

爱上科学

Science

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爱上科学

INTRODUCING • 科技与发明系列
INVENTION AND TECHNOLOGY

水陆交通工具

LAND AND WATER TRANSPORTATION 双语版

[英] Tom Jackson 编
杨忆 译
田春丽 审



人民邮电出版社
POSTS & TELECOM PRESS

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内容提要

《爱上科学》系列科普丛书为读者全面地讲述了科学知识和原理，以通俗的文字、生动的图表为特色，每本书介绍一个或几个主题。从日常生活中有趣的现象出发，引导和培养读者学习的兴趣，扩宽读者的视野，同时还可以帮助读者学习英语词汇、练习英语阅读。丛书涵盖物理、化学、生物、科技与发明这4个系列。适合对科学知识感兴趣的广大科普爱好者阅读。

本书是科技与发明系列中的一本。科技与发明系列主要介绍各种科技成果以及相关发明，覆盖多个领域，包括建筑、交通、医学、军事、能源以及航空航天等，指导读者认知和学习各种科学技术，拓宽视野，引发思考，提高创新能力以及发明意识。

本书主要介绍各种有趣的水陆交通工具，种类多种多样，包含早期的马车、人力车，现代的电动车、汽车、火车、磁悬浮列车，以及各种轮船舰艇，详尽的介绍了它们的外观、原理以及各自的特点。书中含有“科学词汇”栏目，提取每章重点知识词汇。同时还有“试一试”栏目，包含丰富有趣的家庭小实验，有助于提高大家的动手能力。

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丛书序

这是一个科技新时代，我们曾经认为遥不可及的科学，时刻围绕在我们身边。你是否曾经怀疑过所谓的“2012，世界末日”，或者好奇过在地下高速飞驰的地铁，抑或每天都在关注着PM2.5……这说明科学已然走进了你的生活。学习科学，分享科学，爱上科学，让我们共同聆听来自科学的声音。

《爱上科学》系列科普丛书是一套引进版系列科普丛书，译自英国大型出版商棕熊图书（BROWN BEAR BOOKS）有限公司出版的著名科普图书《Facts At Your Fingertips》，其独特的科学解读视角、生动的科普画面、优美的图文设计，得到了欧洲读者的青睐，尤其是得到了欧洲青少年的极大欢迎。本丛书为读者全面地讲述了各个领域的基础科学知识和基本事实，以精彩的主题、通俗的文字、生动的画面为特色，从我们身边的素材和现象出发，激发和培养读者学习的兴趣。

丛书涵盖物理、化学、生物、科技与发明四大系列。物理系列阐释和说明了物理学知识及其发展史，包含对物理学发展史许多重大的物理发现以及著名的物理学家的介绍。化学系列主要阐释现代化学的基本概念，涵盖化学反应、有机化学、生物化学、金属、非金属、分子、原子、物态等多方面内容。生物系列主要阐释生命科学的基本概念，并探讨有关生物学的各个方面，包括植物学、微生物学、动物和人类、遗传学、细胞生物学以及生命形式等。科技与发明系列主要介绍各种科技成果以及相关发明，覆盖多个领域，包括建筑、交通、医学、军事、能源以及航空航天等，指导读者认知和学习各种科学技术，拓宽视野，引发思考，提升创新能力以及发明意识。

本丛书还具有中英双语的独特设计，让读者在阅读中文时，能对照性地阅读英语原文，为他们提高科学领域的英文阅读能力以及扩展科学类英语词汇量提供了很好的帮助。

丛书中还有“试一试”栏目，该栏目包含了丰富有趣的家庭小实验，为大家在生活实践中验证科学知识提供了更多的选择。

学无止境，让我们一起爱上科学！

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ANIMAL POWER

Since the dawn of civilization humans have harnessed the strength of large animals to help them get around. Horses and other “beasts of burden” are used even today to transport people through rugged landscapes.

No one knows when people began to use tame animals to carry things. Perhaps it was around 6000 (B.C.), when the first cities were being built. It may have been in the settlements that grew up on the fertile plains of the Middle East, where the terrain is well-suited to animal transport. Oxen were probably the first animals to be used, then donkeys. We know oxen were dragging wooden sleds in Mesopotamia (part of modern Iraq) before 3500 B.C..

Animal-powered vehicles are not in common use today in most parts of the world. However, they are sometimes used for leisure activities such as carriage racing.



SOCIETY AND INVENTIONS

Lands Without the Wheel

The wheel was probably invented several times over in different parts of the world. However, the ancient civilizations of the Americas, such as the Maya, Aztecs, and Incas, never used wheels. The likely reason for this is that wheeled wagons need strong draft animals such as oxen, good roads, and flat land. American animals, such as the llama (below), are too small to haul large carts. Instead these animals carry loads through mountains that are too rugged for wheeled vehicles to cross. In snowbound countries, too, wheels were useless: in Scandinavia, reindeer were used to pull sleds in winter. Even in the Middle East, where the wheel was invented, camels were used to make journeys across the roadless deserts.



A rope through a nose ring is all that is needed to lead a tame ox. Oxen can be harnessed simply: a pair can be placed on each side of a single shaft, with a wooden crosspiece resting as a yoke across their shoulders. In North Africa donkeys are still ridden without any bridle. To guide them, the rider touches them lightly between the ears with a stick.

The wheel

Oxen helped people move heavy loads. But they couldn't move fast, and the load was limited to what could be dragged along rough tracks. After 4000 B.C. tree trunks began to be used as rollers, making loads easier to pull. At around 3500 B.C., in Mesopotamia, wheels were added to sleds to make the first carts.

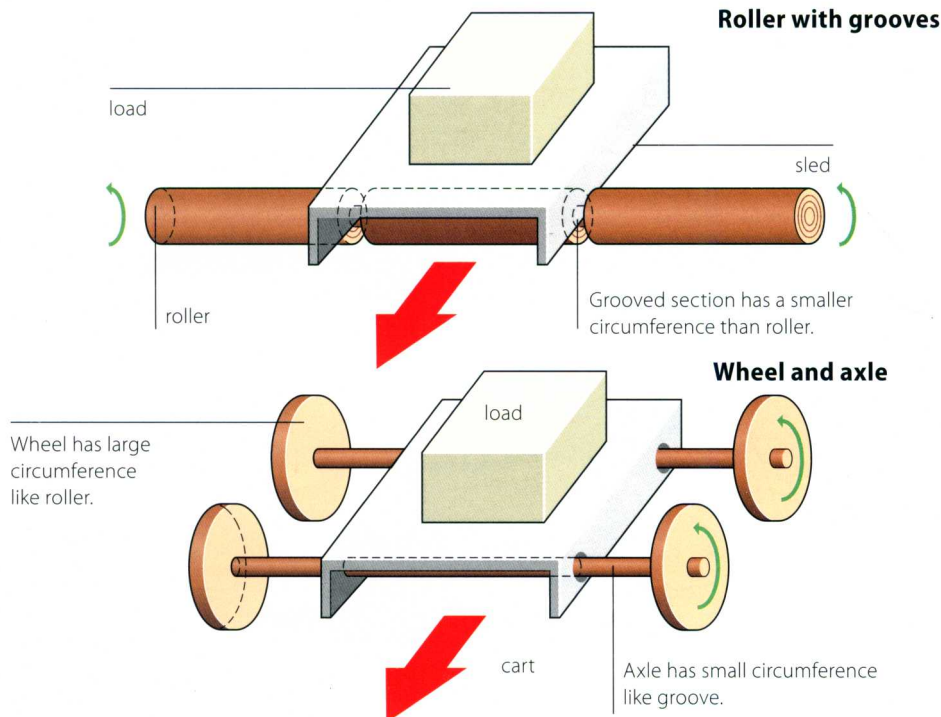


KEY COMPONENTS

Inventing the wheel

Before wheels were invented, loads were moved on sleds that ran over log rollers. A sled rolling across a log many times will cut a groove, and this might be how the first wheels and axles

were invented. The narrow groove became the axle, while the wide roller formed the wheel. The axle was then attached to the sled, forming a simple cart. Later carts had fixed axles in which only the wheels could turn.



随着社会文明的萌芽，人类已经掌握了利用大型动物的力量，让自己空闲下来。时至今日，马和其他“驮畜”仍旧背负着人类，穿越崎岖的陆地地形。

没有人知道，人类何时开始使唤驯服的动物来运输货物。也许在公元前6000年左右，当时最初的城市开始建立。这些在中东地区肥沃平原上逐步发展起来的居住区，非常适合于动物运输。公牛可能是最早被使唤的，而驴次之。众所周知，公元前3500年，美索不达米亚地区（在今伊拉克国家境内）饲养公牛来拖木橇。

兽力拉动的车辆在当今世界大多数范围内已不再普遍应用。但是，它们有时用于休闲活动，如马车比赛。



社会和发明

没有车轮的世界

世界上不同地区的人们可能多次发明了车轮。但是，美洲的古代文明社会，例如玛雅、阿兹特克和印加，从未使用过车轮。对此，似乎合理的解释是，有轮子的车辆需要有像牛一样强壮并可负重的动物，以及平整的道路。美洲的动物，如美洲驼（如下图所示），太弱小而难以拉动马车。如果不是由动物直接驮运重物，翻越高山，而改用有轮子的车辆就显得太过崎岖了。在冰雪包围的国家，轮子也极少使用：斯堪的纳维亚半岛在冬天驱使驯鹿来拉雪橇。即使是在轮子的发明地，中东地区人们还是选择驾驭骆驼，跨越没有道路的沙漠，完成长途旅程。



只需使用一根绳子，穿入一头驯化的牛的鼻孔，就可以牵引它。利用公牛是很简单的：单个辕犁两侧安置两头牛，一根木质横杆架于牛肩上用作牛轭即可。在非洲北部，仍然不用给驴套上笼头，就可骑它们。骑驴的人用一根小棍轻触驴的两只耳朵，就可以指引它。

车轮

公牛帮助人们搬动沉重的货物。但它们的移动速度并不快，搬运的范围局限于在道路上能拖动的货物。公元前4000年后，树干做成滚子，垫在货物下使其拉起来轻松许多。公元前3500年左右，美索不达米亚地区的人们把轮子装在木橇上，制造了第一辆运货车。

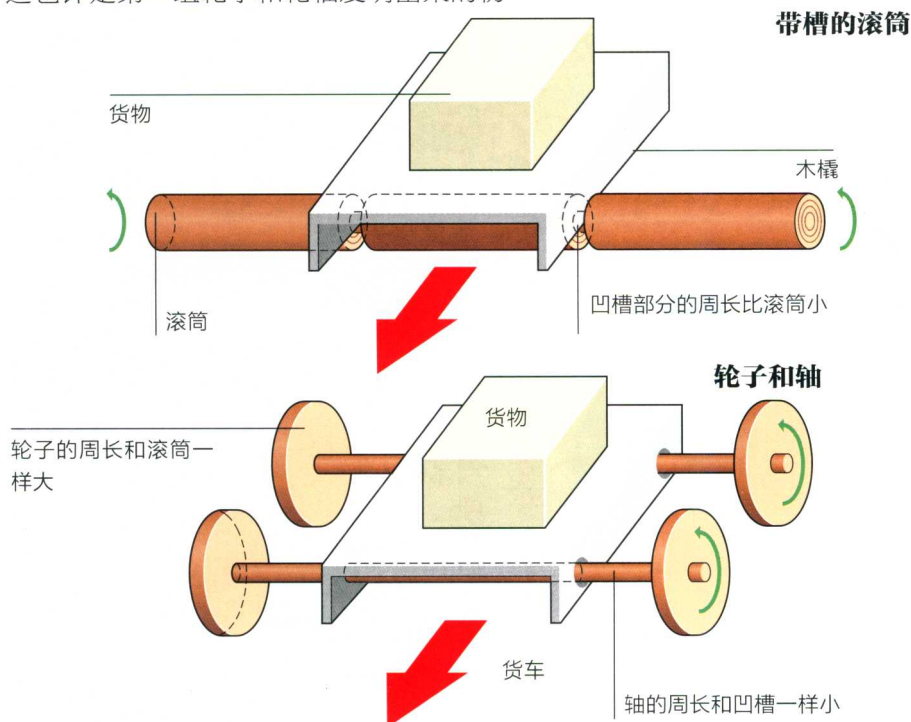


关键部位

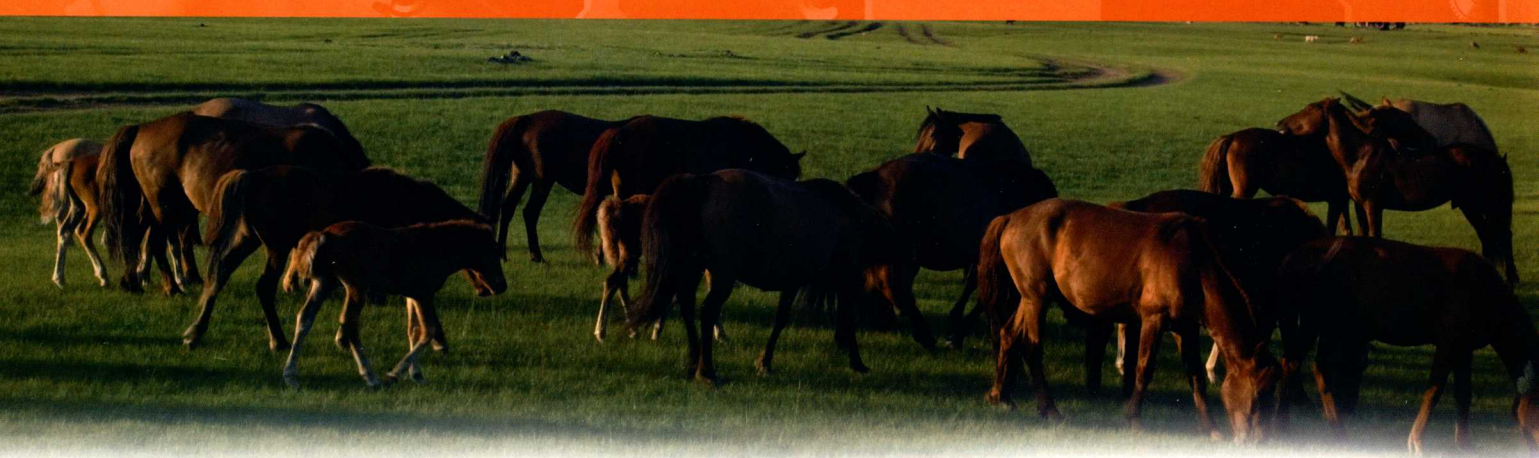
轮子的发明

在轮子发明出来之前，木橇架于木滚筒上来搬运货物。木橇架在木材上多次滚动后，会划出来一条凹槽，这也许是第一组轮子和轮轴发明出来的初

始想法。窄的凹槽当作轮轴，而粗的滚筒当做轮子。接着，人们把轴固定在木橇上，完成一辆货车的雏形。后来的货车轴是固定的，只是车轮绕着它转。



ANIMAL POWER

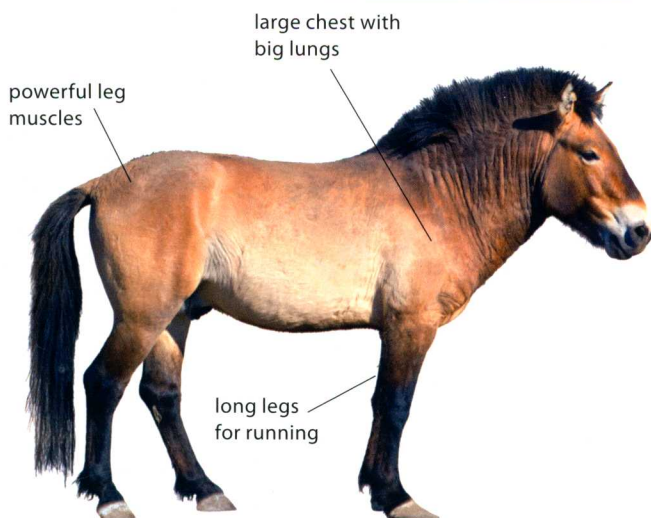


The first wheels were solid wooden disks, either cut from a single plank or made from two or three narrower planks fastened together with cleats (wedges of wood or metal).

The coming of the horse

Almost as important as the wheel was the discovery of how to domesticate horses—and ride them. Riding probably began about 5,000 years ago by nomadic herders on the steppes (flat

The takhi, or Przewalski's horse, is a wild horse from Mongolia. It is very rare today but is probably very similar to the ancient horses that were first tamed by humans.



Horses evolved for life on the wide open grasslands, such as here in Mongolia. The first domestic horses were probably tamed in this Central Asian region.

WAR CHARIOTS

Wheeled vehicles were also soon used in warfare. In Mesopotamia both four-wheeled and two-wheeled carts were used as mobile platforms from which soldiers could hurl spears. Solid wooden wheels made them heavy and cumbersome, but by 1900 B.C. the Mesopotamians had developed the spoked wheel—a circular outer ring supported by wooden spokes radiating from its center. This resulted in light, fast-moving vehicles that could dart about the battlefield.

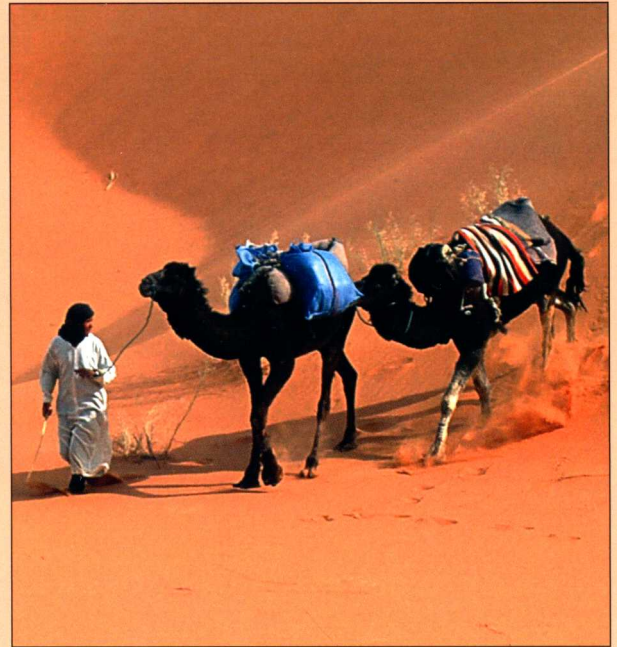


ALTERNATIVES TO THE HORSE

While the horse's combination of strength and mobility made it perhaps the most versatile of the animals used by people for transportation, a number of other species are also important. In the Arctic Circle teams of dogs or reindeer are used by Eskimo peoples to pull sleds. Extreme heat and lack of water are lethal to horses, but camels thrive in such harsh environments and are vital to the desert nomads (roaming peoples) of Central Asia, North Africa, and the Middle East. A camel can carry a heavy load for 30 miles (50 km) in a single day, using only one sixth of the water that a horse would consume in a similar journey.

For really heavy work, however, there is no better animal than the elephant. In India, elephants are used to push down trees and transport logs and other heavy loads. Elephants have also been ridden into battle, where they inspired terror in opposing troops and horses. Mountainous or rocky terrain, too, can prove difficult for horses to cross, and people sought more sure-footed alternatives. The donkey is one such animal, but its small size limits the loads that it can carry, so mules, produced by breeding a male donkey with a female horse and combining the useful qualities of both animals, are often used instead. The true mountain experts, however, are the

llamas of South America and the yaks of the Himalayas, whose thick coats protect them from the cold at high altitude.



Camels have a store of fat in their famous humps, which allows them to survive without eating or drinking for several days.

plains) of Central Asia. Riding horses gave people far greater mobility, so they could make long journeys, herd animals more easily, and tower over their enemies in battle. These early riders probably rode bareback, gripping with their knees and just using a simple strap to control their mounts. Riders placed animal skins on their horses' backs to make the ride more comfortable—so creating the first basic saddles.

Charioteers

Early domestic horses were smaller than modern breeds and not strong enough to carry heavily armed soldiers. Horse-drawn chariots made use of a horse's mobility but were stable enough to transport and fire weapons. The Hyksos people used a chariot-based army to invade the Middle East and established the Hittite Empire. In 1286 B.C. the Hyksos used 3,500 chariots to defeat the Egyptian forces of pharaoh Ramses II.

动物的力量



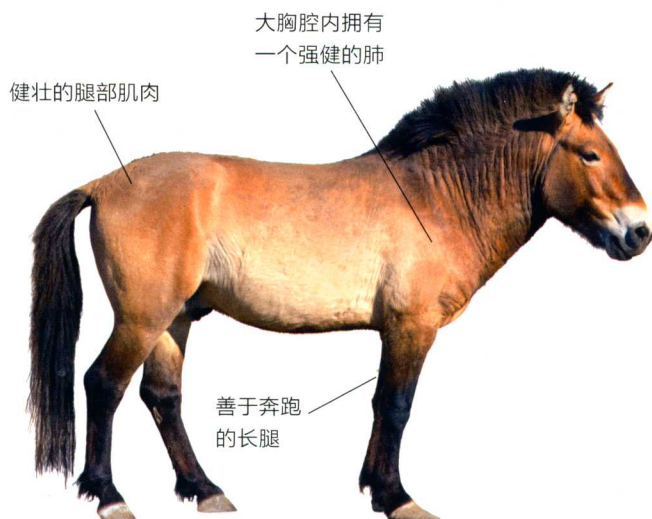
最初的轮子是用实心木盘做成，可以从单块木板上切下来，也可用夹板（木质或金属的楔子）固定的两三块窄木板制成。

进化后的马，适合于生活在宽广开阔的草地上，例如这里的外蒙古。首先被驯化的马大概是出现在中亚地区。

马匹的到来

与轮子几乎同等重要的是，发现如何驯养并驾驭马匹的方法。可能早在5000年前，中亚地区的草原（平原）上的游牧民就会骑马。

普氏野马或者普热瓦尔斯基马是一种来自外蒙古的野马。如今，它已经非常罕见了，但它和最先被人类驯化的古代马种非常相似。



战用双轮马车

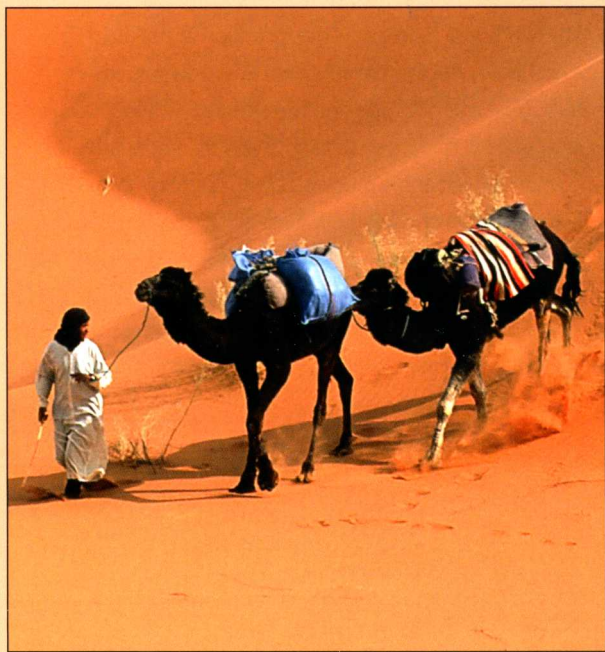
有轮的车辆在战争中也迅速派上用场。在美索不达米亚地区，四轮和双轮马车用作移动平台，战士在上面投射矛。实木轮子使整辆车变得笨重，于是在公元前1900年之前，美索不达米亚人就开发了辐条车轮——木制辐条从圆心辐射开来支撑一个外圆环。这样，轻巧、快速移动的车辆便诞生了，并驰骋于沙场。



马的替代者

马具有力量和移动性的双重特性，使其成为人们用于交通运输用途最多的动物，但其他一些物种也很重要。在北极圈地带，爱斯基摩人利用成群的犬和驯鹿来拉雪橇。极端炎热和缺水对于马来说是致命的，但骆驼在这种恶劣的环境下却能生存成长。它们对于中亚、北非和中东地区沙漠上的牧民（游牧的人）来说很重要。一头骆驼一天可搬运沉重的货物行走50千米（30英里，1公里=0.62英里）。同样的行程下，它消耗的水分仅占一匹马的六分之一。

但是，对于确实很重的工作，大象是最合适不过的。在印度，大象可以推倒大树，搬运木材和其他沉重货物。大象还被骑上战场，激起敌方军队和战马的恐惧。在高山和岩石地带，马也很难穿行。人们需要步履更加稳定的替代动物。驴就是这样一种动物，但它的体型小限制了搬运的货物量。公驴和母马杂交生下了骡，它保留了两者的特质，因而替代了驴。



骆驼在出名的驼峰里储存了脂肪，使它们几天内不吃不喝也能生存下来。

骑马给人们带来了极大的流动性，因此，长途旅程、放牧牲畜和在战争中战胜敌人变得更加轻松。早期的骑马人可能不用马鞍，他们抓住马的膝部，只用一条简单的带子来控制坐骑。后来，骑马人在马背上放置动物毛皮，骑起来更舒服——这样便诞生了最初马鞍。

双轮马车御者

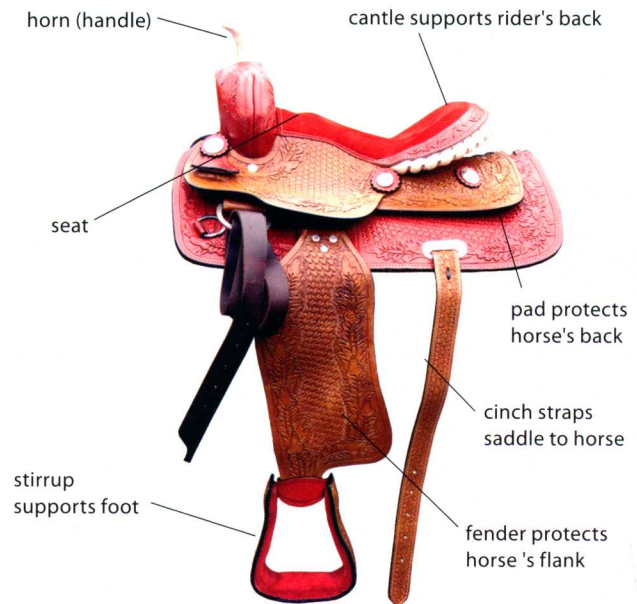
早期驯养的马的体态比如今的马小，力量也不足以运送重装士兵。马拉双轮车利用了马的移动性，却保持稳定性来运输和投射武器。希克索斯人的军队配备双轮马车，入侵中东地区，并建立了希泰帝国。公元前1286年，希克索斯人指挥3 500辆双轮马车战胜了埃及暴君拉美斯二世的军队。



KEY COMPONENTS

Western saddle

The first horse saddle was the invention of the Scythians—a nomadic people from southern Russia who roamed through eastern Europe and the Middle East for 300 years after 600 B.C. The Scythian saddle was made of padded leather and felt and supported by hoops of birchwood. A belt around the horse's belly held it in place. These saddles gave the Scythians a much firmer seat than their bareback contemporaries, so they could use their bows more effectively in battle. The modern Western saddle—that generally used in the Americas (pictured)—shares many similarities with the Scythian design.



Around 1300 B.C. the Hyksos invented the bit, a piece of metal placed between the horse's teeth that can be manipulated using leather straps called reins to give commands to the horse. This remained the standard way of controlling horses until the fourth century B.C., when the Celtic tribes of northwest Europe introduced the curb bit. This is an H-shaped bit with a cross-piece in the horse's mouth. It pulls the horse's head down, giving greater control.

A new age of cavalry

Chariots were not suited for fighting in rugged terrain, so the best armies contained cavalry, warriors that rode into battle instead.

Horseshoes are heated so they can be bent into the right shape before being nailed to a hoof.

