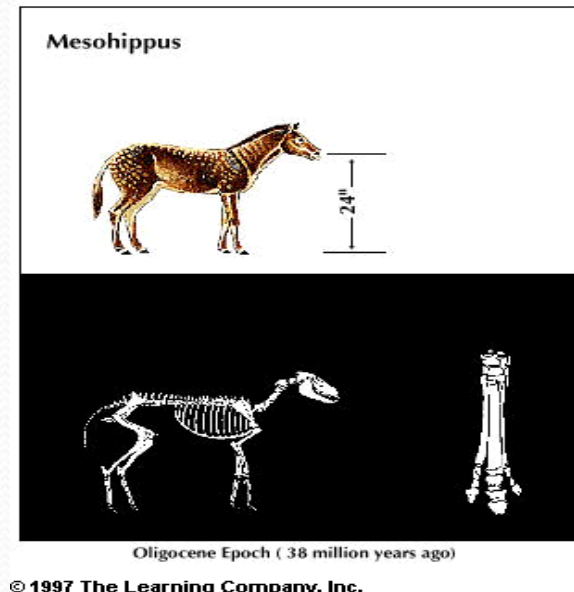
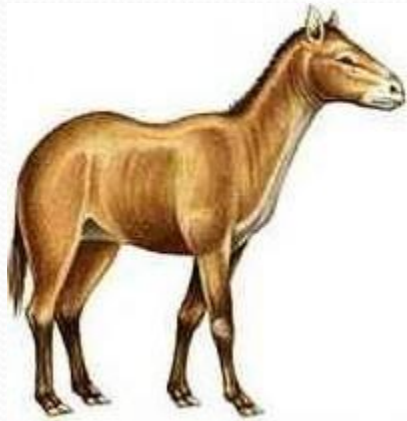
- ❑ It had a "doggish" look with an arched back.
- ❑ short neck, short snout, short legs, and long tail.
- ❑ It browsed on fruit and fairly soft foliage
- ❑ probably scampered from thicket to thicket like a modern muntjac deer, only stupider, slower, and not as agile.
- ❑ Legs were flexible and rotatable with all major bones present and unfused.
- ❑ 4 toes on each front foot, 3 on hind feet
- ❑ Small brain with especially small frontallobes

Medium-Sized Browsing Horses (Oligocene) :

- ❑ The climate of North America was becoming drier
- ❑ The vast forests were starting to shrink.
- ❑ The late Eocene horses responded by developing tougher teeth and becoming a bit larger and leggier
- ❑ **Mesohippus**
- ❑ **Miohippus**

Mesohippus :

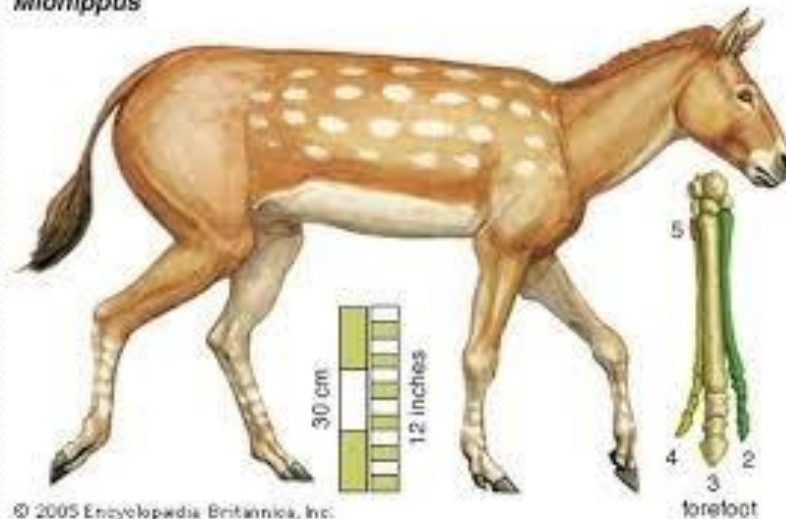
- ❑ It didn't look as doggish, either.
- ❑ The back was less arched, the legs a bit longer, the neck a bit longer, and the snout and face distinctively longer.
- ❑ It had a shallow facial fossa, a depression on the skull
- ❑ Mesohippus had three toes on its hind feet and on its front feet -- the 4th front toe was reduced to a vestigial nubbin



Miohippus :

- ❑ A typical Miohippus was distinctly larger than a typical Mesohippus, with a slightly longer skull.
- ❑ The facial fossa was deeper and more expanded
- ❑ Miohippus also began to show a variable extra crest on its upper cheek teeth

Miohippus



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The Miohippus Radiation :

- ❑ The horse family began to split into at least 2 main lines of evolution and one small side branch
- ❑ 3-toed browsers called "[anchitheres](#)". They were very successful, spread into the Old World, and thrived for tens of millions of years.
- ❑ A line of small "[pygmy horses](#)", e.g. Archeohippus. These horses did not survive long.
- ❑ A line that underwent a transformation from browsing to [grazing](#), taking advantage of the new grasses.

Spring-Foot & High-Crowned Teeth (Miocene, 18 My) :

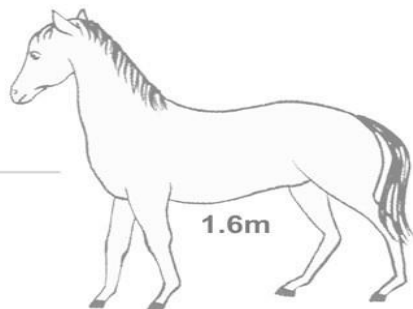
- ❑ the teeth changed to be better suited for chewing harsh, abrasive grass
- ❑ these horses started to become specialized runners. There was a simultaneous increase in body size, leg length, and length of the face
- ❑ the horses began to stand permanently on tiptoe (another adaptation for speed); instead of walking on doglikepads

Whole animal (height)

Forefeet

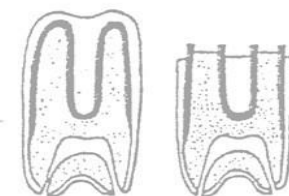
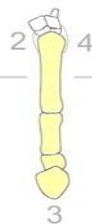
Molar teeth

Recent rock



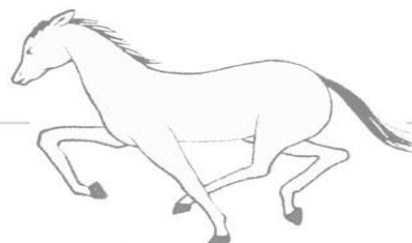
1.6m

modern horse (*Equus*)



before wear after wear

Pleistocene rock
(dates from 1 million years ago)

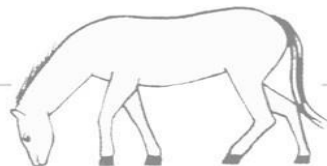


1.25m

Pliohippus



late Miocene rock
(dates from 8 million years ago)



1.0m

Merychippus



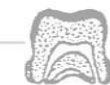
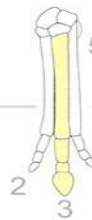
note complete covering of cement

middle Miocene rock
(dates from 15 million years ago)

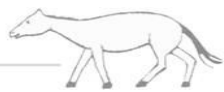


0.6m

Meshippus



late Eocene rock
(dates from 35 million years ago)



0.4m

Hyracotherium



enamel
dentine
cement

early Eocene rock
(dates from 50 million years ago)

Miocene horses, 18 My :

☐ Kalobatippus

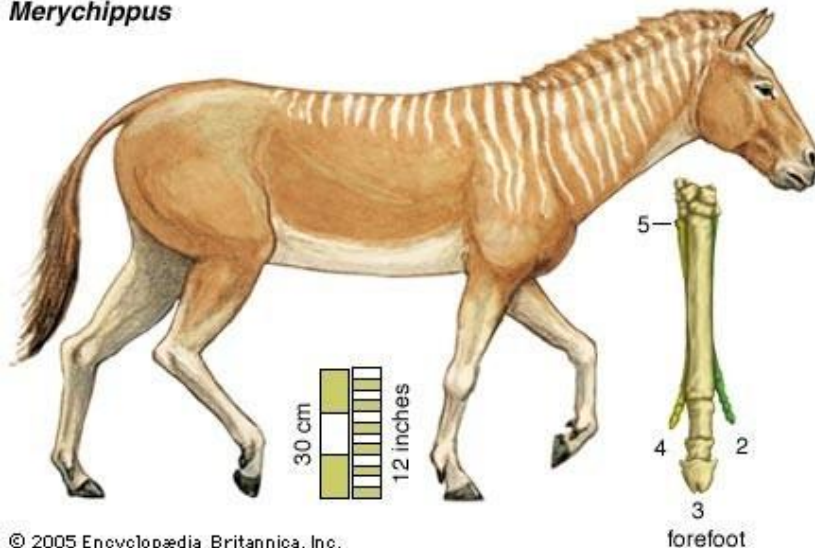
☐ Parahippus

☐ Merychippus

Merychippus :

- ❑ The muzzle became elongated, the jaw became deeper and the eye moved farther back Merychippus was still 3-toed, but was fully spring-footed
- ❑ The radius and ulna of the forearm fused so that leg rotation was eliminated
- ❑ All these changes made Merychippus' legs specialized for just one function: rapid running over hard ground.

Merychippus



The Merychippine Radiation (Miocene, 15 My) :

- ❑ hipparions: Three-toed grazers
- ❑ protohippines: Protohippus and Calippus
- ❑ true equines
- ❑ Throughout the evolution of all these related merychippine descendents, the facial fossae got deeper and more elaborate

(Pliocene) :

☐ Pliohippus

☐ Astrohippus

☐ Dinohippus

Pliohippus :

- ❑ Pliohippus's skull has deep facial fossae, whereas Equus has no facial fossae at all
- ❑ Pliohippus's teeth are strongly curved, and Equus's teeth are very straight.

Dinohippus :

- ❓ Finally, a third one-toed horse called Dinohippus (recently discovered) arose about 12My.
- ❓ They look smashingly like Equus in foot morphology, teeth, and skull.
- ❓ Throughout the end of the Pliocene, Dinohippus showed a gradual decrease in the facial fossae, straightening of the teeth, and other gradual changes

❑ **Equus :**

- ❑ The first Equus were 13.2hands tall (pony size)
- ❑ rigid spine, long neck, long legs
- ❑ fused leg bones with no rotation
- ❑ long nose, flexible muzzle, deep jaw
- ❑ straight grazing teeth with strong crests lined with cement.

Modern Equines (Recent) :

- ❑ one-toed Equus was very successful. Until about 1million years ago, there were Equus species all over Africa, Asia, Europe, North America, and South America
- ❑ In the late Pleistocene there was a set of devastating extinctions that killed off most of the large mammals in North and South America. For the first time in tens of millions of years, there were no equids in the Americas.

Equus species :

☐ Equus zebra

☐ Equus caballus

☐ Equus hemionus

☐ Equus asinus

☐