

EARLY EQUESTRIAN TECHNOLOGY

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By

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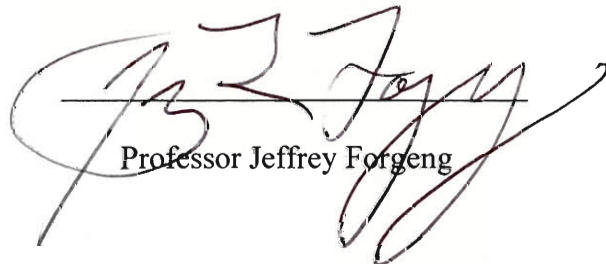


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1. Equestrian
2. Horses
3. Equipment

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ABSTRACT

The Early Equestrian Technology IQP, carried out in collaboration with the Higgins Armory Museum, details the rise, fall, and re-emergence of horses and horse armor throughout ancient civilizations, Medieval and Renaissance Europe, and the

Near/Far East. This project encompassed research on a vast array of topics related to equestrian technology. This research was used to analyze over 170 of the museum's artifacts that were then photo-documented in a catalog. Both the research and catalog are available on the web in PDF format.

Introduction

The Early Equestrian Technology IQP involved the research of the evolution and development of artifacts related to horses and riding, which were provided by the Higgins Armory Museum, located in Worcester Massachusetts. This museum is the only museum

in the Western hemisphere solely devoted to the display and research of arms and armor. The vast array of artifacts portrays the scope and breadth of the historical, cultural, and technological periods of long ago--from the classical world of ancient civilizations through medieval and Renaissance Europe. Eastern culture is also incorporated into the museum's collection along with those artifacts representative of Western culture.

The main mission of this project was the documentation of artifacts in the Higgins Armory Museum collection, as well as research related to these artifacts and to the significant role that horses played in the history of various civilizations. Research includes aspects of equine movement and mentality and the great equestrian changes that transpired within each time period--the rise, supremacy, decline, and re-emergence of the horse shall be documented accordingly. Another important goal of the IQP was to provide a means of making the documentation and research of the equestrian artifacts available to a worldwide audience. This was accomplished by the creation of a web page that offers links to both the documentation of the equestrian artifacts and the research on early equestrian technology in PDF format.

There is perhaps no other animal that is so intimately linked with the history of man as the horse. There is no better example of this than the age of chivalry. In order to be a knight, one had to be a skillful rider. The knights and their descendants were a race of horsemen. In fact, the European words for a knight such as *chevalier*, *cavaliere*, and *caballero* are the basis for the term "gentleman" used today. From this it can be inferred that knights were thought of as a class of gentry and nobility.

The horse was among the last animals to be domesticated because it offered the greatest resistance and challenge to man. Horses were hunted and killed for meat for

thousands of years while other animals such as dogs, common farm creatures (sheep, goats, pigs, chickens, donkeys, etc.), ox, elks, reindeer, stags and onagers were meanwhile being domesticated. However, with the eventual domestication of this once wild beast came a legacy of conquest. The horse enabled man to perform feats never imagined possible-traveling extensive distances in a considerably shortened amount of time and allowing a new form of battle to materialize as well.

The research conducted on early equestrian technology begins with the evolution of the horse along with the origins of the domestication of the horse. It looks at the earliest interactions between the horse and man through activities such as hunting and herding. This is followed by sections on the anatomy, physiology, and psychology of the horse. In order to fully appreciate the technology associated with horses, it is important to understand the reasoning behind the development of the technology- especially since most of the early equestrian technology evolved as a response to the horse's anatomy, physiology, and psychology. Following this is a section devoted to the description and explanation of several kinds of equestrian technologies such as bits, bridles, saddles, spurs, and harnesses that will be spoken of quite frequently throughout the remaining text.

The text then delves into the three major periods over which the development of early equestrian technology is to be studied. The three major periods are ancient civilizations, the Middle Ages, and the Renaissance. For each period, the text looks into the role of the horse as well as the equestrian technology used and developed at that time. The equestrian technology discussed includes bits, spurs, saddles, harnesses, horse-drawn vehicles, stirrups and horse armor. And since some of the artifacts at the Higgins Armory

Museum are of eastern origin, the text also examines the role of the horse in the Orient and the Near East. The research concludes with a look at the development of several equestrian based sports and amusements.

The other part of the early equestrian technology IQP was the documentation of equestrian artifacts, which were, as previously mentioned, provided by the Higgins Armory Museum. The museum has a collection of over 170 equestrian artifacts consisting of bits, reins, saddles, stirrups, horse armor, harnesses, spurs, and textiles such as caparisons. All of the documented artifacts date back to the major time periods that this IQP researched: ancient civilizations, the Middle Ages, and the Renaissance until the 18th century. The photographed artifacts are up until the 18th century but the catalog also includes artifacts from the 19th and 20th century. Although the majority of the artifacts originated from Western Europe, there were several of Eastern European and Asian origin. For some artifacts, in addition to photographs, documentation also included a brief description of the artifact and mention of any unusual or interesting features that it possessed.

Horse Anatomy

Although horses have been adapted and developed to suit the ever-changing needs of the human race since they were first domesticated, the structure and bone formation of the 'domestic' horse has remained the same. Currently, human interference and

crossbreeding has resulted in over 300 breeds. Despite this seemingly great diversity, all horses all belong to the species *Equus caballus*—each with a common body structure (Gordon-Watson 1999:22).

The horse is uniquely designed for a dynamic combination of strength, size, and speed. With minimal bone and a complete lack of muscle, its lower limbs are extremely light. Highly developed muscles attached to the bones of the upper limbs and the remainder of the body propels the legs in a forward and backward motion. In order to fully understand the physical and mental capabilities of the horse, along with its limitations, a basic knowledge of horse conformation and body functioning is essential (Gordon-Watson 1999:22-23). The conformation, or the way in which the horse is externally structured, is shown below. The various body parts are labeled accordingly. The illustration is compliments of <http://www.worldzone.net/recreation/virtuallyhorses/anatomy.html>.

The leg joints of the horse act like hinges, moving back and forth without rotation. The only joint that possesses some lateral movement is the stifle joint, which is located in the proximal (upper) portion of the hind legs. The shoulders and the lower limbs work together in a way comparable to that of a pulley system, while the joints, tendons and ligaments of the limbs are designed to conserve energy, whether at rest or in motion. The structure and mechanics of this 'stay' apparatus system enable the horse to sleep standing up without exerting any muscular effort. Most of the concussion caused by movement and ground reaction forces when the horse is traveling fast or jumping is absorbed by the limbs, particularly the structures of the distal (lower) limb segments. The impact is absorbed here because the spine is fairly rigid and would easily break under such intense pressure (Gordon-Watson 1999:26-27).

Horses are herbivores with teeth adapted to eating coarse vegetation—the incisors at the front are used for cutting and the molars at the back for grinding. The molars have a wide, patterned surface of enamel for efficient grinding. The horse's jaw moves from side to side when it chews, and this grinding keeps the surface of the molars even. However, the lower jaw is narrower than the upper jaw, thus resulting in uneven wear and possibly also causing sharp edges (Gordon-Watson 1999:25).

A horse's teeth provide a rather accurate estimation of its age. Foals have milk teeth (also known as dental cups—dark marks in the surface of the teeth), which appear and then are replaced by permanent teeth between the ages of three and five years old. The teeth become increasingly angled and the incisors gradually wear down beginning at the age of six. This results in a changing cross-section of the inner structure, which then acts as a guide up until the age of about eight or nine. A small notch known as

Galvayne's groove appears at the top of the upper corner incisors at the age of ten. It continues to expand downward until it reaches the lower edge by the age of twenty, from which point on it then begins to disappear all together. As a horses ages, the length, color, shape and markings of its teeth transform to reveal distinct differences between age classes (Gordon-Watson 1999:25).

A horse's performance and overall usefulness is dependent on good conformation, genes, attitude and athleticism, while size is not as crucial a component. Structural weaknesses can also undermine its soundness and strength. The length of the stride multiplied by the number of strides per minute provides a measurement of the horse's speed. The mechanism of a big horse can be more vulnerable and subject to strain than that of a small, sturdy horse because larger, longer and heavier bones require stronger muscles to support and propel them. The hock (which is located in the medial portion of the hind legs) is equivalent to the human heel, while the lower limbs and feet are developed for greater propulsion and speed. In a human, this would be the equivalent of the toes becoming $\frac{1}{3}$ of the leg structure over evolutionary time. The limbs are extremely light and easy to maneuver below the knee (which is located in the medial portion of the front legs), since they carry no muscle and are made up solely of bones, ligaments and tendons. The limbs above the knee, however, are well covered with muscle. As speed increases, a horse will make the transition to a smoother, less jarring gait in order to compensate for the greater impact on the legs and body (Gordon-Watson 1999:27).

Horse Physiology

The horse is able to function—move, breathe, eat, grow, heal, and react to stimuli—because of the complexity governing its body systems. Highly developed senses, coordinated with basic instincts, allow the horse to optimize its chances of survival.

The normal respiration of a horse at rest is six to twelve breaths per minute, and the average heart rate is thirty-two to forty beats per minute, both of which doubles at a walk and triples at an energetic trot. A racehorse at full stride could easily register 250 beats per minute, while a normal, fit horse would have a recorded heart rate in the 100 range. In general, old horses have a much higher heart rate at exercise than mature, young horses. Young horses, however, may also experience elevated heart rates due to excitement, anxiety, and stress (Gordon-Watson 1999:28).

Horses are natural grazers, which means they eat tiny portions throughout the day and during the night. These eating habits correspond to the structure of the digestive tract. Because horses ferment food in their hind gut, they can only hold small amounts of food in their stomach at any given time, which is a significant fact to understand when feeding in an artificial environment. Since the horse also lacks a gall bladder, the caecum and the colon are the digestive organs located in the hind gut that are responsible for the final breakdown of food, which occurs by bacterial fermentation. Unfortunately, intestinal obstructions are common and can lead to the development of colic (Gordon-Watson 1999:29). Horses are selective feeders and would starve rather than force themselves to eat unpalatable vegetation. A field that was once covered by healthy looking grass can be left ragged and patchy by a group of horses because they simply pick out the grasses they

like and leave the coarse, rancid, or fouled areas untouched. Horses are often easily bribed by using tasty tidbits such as carrots, sugar lumps or mints as lures (Gordon-Watson 1999:31).

Natural selection has ensured that the eyes of the horse remained set wide apart at the sides of its head so that the animal has almost complete all around vision without turning its head. Horses have a nearly 180-degree field of vision on either side. They can also perceive depth well and distinguish fine details from a minimum of a few hundred yards away. In other words, they lack forward binocular vision (they also have some blind spots) and instead possess right and left monocular vision, respectively. Compared to humans, horses also have better night vision. This survival advantage was developed in order to provide a protection mechanism against predators in the wild. Because of this, horses must always be approached from the side so that the person is within the horse's range of vision and will not startle it (Gordon-Watson 1999:30).

Horses have a far wider hearing range than humans. This acute hearing means that their ears are constantly in motion, twitching or swiveling continually to pick up sounds similar to that of an antenna. This also enables the horse to constantly monitor the world and multitask at the same time. There are sixteen muscles in the external ear of the horse, which can be rotated through 180-degrees. The shape of the horse's ear is designed like a funnel, meaning that sound is captured in the outer part of the ear and channeled down into the ear canal. Thus, the slightest sound from the horse's environment can easily be detected by the broader outer portion of the ear. Because they are so highly responsive to sound, horses rapidly learn to associate the various tones of the human voice as praise or

scolding, warning or commands. This proves to be a useful aid when the horse is undergoing training (Gordon-Watson 1999:30).

The horse has well-developed nostrils designed for air intake when traveling at great speeds, as well as when enduring stressful situations. The metaphor about 'smelling danger' is truly the case for the horse. This strong olfactory sense is crucial for detecting the scent of a predator via a breeze or other mechanism, which alerts the herd to danger and allows them to literally 'high-tail' (their tails stick high up in the air as they flee) it out of there rapidly. Their keen sense of smell enables them to detect fear in humans via the sweat glands, and they also show sensitivity to the scent of blood. They display their suspicion or dislike of new, unfamiliar smells by sniffing or snorting and then backing off, sometimes even refusing foods that smell strange to them. Interestingly, horses generally dislike the smell of pigs. The horse's sense of smell is also an integral part of its complicated social structure. Horses take in the odor of others by greeting muzzle to muzzle. In addition to sight, horses also recognize their herd mates by smell. Mares and foals especially utilize this sense as a location mechanism by memorizing each other's scents so that they can easily be reunited in crowded areas (Gordon-Watson 1999:31).

Horses are very sensitive creatures physically, especially to pain. Although their skin is tougher than the human epidermis, it is still rich in nerve endings. They also respond favorably to patting and stroking. As mentioned previously, horses are able to detect and respond to human emotion as well. A horse will generally hesitate in the presence of a nervous or frightened rider, while a bold rider will often inspire confidence in this usually timid animal. New surroundings and new people can profoundly affect a

horse. Horses are very good at expressing their emotions, for they will often portray their uneasiness by refusing their feed, sweating, pacing in their stall, neighing and moving tensely. Happy, healthy horses, on the contrary, willingly submit to the demands made upon it if trust has been instilled (Gordon-Watson 1999:31).

Horse Psychology & Behavior

The evolution of horses as prey animals has given them a very unique perspective that is vital for their survival. The components of this perspective include viewing the world as a series of threats, finding safety in numbers and looking to an authority figure for guidance. Understanding the essence of the horse's ways is crucial to developing a good relationship with this easily scared creature, whose natural instinct is to flee rather than fight.

Horses are extremely sociable animals not only in their domesticated state, but in their wild state as well, where they live in herds or small groups known as harems. Domesticated horses often display the same inherent behavior as their wild counterparts. With a few exceptions, horses genuinely enjoy the company of others, horse or human, and become depressed when isolated in a field or stable. Horses thrive on this companionship and form strong bonds with their herd mates. However, they also find security amongst the presence of others. The age old adage about "safety in numbers" is certainly true in the horse's case—an individual horse has a better chance of survival in a herd because if a predator attacks, the probability that any particular horse will fall victim greatly decreases in proportion to the number of other horses that reside in the herd. Additionally, more horses translates into more sets of eyes on the lookout for potential life-threatening situations. The earlier the herd is alerted to this hazard, the more easily the impending danger and possible death are avoided (Gordon-Watson 1999:34-35).

The voice affords the horse a vital means of communication with each other. Horses often repeatedly or even frantically neigh loudly in order to attract a response, particularly in circumstances when it has recently been separated from paired

companions, bonded family members or simply when it feels insecure and lonely. When greeting a friend or calling to its foal, the horse will neigh or produce a quieter nicker. Before touching noses, horses meeting for the first time will approach each other cautiously. The greeting that is provoked may involve high-pitched squeals, particularly from females, or lower sounds accompanied by a shake of the head. Although aggression is rare in domestic horses, two colts or stallions that reside together may fight, and an outsider may be perceived as a threat to a mare defending her foal, who may then attack by producing a roar or screaming noise (Gordon-Watson 1999:34-35).

Horses that are friends recognize each other by sight and smell. Smell is especially important in herd life because a mare's scent sends sexual messages to a stallion. Another important sense is touch—companions will rub, nuzzle, and lick one another, while colts may nip or grab each other in play. Mutual grooming also occurs when two horses stand head to withers scratching each other (Gordon-Watson 1999:36-37).

Because of the inherent social nature of this animal, domestic horses in a field tend to establish a 'pecking order,' just as a hierarchy would develop naturally in a herd environment. Through intimidating behavior such as chasing, biting, kicking or simply by making threatening gestures such as laying back its ears or baring its teeth, the leader will effectively assert itself within the group. A newcomer may even be driven away by a dominant horse, which may also attempt to separate friends or even turn against an old companion in favor of a replacement. Timid horses fall susceptible to this sort of bullying. The victim might endure been bitten, kicked or chased by the dominant horse, and will even starve to death if the threatening horse is guarding the food. If a horse

explicitly shows a desire to be left alone by standing aloof, it will be respected (Gordon-Watson 1999:38-39).

The horse's intrinsic need for leadership has greatly benefited humans. The horse's affinity for dutifully submitting to the authority is what ultimately allowed humans to domesticate them thousands of years ago. However, just as the leader horse must first establish its status and earn the respect of its fellow herd mates, so too must a human first earn the horse's respect before it will succumb to viewing the human as its authority figure. Establishing this security and trust between the horse and its owner is a crucial element to an enduring, successful relationship (Gordon-Watson 1999:36-37).

Long before history was formally recorded, there existed an understanding between horse and man. Carvings, cave drawings and ancient burial grounds where horses were buried in state with their masters provide evidence of this strong relationship. The versatility and servile nature of the horse has been adapted and utilized for survival, war, transportation, work and pleasure. Despite this, the physical and mental character of the horse remains unaltered (Gordon-Watson 1999:37).

Equestrian Equipment

Every discipline has its own associated equipment, and horsemanship is no different. Even within the riding discipline, there exists multiple styles, each of which possesses its own equipment. However, the scope of this manuscript does not examine the differences between the major disciplines that most people are familiar with today—Western and English (dressage). This is primarily because most of these disciplines were not formally defined until after the Renaissance period, which is beyond the time frame of this manuscript. Accordingly, the purpose of this section is to familiarize the reader with the function and mechanics of common horse equipment that was utilized throughout the history of the horse.

The Bit

The bit is a piece of equipment applied to the horse's mouth that transmits information from the action of the rider's hand through the reins to the horse. In this way, the rider's commands are communicated and obeyed by the horse. By applying pressure to the horse's mouth through the bit, the rider can send the message to stop, slow down, turn, and so on. The amount of pressure that is applied depends upon the shape of the bit. The snaffle, the curb and the Pelham are the most commonly used bits. Some bits apply only minimal to mild pressure, while a harsher bit will demand the horse's undivided attention by stricter means.

The snaffle bit is a smooth, rounded mouthpiece that is jointed in the center and has a ring at each end to which the single reins are attached. When the snaffle is employed alone, it also has cheek pieces on the ends. This bit exerts a pinching sensation

in varying ways according to the hand action of the rider—it can bear on the corners of the horse’s mouth, on the outside of the bars of the mouth or on the lips, all of which still allows the tongue to move without restraint. Almost any horse can be schooled or controlled with a snaffle bit because of its mild and gentle action on the horse’s mouth. Since it does not constrict the horse and is rarely painful, it gives the horse complete trust in his rider. It is sometimes covered with leather, rubber or cloth to soften its actions even more. It can be used with two or four reins (Gianoli 1967:206).

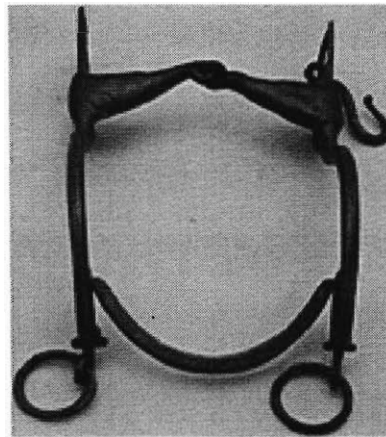


Figure 2. A Snaffle Bit. Note that it is jointed at the center. It is artifact HAM 3088.7.

The thicker the snaffle bit is, the milder its action. Therefore, a thick, heavy snaffle has the added advantage of preventing edgy beginners from harming the horse’s mouth, and it is also most likely to win the willing obedience of the horse. Narrow, thin snaffles are more powerful; yet lose the mild effect of the thicker, heavier version. It is also the bit of choice for accomplished riders, for it is designed for specific purposes (i.e. the hunting snaffle and the racing snaffle) and has a great range of effects when utilized by a skilled horseman (Prince & Collier 1993:33).

The main difference between a curb bit and a snaffle bit is that the curb lacks the jointed formation of the snaffle. Curb bits also have shanks of varying lengths to which the reins are attached, they use a curb chain or strap, and they are more severe than snaffles. The action of the curb is based on the lever principle, with the curb chain acting as a fulcrum. Curb bits apply pressure directly on the tongue and on the bars of the mouth. Curb bits allow no provision for one-sided action like the snaffle bit does because it is a solid mouthpiece that acts upon both sides of the lower jaw simultaneously. A variety of designs exist for curb bits—they may be straight or arched, or they may have a high or low port. The purpose of the port, which is a U-shaped bend in the center of the bit, is to allow greater mobility of the tongue. An extremely high port will dig into the roof of the horse's mouth and is rarely used (Prince & Collier 1993:33).

There is an arm present at each end of the curb bit, with the upper branch of the arm having a fixed ring for the cheek piece of the bridle (onto which the head-stall is buckled) and the lower branch having a loose ring to receive the rein. The lower branch of this arm, which is measured from the middle of the mouthpiece to the middle of the ring, should be approximately 3 ½ inches in length, while the upper branch, which is measured from the middle of the mouthpiece to the highest part of the ring, should be approximately 1 ¾ inches in length. These dimensions account for the assumed depth of the horse's lower jaw. Metal hooks are fastened upon the ring of the upper branches, with the curb-chain then attached to these hooks. The width of the curb bit is dependent upon the horse's jaw—it should not be so narrow as to pinch the muzzle between the branches, and not so wide as to have too much room to fidget (Anderson & Collier 1905:57-58).

The curb has a more acute action than that of the snaffle, which makes it more suitable for use by a fine horseman since the efficiency of the hands is greatly amplified. The curb bit can be used without the snaffle, but there are often occasions when the powers of the curb bit alone are ineffectual, and the snaffle must go to its assistance. However, when the action of the snaffle seems inadequate, the curb then provides the rider recourse to another option. The action of the snaffle must be harmonized with that of the curb, which is accomplished only by an able, experienced rider who can effectively regulate this device by varying the length of the shanks and the curb chain. This provides many combinations of control maneuvers (Anderson & Collier 1905:121).

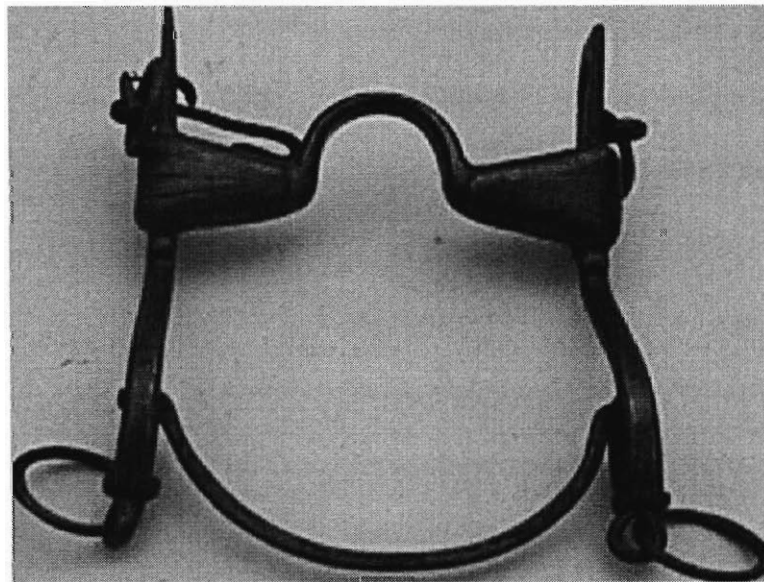


Figure 3. A Curb Bit. Note that it is not jointed at the center. It is artifact HAM 3088.8.

When used in conjunction, the snaffle and the curb bit serve to suit the requirements of most riders. The horseman may raise or depress the forehead with the snaffle bit, as well as freshen and relieve the mouth of the horse occasionally from the restraint of the curb bit. While counteracting the defective action of the curb bit (which

tends to lower the head of the horse), the snaffle bit prepares the horse for obedience to the indications of the more severe curb mouthpiece. The curb bit allows more power to restrain the horse by applying the pressure of the mouthpiece upon the proper place, which the snaffle does not always do. The rider may then more readily keep the nose of the horse down so that the face of the animal will be vertical and thereby ensure that the power is evenly distributed (Anderson & Collier 1905:121).

The Pelham can be jointed or straight, and its effect lies intermediate between that of the snaffle and curb bit. The Pelham is a single bit that performs the task of two. In addition to having rings for upper reins and shanks with rings for curb reins, it also uses a curb chain. It is easy to use, gives adequate results, but is less suitable for fine, rigorous equitation. This bit also provides an excellent teaching method when the horse is transitioned from a single bit to the double combination described previously (Gianoli 1967:206).

The Bridle

A bridle constitutes the headgear that is used on the horse during riding. It consists of a headstall (the part that goes over the ears and connects to the bit), reins (the leather straps that attach to the bit and are held by the rider), and bit (the metal piece that lies within the horse's mouth). The primary function of the bridle is to hold the bit in place. The reins of the bridle are passed over the head of the horse so that they rest upon the neck near the withers, and the bridle is placed so that the nose of the horse is positioned between the cheek pieces. The bridle is then raised until the bits are about to touch the horse's lips, at which point the horse's mouth is opened so that the bits can be

gently inserted. Next, the head-piece can be slipped over the poll of the horse so that the ears remain free, and the bridle is completely assembled once the throat-lash has been loosely fastened (Anderson & Collier 1905:58-59).

The double bridle functions through the inter-coordinated communications system of the snaffle and curb bit. This bridle is fitted so that the snaffle bit lies snugly in the corners of the horse's mouth without pressing against the lips. The curb bit, which is situated lower in the mouth, rests upon the bare bars just above the tusks of the horse or the place where they are usually found in the male. The curb chain isn't fastened until the rider is about to mount, and a horse should never be led while the curb chain is hooked on both sides. However, before the curb chain is hooked, the rider must make sure that it is outside the snaffle on the far side and that it is untwisted until it lays relatively flat. The curb chain is then hooked onto the nearest area outside of the snaffle, at such a length as to lie smoothly in the chin groove. To test the accuracy of this, the curb reins should be seized under the jaw of the horse and drawn towards its chest. If the bit stands stiffly, the chain is too tight. If the branches of the curb bit come back in a line with the reins or anywhere near it, the chain is too loose. The chain is the correct length if slight tension through the reins exerts pressure upon the jaw of the horse so that the chain's place in the chin groove is maintained. If the curb chain is incorrectly fastened and is not brought from one hook to the other on the outside of the snaffle, it will interfere with the action of both bits and will pinch the lips of the horse (Anderson & Collier 1905:58-59).

The Saddle

Saddles are of varying design, in accordance with the purpose for which they are intended. Among the most common types, there are general riding or hacking saddles, hunting, jumping, cavalry, flat-racing, show-ring, stock, and side saddles. Saddles are mainly designed to fit the rider, while the tree must be the proper size to comfortably fit the horse. The frame over which the saddle is built is called the tree. All saddles are built along the same standard principles, with the tree having to meet specific criteria: it must be strong enough to withstand the pressure of the rider, high enough to clear the horse's withers and bones, and wide enough so that it sits securely on the horse. It is generally made of wood (often beech) and metal (usually steel), while many modern saddles have a solid light-metal construction (Prince & Collier 1993:32,35).

The tree of the saddle should have a cutback pommel (front portion of the saddle) and cantle (rear portion of the saddle) to prevent the withers of the horse from being chafed. The side-bars should take an even bearing upon each side of the horse's back, with a channel in the panel being made to keep the saddle clear of the spine. The throat of the tree should not be so narrow that it pinches the horse, though it will be unstable if it is too broad. If the tree is suitable concerning these aspects, it should then be very easy to bend the lower points until they embrace the shoulders snugly, which makes for a well-fitted saddle (Anderson & Collier 1905:54).

For a custom-made saddle, the shape and dimensions of the tree must conform to the height and weight of the rider, along with the conformations of the horse at the withers and back. To ensure comfort while riding, the saddle should be fairly soft, with its flanks sufficiently slanted in front to permit the rider to place his thighs and knees

correctly. The tree should be perfectly fitted to the horse's contours, as should the padding and lining, in addition to being flexible enough not to cause discomfort to the horse, and to avoid pain or sores, particularly at the pommel (Gianoli 1967:214).

In saddling the horse, the first care is to see that the panel is perfectly clean and dry, and then to ensure that the hairs on the back of the horse lie smoothly so as to avoid any discomfort for the horse. The panel (under-stuffing of the saddle) would be covered with a felt cloth or a thin piece of leather in order to preserve it from the friction of the saddle. The saddle, with the girths and stirrup leathers crossed over the seat, should be lifted gently onto the back of the horse, and put exactly in the saddle-place, which is as far forward as it will remain fixed and still be able to clear the withers and give the shoulders free range of motion (Anderson & Collier 1905:60).

The Tack

In addition to the saddle, the tack includes the girth, stirrup leathers and irons, saddle pad (which is generally made of wool felt), and the bridle, with all its parts and accessories included. The average English saddle, together with its tack, weighs from fifteen to eighteen pounds, while a traditional Western saddle, even without its usual silver trappings and decorations, can easily amount to thirty to forty pounds. On the contrary, the weight of a racing saddle can be expressed explicitly in ounces (Gianoli 1967:215).

The Girth

The purpose of the girth (referred to as a cinch in western jargon) is to hold the saddle onto the horse's body. The girth is generally made of canvas for saddle horses, but can also be made of leather or fabric. It must be just tight enough to keep the saddle in position. String girths, which are often used as the standard equipment of the military and the mounted police, are often employed when a horse is tender (Gianoli 1967:215).

The Stirrups

The purpose of stirrups, often referred to as "irons", is to support the weight of the horseman while maneuvering, so as to provide leverage during riding. Essentially, it is the correct placement for the rider's feet while riding. Stirrups are made of various sizes and weights, but should be wide enough to slip from the rider's feet in case of a fall. When used with flat or English saddles, the stirrups are ordinarily made of metal, although those used with stock saddles are usually made of wood, with leather hoods and wrappings on the treads. Stirrup leathers are designed to hold the irons onto the saddle. Western saddles, on the contrary, come equipped with the leathers and stirrups already attached (Gianoli 1967:215).



Figure 4. A Stirrup. It is artifact HAM 992.a.

Artificial Aids

Signals by which the rider communicates with and controls the horse are referred to as aids. Natural aids are of primary importance in this process, and include the rider's usage of voice, weight distribution, hands and legs to convey adequate information to the horse. Artificial aids may be used to support these natural aids. It should be emphasized that such aids are to be used as means of communication and not punishment. However, the use of artificial aids is oftentimes extremely helpful in enforcing obedience, but these tools should not be abused. The more patience and insight exhibited when interacting with one's horse, the less frequently one will need to use artificial aids.

The Martingale

The martingale is a device that steadies a horse's head and checks its upward movement. It consists of a strap that is fastened to the girth that passes between the

forelegs, and divides into two rings that hold the reins. There are several different varieties of martingales. The standing martingale, or tie down, runs from the noseband of the bridle to the girth. This piece of equipment allows the horse full range of motion as far as extending his neck forward, yet prevents the animal from rearing or throwing its head back. Thus, its main purpose is to limit the upward movement of the head without restricting the forward movement. This martingale is not recommended for jumping purposes because the adjustment might fail to correspond correctly for the needed stretch of the neck. If the horse's head is positioned up in its natural position for movement, then the adjustment can be tested for proper fit—the martingale must be able to be pushed up from underneath to ever so slightly dig into the horse's throat (Prince & Collier 1993:36-37).

The running martingale, in contrast, is Y-shaped, with a loop at the base of the Y that slips over the girth and a ring at each tip. This martingale is comprised of a breastplate and strap with rings which pass through the snaffle reins. This design is suitable if it is employed with a snaffle bit alone or with a combination of a snaffle and curb bit. The lower reins pass through the rings with a snaffle bit and four reins, while the upper reins go through the rings with a jointed bit. The length of the strap adjustment is determined by lifting the rings to the height of the withers, and serves primarily to prevent the reins from going over the horse's head when it turns or tosses. Additionally, the strap is used to offset any trouble that might arise if the hands were to suddenly be raised abnormally high. This strap also improves the rider's control of his mount in the same way that the standing martingale does (Gianoli, 1967:207).

The running martingale is a much more adaptable aid than the standing martingale because it serves more flexible purposes. It functions as an excellent training device for a horse with an unmade mouth, and can also act as a safety device. For example, a rider would be unable to maintain control of a horse if it were to bolt with a snaffle bit because the horse could seize the bit in its teeth and leave the rider helpless. However, the running martingale prevents this from happening by holding the bit against the bars so that the rider can easily regain control. This martingale also allows the horse's neck to stretch as long as the rider gives adequately with his hands, therefore making it a suitable aid to be used in jumping (Prince & Collier 1993:36).

The Cavesson

The cavesson is a dropped noseband that is used in the training of younger horses. It is composed of two independent cheek pieces adjusted so that they are about two fingers width above the bit. This is so the lips of the horse are not pinched or injured (Gianoli 1967:207). The cavesson is generally used in conjunction with the snaffle bit, since many horses evade the action of this particular bit by moving their tongue over it. The action of the cavesson is only felt by the horse if he should open his mouth in an attempt to offset the action of the hands and the bit. Therefore, the cavesson effectively keeps the horse's mouth closed while allowing the snaffle to remain in place. Proper use of the cavesson affords the rider control without having to resort to a stronger, more uncomfortable bit (Prince & Collier 1993:38).

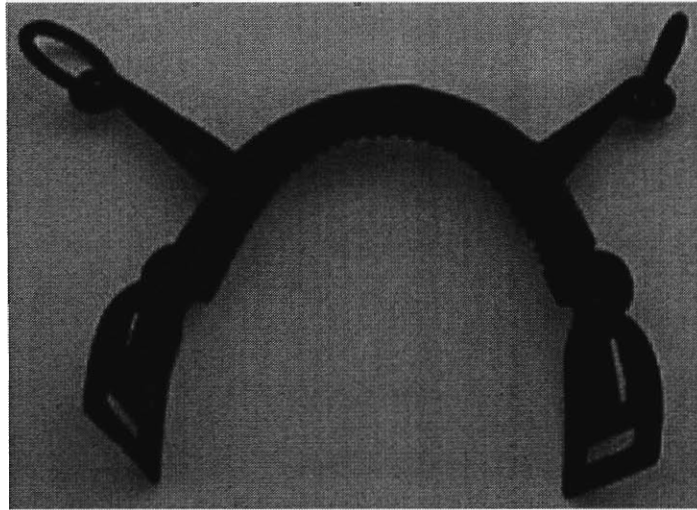


Figure 5. A Cavesson. It is artifact HAM 612.

The Spurs

The purpose of the spurs is to add authority to the action of the rider's legs. The various types of spurs include those used for open-field riding and competitions, which have plain shanks. In dressage work, roweled spurs are used, while in grand dressage, the spurs are curved into an S-shape with a slight rowel. Although the spurs are meant for communication purposes, they must be used with understanding (Gianoli 1967:207).

The spurs should not be applied with great pressure; instead, short, light jabs should be used just behind the girth, and should not be scraped over the horse's ribs. If applied at the right moment and with the proper amount of lightness or severity, the spurs provide a highly effective correction strategy. If the horse reacts defensively, the rider should spur it again lightly, but taking care that the horse does not become aroused, and making it easy for the horse to understand what is required of it (Gianoli 1967:207).

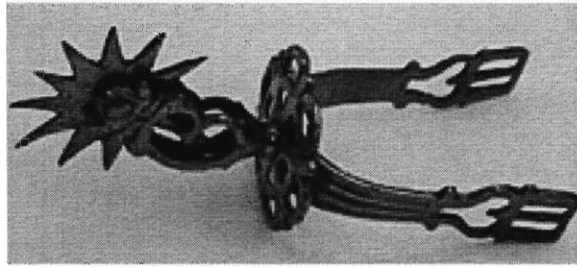


Figure 6. A "Rowel"Spur. It is artifact HAM 1892.1.

The spurs should only be used while giving the horse complete freedom in the mouth. Spurs can also be used as a means of reminding the horse to behave by simply moving one's foot, and for this reason many are made to produce a sort of jingling sound. The spurs should not be used by inexperienced riders who are unable to control their legs in certain situations. Improper use will only lead to irritating the horse and inducing the development of bad habits. While severe physical injury is rare, it may cause irreparable damage in the horse's mental balance and confidence (Prince & Collier 1993:36).

The Whip

The purpose of the whip or crop is to get the horse to better understand the aid of the rider's legs, to incite him to action or to correct him. The whip may be thought of as an extension, or reinforcement of the rider's arms. The whip should be a light, flexible contrivance, not to exceed two feet in length and should have a smooth surface with no more of a lash than a silken tip. The whip should be used behind the rider's leg when inciting action in order to provoke the horse to obey a command. However, the whip should only be employed delicately and at the proper moment. The whip may occasionally be used in jumping, so as to aid a horse who hesitates before an obstacle. In situations such as this the rider usually realizes that the leg action alone will not suffice to persuade the horse to jump, and incites the action of the whip. The whip may also be used

as a means of correction, including use as a defense mechanism against a bad-tempered or ill-trained horse. In these instances, the whip should be used repeatedly and energetically, and at brief intervals while alternating the applied jabs to the flanks and shoulders, but never around the head region (Gianoli 1967: 207).

The Harness

The harness serves two fundamental functions: first, to attach the horse to the vehicle so that he may pull it; second, to enable the coachman to guide the horse. The elements of all harnesses include the collar, hames, trace, bridle, bit and reins. The pulling part—the collar, hames, and trace—should be strong, but also as light as will fulfill their purpose, while the guiding part—the bridle, bit, and reins—should be light, but also be strong enough to hold the horse (Anderson & Collier 1905:263).

The Collar

The collar is the keystone of the pulling segment of the harness. The collar should be lined with some non-porous material, preferably soft leather. Collars that are too wide will rub the horse's shoulders, while ones that are too short will choke the horse, and ones that are too round will apply unnecessary pressure and irritate the withers. If the collar is able to fit over the horse's head, it will generally fit with respect to width, while the length is correct if four fingers can slide vertically between the neck and the collar when the horse's head is held in its usual position. In order to prevent the point of the collar from rubbing on the withers, the upper sides of the collar and the sides over the shoulders should be properly fitted. Horses with unusual head or neck conformations will benefit

from a collar that possesses an opened top. Collars that are curved back display the musculature of the horse's neck, but they exist in straight forms for those with less defined structure. A Dutch collar, or breastplate, is sometimes used in a light harness instead of a neck collar. Such a collar displays the horse's elegant composure, and is oftentimes used to show off the lead horse of the tandem. It is also useful in alleviating the pain of a horse that is experiencing shoulder soreness (Anderson & Collier 1905:264).

The Hames

The hames (the curved wooden frames of collars) must fit the collar. In addition, the draught-eye in the hames, to which the tug is attached, should be placed so that the pull resides on the muscles in the lower portion of the shoulder blade, or at a point where this large bone is narrowest. The hame-rings are usually placed a full inch lower on the hames when fitted to the collar. This positioning affords the horse free range of motion in its shoulders, while simultaneously situating the draught-eye to where the horse can easily apply the greatest power. The incline of the trace from the collar is of less importance, so long as it is not too high or too low. However, it is advantageous to have the trace decline from the collar to the vehicle (Anderson & Collier 1905:265).

The Trace

The hames on the collar are fastened to the tug, the tug to the trace, and the other end of the trace is fastened to the vehicle. The tug and the trace should be long enough so that the back-band is able to lie on the middle of the pad when the horse is pulling. This

prevents the horse from awkwardly pulling the vehicle by the back-band rather than correctly by the trace (Anderson & Collier 1905:266).

The Reins

Good, strong, pliable reins, particularly those with a length of 23 feet 6 inches, are required for the lead-reins of a coach. The width of the reins is more variable, and depends upon the length of the driver's fingers—short-fingered reins should be $\frac{3}{4}$ or $\frac{7}{8}$ of an inch, while long-fingered reins should be an inch or slightly more. This allows the coachman to appropriately handle the reins in an unhampered fashion (Anderson & Collier 1905:266).

The Evolution of the Horse

Horses have been adapting to changing climates and habitats for over 60 million years. According to the fossil record, the earliest known ancestor of the horse was *Hyracotherium*, a small, swampy forest animal (the size of a fox) that stood only 10-14" high at the shoulder. This creature was referred to by the name Eohippus (meaning "Dawn Horse"), which was derived from the early Eocene geological era (50 million years ago) and from the Greek word for horse—*hippos*. Eohippus had a soft pad at the base of its toes (four front toes and three back toes that all bore weight equally), each of which had a horny, hoof-like nail on the end. Eohippus evolved on the North American continent before migrating east and west over the land bridges that linked America to Asia and Europe. Between 40 and 35 million years ago, Eohippus disappeared and a gradual transition occurred (Gordon-Watson 1999:16).

The next significant step was the emergence of a sheep-sized creature between 40 and 26 million year ago, during the Oligocene era. Known as the Mesohippus, this creature stood 18" high at the shoulder and had only three toes on each foot. Its middle toe was longer and more prominent than its side toes, and was also able to bear more weight, which suggests that slightly harder ground may have been forming. Mesohippus retained the soft, leafy vegetable diet of Eohippus. Mesohippus was superseded by Miohippus over the next 15 million years or so, during the Miocene era (26-10 million year ago). As the climate became drier, the swampy forests gave way to open grasslands. Miohippus was slightly taller than Mesohippus (24" high at the shoulder), and not only traveled further and had longer legs, but it also began to eat grass as its teeth changed and neck lengthened. Miohippus had a wider field of vision, as its eyes were no longer

centrally located in its head and began to move further apart. Additionally, Miohippus was also able to more accurately pinpoint distant sounds as its ear began to lengthen (Gordon-Watson 1999:16-17).

These early horses were finally beginning to resemble the modern horse, although its size was more similar to that of a pony. Six distinct groups of horse-like creatures now occupied North America. The most significant of these, Merychippus, appeared about 20 million year ago and probably overlapped with Miohippus and others such as Megahippus (which was an exceptionally big creature—larger than any known horse today) for a few million years. Eventually, all of the browsing horses except for Merychippus became extinct. Merychippus was better adapted to the open grasslands because its longer legs enabled it to flee predators more swiftly. Merychippus developed flexible ligaments in order to provide better control and support to these longer limbs. Although its soft pads had disappeared, Merychippus still had three toes. However, only the central toe bore any weight, as the side ones became increasingly vestigial (Gordon-Watson 1999:17)

The last stage in the evolution of the modern horse occurred about 6 million years ago, during the Pliocene era, when Pliohippus appeared. Pliohippus stood 48” high at the shoulder and was the first to possess a single horn-covered toe. Having even longer legs, it was well suited to life on the plains, steppes and prairies because hiding places were rare and it needed to rapidly evade potential threats. Larger and longer incisors meant that cutting and tearing coarse grass was easier, and the elaborate pattern of ridges that developed on its molars also enabled it to grind the tough cellulose of grasses (Gordon-Watson 1999:17). The evolution of the hoof from Eohippus (a) to Miohippus (b) to

Merychippus (c) to Equus (d) can be seen below. Note the increasing prominence of the middle toe, as the side ones become progressively more vestigial. The illustration is compliments of http://www.cs.colorado.edu/~lindsay/creation/horse_series.html.

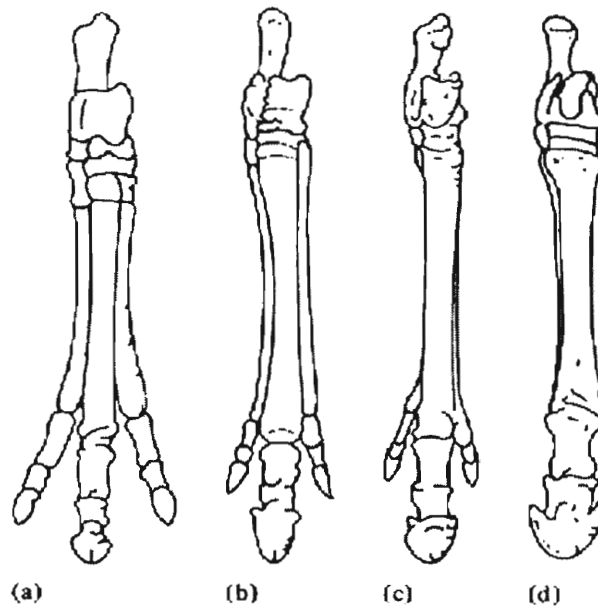


Figure 7. Hoof Evolution

As all the other branches of horse-like creatures became extinct, the horse as it is known today, *Equus caballus*, was established one million years ago. Members of the Equidae family are classified as perissodactyls, or one hoofed animals that bear weight on what was once the central toe. Modern equids are referred to as equines. Three related groups of equines were found in different areas by the end of the Ice Age in about 9000 B.C., all of which had evolved from *Pliohippus*. Europe and western Asia were inhabited by horses, northern Africa and the Middle East were inhabited by onagers and donkeys, and

eastern and southern Africa were inhabited by zebras. Experts are unable to explain why the horse then became extirpated in the Americas about 8,000 years ago. The Spanish later reintroduced the horse when they landed in Mexico in 1519 (Gordon-Watson 1999:18). The structural differences between the earliest known horse-like creature and the modern horse as it is known today can be seen in the figure below. The illustration is compliments of <http://campus.northpark.edu/physics/bts3910/schimmrich/horses.html>

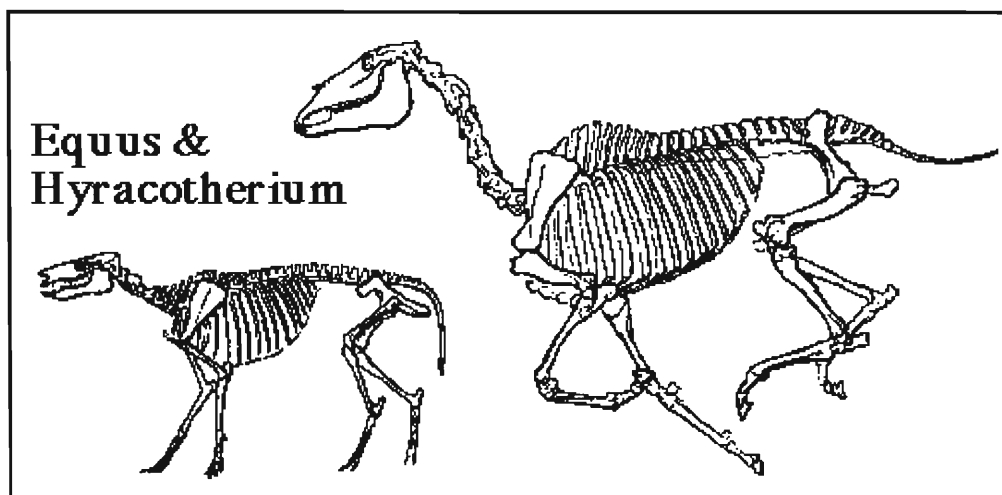


Figure 8. Equus vs. Hyracotherium

The Origins of Horse Domestication

Despite intensive investigations over many years, researchers know very little about the origins and evolution of horse husbandry. However, throughout the course of the 20th century, a variety of theories have been developed to explain where, when and for what purposes the horse was first domesticated. Archeological and paleontological evidence indicates that the horse was domesticated around Mongolia (and possibly southwest Asia and even Western Europe) in 3000 B.C., substantially later than any other farm animal. By that time, the dog had been the human's companion for 9,000 years. Humans had also herded the more tractable animals such as cattle, sheep and goats for over 5,000 years, along with domesticated pigs, chickens, donkeys, oxen, elks, reindeer, stags and onagers (an Asian species intermediate between donkeys and true horses). Once domestication occurred, horses had a decisive influence on the history of humankind.

Hunting & Herding

Although early humans and horses have been interacting for at least some 50,000 years, horses were used solely as a source of food for a long time. Cave paintings in France leave undisputable evidence that the horse was a primary food source for the Cro-Magnon Stone-Age hunters. When the New Stone Age (6000-3000 B.C.) ended and the Bronze Age (3000-900 B.C.) began, humans in Europe and Asia already had generations of experience working with animals, having mastered the skills of herding cattle, sheep and goats. They had also learned to herd horses, which they kept mainly for meat and possibly also for milk (as nomads in Central Asia still do today), hides, skins and hair. In addition, people had learned to cultivate grain and had abandoned hunting in roving

bands in favor of settling in permanent agricultural communities. Therefore, as humans became increasingly assured of regular food supplies, they then had the time to appreciate the horse for qualities other than its ability to provide a family with a substantial supply of food (Levine 2002: 1-7).

Horses were primarily hunted for food for a longer time in Europe than further east because the horses there seemed far less suitable for any other role. However, during the 3rd millennium B.C., a culture emerged in the vast Asian steppe lands from people who avoided the settled life of the narrow coastal areas and had instead adopted a nomadic lifestyle. These steppe-people constantly moved from one area to another in search of better hunting, following the herds of horses, which became an invaluable resource of food and milk for them. A method of controlled herding was first adopted by these steppe-peoples, in which they easily handled the more placid herds so that the horses could travel with them. These first herds consisted exclusively of mares, for the stallions proved too difficult to control and were also unable to provide a source of milk. In order to breed the horses, these steppe-people would isolate individual mares from the rest of the herd so that the stallions had an opportunity to mount them (Hyland 1994:15).

Domestication & Taming

Both domestication and taming are defined as the adaptation to intimate association with human beings. However, there is a distinction to be made between the terms domestication and taming. Domestication refers to the controlled breeding of a species in captivity, such that their genetic composition is altered to suit the needs of the human population it serves. Domestication is therefore the forced evolution of a species

through human intervention. Taming, in contrast, is simply the conversion of a wild animal into one that is capable of peaceful coexistence in a human community. It does not imply that members of the entire species are tame; rather it means that a particular individual was trained. Taming is therefore the first step to domestication.

According to Clutton-Brock (1987:12), “A tame animal differs from a wild one in that it is dependent on man and will stay close to him of its own free will.” All types of wild animals are tamed to be kept as pets by aboriginal hunter-gatherers and horticulturists throughout the world. Horse taming may have first arose as a by-product of hunting for horse meat. Wild horses, particularly as foals, can be captured and tamed and, ridden or harnessed and, at the end of their lives, if necessary, slaughtered and eaten. Both the North American Plains tribes and the Mongols used the arkan (lasso) or herd drive method (startle a band of horses into stampeding over the edge of a natural cul-de-sac or precipice, and then finishing them off by stoning them to death) to capture wild horses to eat or to tame during ancient times. Accordingly, orphaned foals may have been captured and then adopted and raised as pets.

Eventually, and perhaps repeatedly, the discovery was made that these pets could be utilized for labor purposes. This knowledge could have been acquired and lost many times from the Pleistocene (the major glacial epoch also known as the “Ice Age”, which occurred 1.8 million to 11,000 years ago) onwards. However, it was only during the Holocene (the name given to the last 11,000 years of the Earth’s history; also known as the Anthropogene, or the “Age of Man”)—possibly between the Neolithic and the Early Bronze Age—that it began to influence human social developments (Levine 2002:1-7).

The difficulties involved in maintaining the wild horses that had been captured would have initially set limits to their impact on human society. For example, it seems likely that horse-keeping would have had to be relatively advanced before controlled breeding, and thus domestication, would have been possible. According to Boyd and Houpt (1994:222), "Failure to consider the typical social organization of the species can result in problems such as pacing, excessive rates of aggression, impotence and infanticide." This means that in order to breed wild horses successfully in captivity (and thus domesticate them), their environmental, nutritional and social requirements must first be met.

The process of horse domestication began at different stages in various parts of the world. Although much speculation exists as to the exact period during which the horse was domesticated, the vast majority of historians and anthropologists believe it to have transpired somewhere between the Neolithic (6000-4500/4,000 B.C.), Eneolithic (4500/4000-3000 B.C.), and Early Bronze Age (3000-2000 B.C.). The earliest, unambiguous evidence for horse domestication dates back to the end of the 3rd millennium B.C. Evidence for riding and traction are even more recent, as these artifacts only date back to the beginning of the 2nd millennium B.C. (Levine 2002:1-7).

The domestication of horses in the ancient world can sometimes be easily verified from textual and artistic evidence. For example, the remains of horse specimens were found to be accompanied by well-preserved equipment such as bridles, saddles and harnesses in some south Siberian Iron Age (900-300 B.C.) kurgans (ancient burial sites), including those discovered at Pazyryk, Bashadar and Ak-Alakha. Sintashta burial sites located on the south Ural steppe, contained the remains of horses from before 2000 B.C.

These graves contained a considerable number of horses buried in highly prestigious, and elaborately decorated tombs. This suggests that the horse played an important role in society by this period (the Middle Bronze Age: 2000-1500 B.C.). It also indicates that the horse was almost certainly domesticated for an extensive period of time before this date. Horse domestication throughout Europe seemed to expand rapidly shortly thereafter (Levine 2002:1-7).

Determining the origins of horse domestication then becomes more complicated when considering the many sites that date back to periods when horses were first used for riding and traction. Archaeological and pale-ontology records are rarely able to recover organic materials such as leather and wood. Even solid materials such as bone are eventually destroyed when unfavorable soil conditions are present. Moreover, it is highly likely that horses were ridden without the use of a saddle or bridle during the early stages of horse development (Levine 2002:1-7).

Riding

Riding was unknown to most horse owners for approximately a thousand or more years after the initial domestication by the steppe-peoples. This was due to lack of incentive, as well as to the crippling techniques that were utilized to catch the horses to begin with. The majority of herdsmen used crude rope traps which usually left the horses as permanently crippled specimens that were unable to be ridden. As nomadic practices spread, the power of the horse was soon discovered, with one of the first references to riding appeared in a drawing on a bone in Susa, in the Euphrates Valley and dating from the 3rd millennium B.C. (Levine 2002:1-7).

There is also evidence as far back as the 5th century B.C. that horses were ridden by the early Sarmatian peoples. Rudenko states in *The Frozen Tombs of Siberia* that “together with small plain herd animals there were thoroughbreds, powerful cantering animals and typical riding horses.” The term thoroughbred is rather misleading in this context, because it simply refers to a horse, and not the breed contemporary readers know of today, which was not yet in existence at that time (Hyland 1994:2).

Similar findings from the central Asian nomadic tribes show that riding was established there at least by the 2nd millennium B.C. Although a neolithic Prussian amber sculpture was found from the 3rd millennium B.C. depicting someone riding, as far as supporting archaeological and paleontological evidence exists, riding did not appear this far west until the last thousand years before Christ. The Chagar Bazar tablets of 1800 B.C. from Mongolia are amongst the earliest written references to man on horseback. Additionally, a letter written by Samsulluna in 1750 B.C. states that extensive movements of nomads occurred in Mesopotamia during this period. These people most likely brought the horse with them as they traveled into Egypt (Levine 2002:1-7).

Carrying Capacity

Carrying capacity of a properly harnessed horse can not exceed the weight of 2200 pounds, which is significantly more weight than a donkey is capable of pulling. However, the carrying capacity of a horse when being used as a pack-animal is relatively the same (although it is slightly more) than that of a donkey, 374 as compared to 330 pounds, respectively (Ohler 1989:15).

Ancient Civilizations

The nomadic peoples in the steppe lands of Asia developed the use of a horse as a riding animal during the last millennium B.C. They all depended on the horse to facilitate long-range conquests. However, it was not merely aggression that prompted the movement of the nomads but the ever-increasing need for new grazing grounds in order to support their herds of horses and domestic stock. The need for land and distance was also a factor, especially with the growing number of tribes (Hyland 1994: 1).

Mesopotamia, which later became the center for horse breeding, was the location for the invention of the wheel around 3500 B.C. As tribes gained status and wealth by dealing horses, the wheel enabled an easier form of trading to develop. Far-reaching trade networks were established over the next millennium, especially in western Asia and southeastern Europe. Elsewhere, horses were being used in warfare to conquer neighboring peoples. By the middle of the 2nd millennium B.C., horses were being used to pull chariots throughout Greece, Egypt, Mesopotamia, Anatolia, and the Eurasian steppe. Chariots were not introduced in China until the 14th century B.C. (Gordon-Watson 1999:).

Although horses may have been ridden as early as the 3rd millennium B.C., their initial war impact was not a result of this riding capacity. Rather, the horse was utilized as a method of powering the early war chariot. A wave of invasions overflowed from the steppes around 1500 B.C. These nomadic, horse-riding peoples most likely came from the more settled steppe communities and were driven from their homeland due to agricultural calamity (Gordon-Watson 1999:).

In other parts of the world, the people of Parthia, Sassanian Persia, and Armenia had a large, superior mounted force with their horses. The horse played an important role in each of these civilizations, as it was the means for protection from outside invaders and served as a gateway for interaction with other cultures. The Parni, ancestors of the Parthians, came from the steppe lands around the Caspian Sea and brought their expertise in nomadic equestrianism with them (Hyland 1994:2).

Until mounted armies, or cavalry, came into wide use, the chariot continued to be the primary vehicle of war. The cavalry developed and proved very effective in combat as weaponry and tools also improved. The advantages of speed, height and surprise that the cavalry brought now became the new indispensable form of warfare. Areas unsuitably for the chariot were also able to take advantage of cavalry units. Larger horses were eventually sought to carry armored men as technology gradually advanced. In order to control the horse's speed and direction, bits, reins, and spurs were introduced. These were initially made of wood, bone, or hide. By 1500 B.C., bronze was used to make this equipment, which was then replaced by iron. The late Roman period (4th-5th century A.D.) saw the advent of the saddle (rather than using a cloth), while stirrups were not invented until a later date (Gordon-Watson 1999: 20).

The open terrain of central and southwest Asia provided a natural environment for the development of horse-riding military forces as early as 600 B.C. By the time of Alexander the Great and Philip of Macedonia, cavalry horses of this region wore scale armor and breastplates (Robards 1997:12).

The Sarmatians began to move in 70 B.C., and then the Quadi and Alans, who, in turn, were followed by the Huns. The Huns used small ponies to create a light cavalry.

Up until the early medieval period, steppe tribes arrived one after another. The Huns, Goths, and Visigoths came in the 4th and 5th centuries, while the Slavs, Avars, and Bulgars followed in the 6th and 7th centuries. The horse allowed the travelers to move efficiently and to live off the land (Hyland 1994:1).

Armenia

Armenia had a tradition of horse-breeding for cavalry that originated in Assyrian times. Armenia later became a recruiting ground for the Byzantine Empire. Armenia is first mentioned as a horse-breeding nation during the rule of Sargon II of Assyria (721-705 B.C.). It is believed that the Armenians learned their horsemanship and archery from the Medes. Part of the stock was sent to Persia each year. The Armenians armored their horses like the Albanians and Syrians (Hyland 1994:3).

Persia

The Assyrians were a martial people whose empire was at its height in the mid 8th century B.C. Horsemanship was regarded as the ultimate aim in the pursuit of a political and military life. This tradition was then continued by the Persians, who conquered the Assyrians in 612 B.C. The Persian ruler, Cyrus the Great, conquered Babylon in 539 B.C. through the use of an extensive cavalry unit. His own personal collection included 8,000 stallions and 6,000 mares that were then housed in his stables in Babylon alone (Gordon-Watson 1999: 21).

Persia played a pivotal role in the dispersing of horses in Asia Minor. Persia had a heavy Nesaeen breed and Turanian horses of Bactrian and Sogdian Satrapies. It was from

this stock that the best cavalry emerged. The Turanian horse was lighter and therefore a more effective light cavalry mount. The archers, notorious for their infallible Parthian shot primarily used these horses (Hyland 1994:3).

The large and well-equipped forces of the Persians protected them from Roman invasion. Despite some victories, Rome was never quite able to conquer Persia. Though unable to take over the land, Rome borrowed and assimilated many of Persia's equestrian customs. These included barding chargers and the use of cataphract, or heavy armored trooper whose horse may also be armored as well as *clibanarii* heavy cavalry (Hyland 1994:3).

Rome

Throughout the Roman period, horses were acquired from conquered territories. Horses came from Spain, Thrace and Pannonia. Part of this population of horses was oriental, as horses from Syria, Africa, Palestine, and Moesia made up the large cavalry. By the 4th century A.D., Roman legionnaires were using heavier horses from Persia and central Asia. These horses were covered with protective coats of mail (Robards 1997:33). During the 4th century, the horses considered as best suited to military pursuits were the Hunnish, Thuringian, Burgundian, and Frisian breeds (Hyland 1994:6).

The Roman cavalry units were subdivided into heavy and light cavalry. The heavy cavalry consisted of cataphracts, where both men and their horses were armored. During a mass charge, a horse capable of delivering more thrust would have been preferred so that a heavier conformation could then be formed solidly and powerfully behind the troop. The light cavalry, in contrast, consists of non-armored horses upon

which missile throwers, javelineers, and archers would ride. The javelineers were even further subdivided into men who moved forward and fought at close range with the *spatha* (a long, slashing cavalry sword) once they cast their javelins, and those men who never closed in on the enemy and simply threw missiles (Hyland 1993:13).

Mounted exercises, known as the *Hippika Gymnasia*, were utilized as training strategies for the Roman cavalry. The *Hippika Gymnasia* not only prepared the horse for attack and combat, but also was useful in priming the rider for maintaining maximum efficiency aboard a rapidly moving mount. Maneuvering, tactical and weaponry elements of the *Hippika Gymnasia* were valuable for teaching the riders methods of controlling, directing and urging the horse, while at the same time retaining full jurisdiction over his own weapons and avoiding those being launched against him (Hyland 1993:15).

The *Hippika Gymnasia* was performed in front of an informed military audience as parade-ground exercises. Mounted riders executed mock attacks and retreats in order to incorporate a wide range of movements into practice. It was a spectacular demonstration of the speed and awe of battle, as men clad in tunics of many different hues presented a colorful kaleidoscope of war maneuvers (Hyland 1993:17). Before participation in the *Hippika Gymnasia*, a horse and rider had to be sufficiently trained, for such a highly disciplined spectacle was not intended to be an amateur event. This was accomplished in a *gyrus*, or Roman training ring. It was a curved track with a high fence circling its perimeter that was conducive in serving a dual purpose—it guided the horse so that it kept moving forward, and also afforded the horse a sense of containment and control so that it could concentrate on the skill being learned (Hyland 1993:24).

The sides of a *gyrus* were built high enough so that the horse could not see over the top, with a typical ring measuring approximately 1,024 square meters (1,225 square yards). The dimensions of a *gyrus* have been adopted in modern practices, with today's English dressage areas appearing in two standard sizes for competition: either 800 square meters (955 square yards) for below Grand Prix level, or 1,200 square meters (1,435 square yards) for Grand Prix level. Another aspect of equestrianism that Americans have inherited from Rome via Spain is the use of a small, round, high-sided pen (also an adopted version of a *gyrus*) that Western stock seat riders require for colt breaking. The Spanish equestrian heritage began prior to being occupied by the Romans. However, many additional elements were then introduced to them by the Romans (Hyland 1993:25).

The *Hippika Gymnasia* performances, as well as battle conditions, both required the same basic tack—saddle, girth, bridle, bit, breast-collar, breeching straps, and saddle pad. A horse could function adequately in a cavalry troop as long as this minimum amount of tack was used. Additional equipment included the use of a metal *psalion* (hackamore), a bridle with a loop capable of being tightened about the nose in place of a bit or with a slip noose passed over the lower jaw, if extra control was needed or a muzzle if the horse was a biter. However, even among the basic equipment, many variations in style existed, as the parade embellishments were often intended to provide visual impact at the expense of practicality (Hyland 1993:37).

Shaffrons, protective head armor for the horse, came in a wide range of very ornate styles for parade specialties. Eye protection against a missile or lance blow could also be added to the shaffron. These eye protectors were constructed of intricately

patterned ‘fretwork’ that was pierced with holes to provide the horse with a clear visual perspective. While some shaffrons consisted only of eye guards attached to the bridle by straps (this was obviously the minimal head protection offered aside from no equipment at all), others covered much more than simply the eyes, and encased half the frontal plane of the horse’s head. Parade shaffrons that were made of leather and amply decorated with studding and little plaques of metal in varied designs were also commonly used (Hyland 1993:37).

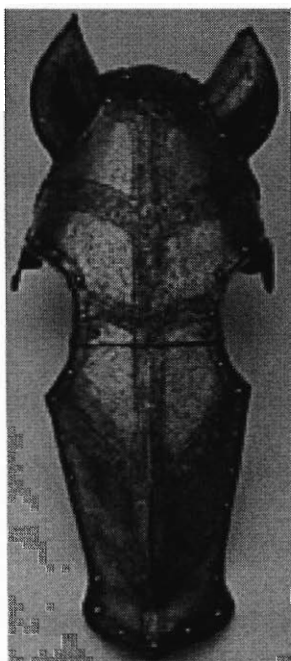


Figure 9. A Shaffron. It is artifact HAM 2604.4

Parade saddle pads were the other primary ceremonial addition, and consisted of a cloth (shabracque) that was usually elaborately adorned. Everyday saddle pads (*ephippium*) covered the area down to the horse’s mid-belly and extended to the rear of the saddle. Parade saddle pads, in contrast, entailed variations of this simple style. For example, they often reached as far as hock (knee) level, and occasionally even further down the horse’s body. The loin area, and sometimes even as far as the hip, was covered

by the saddle pad, for it was extended well beyond the rear of the saddle. The lower edges of the saddle pad were fringed in the parade version, and also included an arrangement of triple straps (saddle strings) that were attached to the lower saddle arch in the front and to the lower cantle area in the rear. These saddle strings served only for decorative purposes in the parade form, but also existed as functional tack in military saddles. The military versions, however, were much shorter and could be used to tie spare clothing or equipment to during battle. Although the material composition of the saddle pads remains unknown, it is postulated that they were made of leather rather than cloth. Since saddle pads were meant to form a small degree of protection against blunt weapons, leather would effectively be able to absorb some of this impact without impeding the action of the horse. Cloth is more flimsy than leather, and unless it was heavy canvas or made up of several quilted layers, it would not sufficiently protect the horse against the severe bruising that could be inflicted by a blunt weapon (Hyland 1993:39).

Color was another important aspect of parade horse equipment. Tunic colors that were most popular included purples, reds, and blues, and were used with saddle pads of matching colors to enhance the overall visual effect. Gilt (iron or bronze) shaffrons with bright yellow plumes were also fashionable. Although there was the possibility of special tack being colored by dyes in the manufacturing process, most of the leather that was used was probably naturally colored during the tanning process. The leather was then usually darkened by oiling to ensure suppleness and preserve fiber strength (Hyland 1993:41).

Bridles and breast-collars were secured through the use of metal *phalerae*, which were metal discs that had integral attachments on their underside for fastening individual leather pieces together. Composed of metal, usually brass, and sometimes silvered so that they gleamed, the visible upper surface of the *phalerae* was usually highly decorated for parade purposes. Ornamental metal pendants were also used as additional decorations during parades. In battle, however, simple metal rings could be used as a means of leather attachment. Modern techniques use buckles, stitching, rivets or tiny hooked studs to secure the narrow leather pieces of bridles and breast-collars (Hyland 1993:41).

Although the saddles, bits and hackamores of the Roman period were effective in terms of protective and functional aspects, they were not designed with comfort in mind, either to the horse or the rider. The adoption of a deep-seated saddle with a rigid tree was possibly the most radical development of the cavalry during Roman times. This saddle afforded the rider security that he had not previously known, for it significantly reduced the chance of the rider being knocked off the horse's back by a lance thrust. When the rider employed his sword, this saddle gave him a considerable amount of lateral security and allowed him to exert greater force behind any missile weapon (especially since the stirrup was not used by the Romans). This saddle also allowed the real shock tactics to be incorporated into offensive strategies (Hyland 1993:45).

The Romans admired size in their stock. Accordingly, nutrition was of foremost importance during the Roman Empire, as the grains they had available for feeding carried higher protein content than most of the strains in use even today. While horses denied of the proper nutrition rarely reached their full genetic potential, the Roman horse-breeds were of extremely large stature. Julius Caesar (one of the most famous and powerful

Roman Emperors) once commented about the inferior condition of Germanic horses. His adverse opinion most likely stemmed from the fact that the Germans, who despite being good horsemen, rode small horses (Hyland 1994:3).

The Romans and Persians are examples of nations that took great pride in the breeding techniques for their horse stock and were interested in the further development of horses. They placed much value on the horse because they saw the horse as more than a means of transportation. These nations gained status with the growth and development that the horse offered and also had the advantage of using the horse as a weapon in war.

Technology

Bits

It was the ancient world that developed the proper use of the bit. The earlier bits were composed of two links but it was the Greeks, the Celts and the Assyrians who used a three-link bit. This three-link bit had a small center link in the mouth, thereby increasing its flexibility and reducing the chances of the horse gaining control by biting. The snaffle bit was the basic design for these bits, which included a simple mouthpiece and a single rein (Singer 1956:558).

The snaffle and curb bits (which were very harsh and even cruel by today's standards) were used during Roman times. The early Roman curb bits consisted of a loop of metal that passed under the chin from the ends of a mouthpiece. The metal loop could be pulled upwards and forward by a second rein that operated on a lever (Singer 1956:560).

Saddles

The first form of a saddle and stirrups were developed on the steppes and were transmitted to the west by the semi-nomadic horse riding peoples. The Scythians of the steppe lands used the horse cloth, usually an animal skin, from the 6th to 3rd centuries B.C. It developed into a saddle when it was strapped onto the horse by breast and girth straps. It also included padded bows during the 4th century B.C. (Singer 1956:556).

There is no exact date on the first well-designed saddle, although a ‘true’ saddle (meaning that it had a proper tree design) is not believed to have existed until well into the Christian era. The horsecloth was used widely in Rome, Greece and Assyria. It was part of a soldier’s equipment by the 4th century B.C. The Romans, however, did not use padded saddles until introduced to them by the Chinese in Han times (25-220 A.D.) (Singer 1956:556). The Roman *ephippium* and the Greek *ephippion* were terms used to describe riding either bareback or simply with a blanket, which eventually developed into a stuffed pad. However, saddles found in burial grounds of the Pazyryk culture were of advanced design and elaborately decorated. These specimens contained functional aspects of the saddle that demonstrate an early understanding of saddlery mechanics as far back as the 5th century BC (Hyland 1994:5).

The saddle underwent technological advances from the 5th century B.C. onwards. The basic shape, however, consisted of two bars of material that were known as the tree—stuffed pads, felt, wood, metal, or a combination. These two bars fit on either side of the horse’s spine and were joined by a pommel, an arch, bow, or fork over the wither,

and a cantle over the back. The saddle offered some sense of comfort and security despite the absence of stirrups (Hyland 1994:4).

The Roman saddle was most likely borrowed from the Celts, Parthians, and Sassanians, as was much of the other equipment utilized in the Roman military sphere. The military version of the Roman saddle, which was far more advanced than merely a stuffed pad, consisted of a rigid tree saddle with four angled horns to ensure the rider's security. The "Connolly" saddle, as it is now called (because of a man by the name of Peter Connolly who has reconstructed this ancient saddle), had two main features which served identical functions. The raised pommel and cantle was designed to prevent the rider from being thrust from the saddle whether it be from a threatening weapon blow, or by the rapid twisting and abrupt halts of the horse. The cantle was continuous, with metal plates meeting in the center of the saddle. In order to accommodate the withers of the horse, the pommel and the front arch of the saddle were raised very high, and were also flanked by flaring horns. This saddle also took direct pressure off the horse's spine by transferring this applied weight to the upper ribcage. In addition, it also more evenly distributed the rider's weight. Although the advent of stirrups provided a firm base on which to apply the pressure of the rider's foot, thus enabling more poundage to be injected into a missile thrust, such as delivered by a javelin or spear, had not yet been introduced to Rome, this saddle revolutionized cavalry warfare (Hyland 1994:5).

Stirrups

The original stirrups seen in the 2nd century B.C. in India were straps hanging from the girth of a horse that ended in loops. The idea of the stirrup ring stems from the steppe riding peoples as well. Crafted by the Chinese, these stirrups were made from cast iron or bronze. It was in Hungary that the cast iron stirrups were first found. The use of the stirrup then spread to the Byzantines, where it was implemented into the cavalry. The stirrups used were iron rings that were either round or triangular and hung from leather straps. These stirrups were designed to give the foot a flat resting area for support (Singer 1956:556-7).

Spurs

Spurs were not used by the Greeks but came to the Romans around the 3rd or 4th centuries B.C. The early spurs are described as “stumpy.” They have short pricks and either studs or buttons at the open ends for attachment to the strap (Singer 1956:557-8).

Harnesses

The harness used by the Romans had been inherited from the Bronze Age and was relatively unchanged. The shortcoming of the harness was due to the failure of the Romans to realize that a horse’s strength is in its shoulders. They also did not take into consideration the principles of balance and suspension. This lack of improvement of the harness limited the Romans in their exploitation of animal power and therefore the tamed horse was primarily used as a draft animal around the 11th century B.C.

The available throat and girth harness used for oxen at this time was unfit for horses. The breast and girth bands met on the yoke at the withers. A dragging breast band slid up a horse's throat and, when pulled hard, exerted pressure on the horse's windpipe, thus choking the horse. Therefore, the horse could only be used to pull light loads.

The outdated harness made transportation inconvenient. For example, harnessing in tandem, (a two seat carriage drawn by horses harnessed one before the other), turning sharply, suspension, and lubrication were all problematic issues.

On the other hand, horses were pulling against a breast strap by the 2nd century B.C. in China. This strap allowed the horse to breathe freely as its overall efficiency was increased through the use of a collar harness. There is no exact date for the invention of the horse collar. It is also not known whether the invention of the collar was gradual or instantaneous.

Improvements to the traction harness were made in Persia and Han China in the 3rd century A.D., and in Western Europe by the 9th century. The breast bands were set horizontally instead of diagonally. The breast bands were the piece that transmitted the horse's horizontal pull. These were then joined to the middle of the girth band. From there, the pull was taken at the withers. The disadvantage of this arrangement was chafing (Singer 1956:552-3). Another improvement in the traction harness was the padding of the collar. Roman vehicles had small, padded, shoulder collars hanging from the yokes (Singer 1956:554).

Shafts

Though not used in Roman times, shafts, or two long pieces of wood between which a horse is connected to a vehicle, were used in China during the time of Christ. Shafts enabled the use of a single horse or those in tandem. The shaft replaced the single draught pole and was attached down the breast band in such a way that a pull did not make it slide up the horse's throat. Shafts were also combined with yokes and used with oxen.

The Greeks and Celts used traces instead of shafts. These could also be attached down the breast band from the vehicle. The Greeks used traces that were attached to the withers of the horses in the four-horse team (Singer 1956:553-4).

Carts

The horse-drawn cart was introduced in Egypt from the Hittite and Syrian territory at the beginning of the 18th Dynasty. The foreign origin of the cart can be deduced by its Semitic name, *mrkbt*. The cart had a semi-oval box with wide lateral openings, a shaft coming from the rear of the box, and four-spoke wheels. The cart was used either in hunting or war (Gianoli 1967:49-50).

One of the oldest examples of a Cretan cart is a clay model from Palaikastro. The model has a large rectangular box, of which four sides are painted with polychrome panels. The wheels are painted with three concentric circles over crossed lines. These carts also had two four-spoke wheels and a very long shaft (Gianoli 1967:50).

Chariots

The first use of the chariot can be traced to an illustration found from the civilization of Sumer. A mosaic covered box, the Standard of Ur from 3500 B.C., depicts a wheeled cart. The vehicle has solid wheels fashioned from two half discs, which was able to hold a driver and a warrior. The javelins that the warrior threw were placed in a quiver, a case for holding arrows, mounted on the high front. Considering the slow speed and bulky composition of this chariot, it is doubtful that it was used for anything other than a means of transporting men onto the battlefield. It is around the 2nd millennium B.C. that faster vehicles were designed in Asia Minor. The overall weight was reduced with the introduction of wheels that had spokes rather than a solid composition. The Asian hinterland is home to the classic, light two-wheeled chariot, an innovation that spread to most parts of Europe and Asia. The Aryans escorted it through Persia to India, the Hittites and Mittani to Mesopotamia and Syria, the Kassites into Babylonia, the Hyksos into Egypt, and the Celts and Germans into Europe (Levine 2002:1-7). Also, the chariots were now being pulled by horses instead of by donkeys (Wilkinson 1978: 27).

In 1750 B.C., the Hyksos from the Middle East were able to conquer the Egyptians because of their superior knowledge of chariot warfare. However, under the rule of Amen Hotep I (1550 B.C.), chariots became an integral and important part of the Egyptian army and so it was then that the Egyptians were able to drive out the Hyksos in 1580 B.C. (Wilkinson 1978:27)

The Assyrians used a larger chariot around 1100 BC. The chariot held a driver, a spear thrower or archer, and a shield bearer. Chariots were in use on the mainland of Greece by 1500 BC and were similar to the ones used in Egypt. They had the same spoked wheels, a high front, and a single shaft with a high collar for the horses. The body

of the chariot was simple, consisting of only a rail and a floor for the riders (Wilkinson 1978:27).

The chariot was a most effective tool in battle. The force produced by a large number of chariots, attacking in mass charges at high speeds, helped to make way through the lines of spearmen. The Ancient Britons ran along the central shaft to strike at the enemy and then back to the body of the chariot at high speeds. The Celtic and British chariots had a body with a fenced in back, front, and sides. The use projecting blades to fit the axles was borrowed from the Persians (Wilkinson 1978:27).

The chariot has a long history in the Greek world. It was used as a fighting-vehicle from the 16th century B.C. in Mycenaean Greece, which may have come from Mitanni and Hittite cities located between the Black and Caspian Sea. Eventually the chariot was no longer used as a weapon of war but continued to be seen at races and ceremonies. The use of the cart chariot in Greece rapidly fell after the Homeric Age, though it still remained as a heroic and mythological emblem in the legendary scenes depicted on vases (Singer 1954).

Greek chariots were used to enhance a warrior's mobility. The chariot carried two people- a charioteer and a warrior. With the exception of spear-throwing, fighting was not conducted from the chariot. The Greek war chariot, or biga, had a closed box in front, two wheels, and had a panel that was highest in front and decreased in height on both sides going toward the back. Because of the introduction of the cavalry, mostly chieftains and military leaders used the chariot. The chariot allowed them better command on the battlefield because their men could more easily spot them (Gianoli 1967: 50). Roman chariots were modeled after Etruscan chariots. Unlike Greek chariots, the Roman

processional and racing chariots carried only the charioteer and sometimes only had one horse (Singer 1954).

Cavalry

Cavalry played an important part in warfare and is thought to have surfaced around the 11th or 10th centuries, as evidenced by a Cretan vase painting. There is also evidence to suggest that some of the Greek cavalry horses were armored with faceguards, or shaffrons. The cavalry played an important role in Greek history, especially after the Peloponnesian wars (451-404 B.C.). It is around this time (445-335 BC) that Xenophon, a Greek equestrian whose writings on the horse are still widely read today, gave his description of the ideal cavalryman (Wilkinson 1978: 33).

The great expense involved with owning, maintaining, and equipping horses meant that it was confined to royalty and nobility. Mounted soldiers formed a distinct social class in both the Greek and the Roman Empires.

The Middle Ages & The Renaissance

Significant technological developments arose from design changes and modifications that occurred during the Middle Ages and the Renaissance. However, the equipment from these two time periods does not differ enough to merit the formation of distinct sections in this paper. Rather, it is more beneficial to view the advances in a step-wise manner as a chronology from the beginning of the Middle Ages to the end of the Renaissance.

Brief Historical Context of the Middle Ages

The Middle Ages are considered to have started after the fall of the Roman Empire. The dates given to the entire period are A.D. 500-1450, the earlier part terminating at A.D. 900.

Owning a horse during medieval times provided a considerable advantage. For example, the deterioration of the Roman roads and the necessity of defending oneself against the Arab, Hungarian, and Norman invaders were satisfactory reasons for people to have horses. A horse gave a person the means to flee or to take the opportunity to seize goods. For that reason, the horse became identified with the power of the individual, and subsequently, with political power, as well as military strength (Gianoli 1967: 68).

It was during the Middle Ages that two important developments spread throughout Europe. The first was a new form of agricultural organization that included the use of a new plow. The second was the addition of a new military caste that included armored horsemen. A major factor in both these developments was the horse.

Agricultural Revolution

The revolution in agriculture was centered on the estate. Tenants were able to divide their time and labor between their lord's land and their own. Tenants had the right to the use of their land, and this right was inheritable. The employment of the heavy plow was somewhat limited until the 6th century. An improvement in the harness for harnessing in tandem allowed the use of multiple teams of horses to pull the heavy plow. The combination of these teams and the heavy plow gave farmers the chance to clear much of the forestland that they had previously been unable to utilize due to the enormity of the task. The use of these teams and the heavy plow led to the invention of new technologies as well as the implementation of technologies otherwise ignored. Examples include the harrow, the scythe, and the pitchfork (Gies & Gies 1994: 44-45).

Civilian populations also benefited from the breeding of war-horses as the horse became more widespread and began to gradually lose its character as a purely aristocratic mount. Through the development of better harnesses, the use of horse shoes and other technical advances, the horse was bestowed with more power to pull heavier carts and new farming equipment. Also important was the introduction of the rigid, padded horse collar to Europe. This collar turned the horse into an efficient draft animal. The replacement of the throat and girth harness with the padded collar freed the respiratory channel of the horse, thus allowing it to pull at least three times more weight. The fact that the horse was faster and had a higher endurance than the ox made it the preferable animal for plowing and transportation (Gies & Gies 1994: 45-47).

The arrival of the horse onto the agricultural scene also directly influenced the population explosion of the high middle ages. It enabled farmers to produce good yields

from areas where the hard ground had previously prevented it from being harvested. A three-field rotation system was developed, and this, along with the cultivation of oats, benefited the horse as well. Horses were also able to transport travelers faster than donkeys or oxen, and could be used as mounts or to draw vehicles. A significant result of this was that perishable food stuffs (such as vegetables and fish) could now be transported over long distances to reach people who resided in cities or towns away from the coast. This, as well as better provisioning, led to the rapid growth of cities and towns in the mid-late middle ages (Ohler 1989:16-17).

Military Revolution

The Byzantine army underwent drastic changes by the beginning of the Middle Ages. Infantry, though still large in number, was no longer considered the most important element. Man and warhorse now formed a unified fighting unit, for the horse was now far more than simply a means of conveyance. As Diaz de Gamez observed, “ There are horses who are strong, fiery, swift and faithful, that a brave man, mounted on a good horse, may do more in an hour of fighting than ten or mayhap a hundred could have done afoot” (Ayton 1994). The horse allowed soldiers to arrive at battle without fatigue, to surprise their enemy with unexpected action, and allowed them to flee if necessary. All this contributed to the formation of a class of professional soldiers—the knights.

The Middle Ages also brought change to the face of military technology with the introduction of new weapons, defensive armor, fortifications and equipment for the riding horse. The warhorse became the defining feature that identified a man as part of the military class. To be a knight in medieval times therefore meant that the status of the

warhorse was held in high esteem by society. This was particularly the case in England during the second half of the 14th century, when King Edward III rose to power. This paved the way for England to step forward as the most powerful military country of the period. So many changes occurred that focused on military organization, royal army composition and war conduct that England underwent a 'military revolution' (Ayton 1999:9).

Crucial to this new transformation was the reemergence of the aristocracy (the traditional warrior class) into the realm of fighting, especially with the recommencement of the war with France in 1369, which had begun in 1336. The two new radical developments of the 14th century included the emergence of the mounted, or horse, archer, and the establishment of the entourage of mixed army structure-mounted archers mingled with foot soldiers, who were also referred to as men-at-arms. This caused a significant shift not only in the social composition of the military community, but also in the patterns of military recruitment (Ayton 1999:14).

Between the 11th and 14th centuries, the size of the best warhorses had increased drastically. The early decades of the 14th century also gave rise to the emergence of the true 'great horse', or *magnus equus*. Powerfully built and indeed the most expensive, the *magnus equus*, which was also known as the destier, had to be of formidable stature (estimated to be between 15-18 hands in height) in order to meet the pressure of a growing burden of heavier equipment for both man and warhorse. The destier (or *dextrarius*), however, was reserved for the upper aristocratic class, while the remainder, and certainly the majority, of the English military owned horses of less imposing physique. Many of these heavy hunting horses were described as *runcini*, *equi* or *chivals*,

while the best were referred to as coursers (or *cursarius*), which described their superiority in terms of their speed, strength and stamina. All of these underlying warhorse virtues were required of a good hunter (Ayton 1999:23-24).

During the reign of Edward I and Edward II in the early 14th century, the arrayed infantry was ill-equipped and undisciplined. This was primarily because many of the foot soldiers were enlisted from the lower peasant class. The mounted archers of Edward III during the mid-late 14th century, in contrast, were more expensively equipped and frequently drawn from the wealthy gentry or nobility. This meant that members of this new military class had to have a highly distinctive social standing in order to serve in this more restricted military sect. In addition to these newly adopted social distinctions, economic divisions between men-at-arms and mounted archers also began to vanish. Mounted archers eventually became the norm in the army and outnumbered men-at-arms by at least three to one. Some gentry families even embraced archery symbols as their seals as popularity for these mounted warriors grew more respected (Ayton 1999: 12-16). Henry V was still adhering to these stringent standards in 1421. He continued to emphasize the importance of the mounted troops that had significantly enhanced the effectiveness of Edward III's forces. A destructive, fast-moving military plan, known as a *chevauchée*, was often employed during the Hundred Years War (1337-1453), and including entire mounted services of archers and men-at-arms. Conducting this strategy on the battlefield meant not only an effective, but flexible tactical response to enemy advance (Ayton 1999: 21). A composite of German "Gothic" armor from 1480 that was designed for both man and his warhorse can be seen in the figure below. The illustrations are compliments of <http://www2.truman.edu/~capter/jins343/medi.htm>.

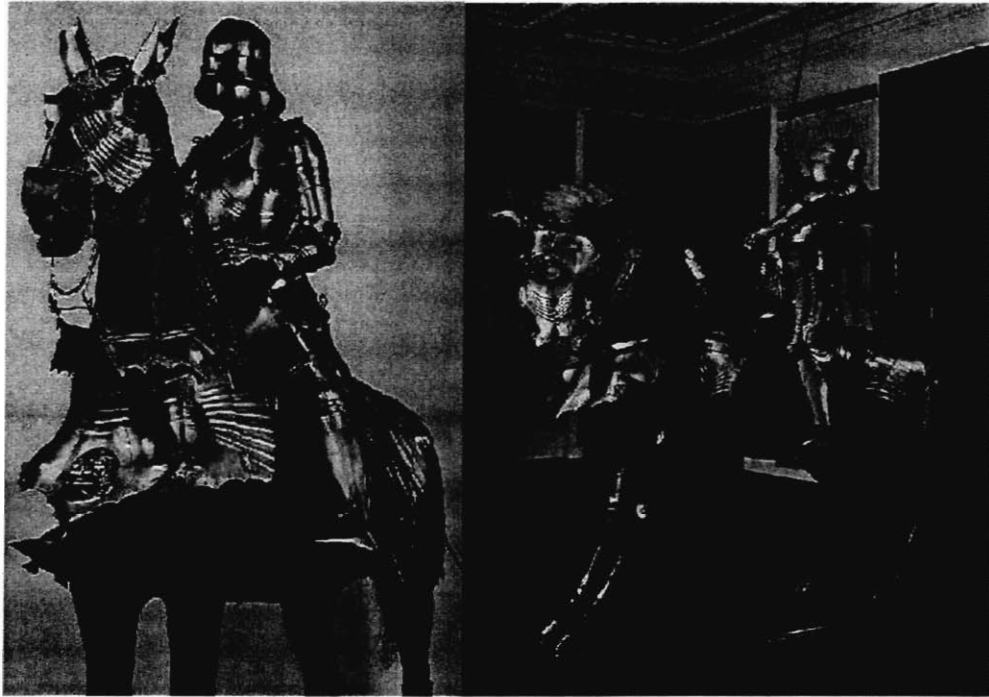


Figure 10. Medieval Horse Armor from the 15th Century

Warhorses had previously been utilized only in the closing phases of battle, primarily for hastily fleeing the field. While the role of the warhorse had been greatly underestimated prior to the 14th century, successful battlefield function now encompassed the *chevauchée* to execute raids. As the *chevauchée* became essential to successful battle prosecution, the value of a good horse was also increasing. However, the traditional warhorse—the destrier—was not suitable for the strenuous riding over rough territory. Although the destrier, or true ‘great horse’ (*magnus equus*), was highly bred for battle fare, it was also not apt for the conditions present at siege-camps and often fell victim to epidemics and disease. The arduous *chevauchée* required the qualities of stamina and mobility possessed by cheaper warhorses, rather than the stature and weight of the

destrier. Therefore, the role of the destrier soon became trivial as soldiers began sending their valuable horses back home in order to spare them from almost inevitable death during war missions. There was also an increased emphasis on naval expeditions, with many knights being called on for such seaborne operations (Ayton 1999: 22). This too contributed to the decline in the importance of the warhorse, which was no longer viewed as the pride of the English aristocracy as the Middle Ages drew to a close.

Brief History of the Renaissance

By the onset of the Renaissance (1450-1600), the horse had evolved from an instrument of war (as was seen during the Middle Ages) to an object of beauty, as well as a sporting companion for leisure activities such as hunting (Gianoli 1967:95).

In Italy, the princely families set out to develop their own breeds. They aspired to have horses that were faster and more beautiful. Soon these breeds became the glory of their respective houses and they were sent all over Italy to compete with the horses of rival princes. Horses were also the topic of conversation among the cultured. To speak of bloodlines and breeding was just as elegant as discussing books, paintings, or philosophy (Gianoli 1967:95).

In Europe during this time equestrian literature also appeared. The works of the Sicilian Giordano Ruffo, the Roman Lorenzo Risio, and others provided a rational study of the horse. These manuscripts helped quell medieval superstition. In addition to written work, painters and sculptors studied the horse as well. Through the work of artists such as

Leonardo da Vinci, it can be seen that artists paid particular attention to the anatomy of the horse (Gianoli 1967:95).

Veterinary Medicine

Veterinary medicine was first observed in the 1250s. The standard work on this subject was compiled in the reign of Constantine VII Porphyrogenitos. It was a Byzantine work called Hippiatria (Horse-Medicine). The 13th century Emperor Frederick II enlisted Jordanus Ruffus of Calabria to the task as well. Ruffus wrote *De Medicina Equorum* (On the Medicine of Horses). It was based on the observations of a veterinary surgeon. The main part of the book was concerned with diseases and wounds to the horse and the best method of treating them. His book marked a decisive advance in veterinary medicine because its use of scientific observation established a sound basis for the development of animal pathology. In the Mediterranean world, its value was recognized rapidly and remained in use throughout the remainder of the Middle Ages and the Renaissance. (Davis 1989).

School Equitation

Riding academies were in existence since the 12th century in Naples. However, the essence of equitation was then transformed into a mathematical and physiological study during the Renaissance. It was passionate and rigorous compared to the brutal and utilitarian equitation of the Middle Ages. It saw the rider and horse as a dual entity. All aspects were considered: the influence of the rider's seat, the reactions of the horse, and the balance between horse and rider (Gianoli 1967: 103-4).

Breeding

Cavalry was the essential feature of a medieval army and the knights who formed it were the essential feature of medieval society. In order to be a knight, however, one needed the right horse. The right horse was not easy to find, therefore, the business of acquiring and producing warhorses was a major industry in the Middle Ages. Breeders and dealers had to anticipate military development so that with every change of armor or tactics they could produce horses suitable for the new requirements. But by the time they caught up with a new technique, odds were it had already changed.

During the Middle Ages, the use of the horse became universal, and employment of armored cavalry gave rise to experimenting and breeding to produce horses capable of bearing enormous weight. This was the period when big, strong, powerful horses began to be bred. They were derived from the Nordic strain, which had become famous as packhorses during Roman times, and formed the basic stock in crosses that led to chargers capable of carrying as much as 650 pounds (Gianoli 1967:68, 76).

Technology

Bridles & Bits

The majority of knights used extremely long-shanked curb bits during the Middle Ages. Although the snaffle bit was used less frequently it was often seen in the Teutonic countries. The long-shanked curb bits were so harsh that a horse's jaw could be severely damaged in the heat of battle, when both rider and horse were overcome with excitement and emotion. Many warhorses likely endured injuries to jaw muscles, nerves, and bones because of these bits (Steffen 1968:31-32).

Medieval and Renaissance bridles often had an overabundance of straps. For example, instead of just a single throat latch, there would be a neck collar attached to the rig as well. Besides ear loops for both ears, there would also be a browband. Although cavessons, or nosebands, were present, there would then be another strap running from the bridle cheeks under the jaw. There was usually little reason for any of these extra fittings; most could not even be considered decoration, as they added nothing to the artistic appearance of the ensemble.

Another device, known as a windbreaker, was controlled by a second set of reins, and was used to clamp down on the outside of the nostrils. This caused a partial closure of the nostril so that the horse's air supply was discontinued until it submitted to the demands of the rider and was brought under control. This piece of equipment consisted of two flat metal pieces with slots for the passage of the noseband. The same ring on the headstall that anchored the noseband was also used to fasten the auxiliary rein. A prolonged pull on this rein then activated the windbreaker (Steffen 1968:32).

Saddles

Roman and medieval saddles both had two main features that performed the same functions. The raised fork of the pommel and the cantle kept the rider in the place despite the threat of a weapon thrust or the stops, turns and twists of a working horse.

The medieval war saddle went through a gradual process of evolution, although the basic concept did not deviate a great deal from the Roman military saddle. The two front horns were transformed into a continuously raised front portion, while the two rear horns developed in a similar manner with the addition of hip-encasing extensions. The

jousting saddle (in its exaggerated form) was designed so that the rider stood on both the stirrups and the seat. This seat was made of a rigid bar that was set at a sharp angle so that the front part was at least ten inches from the horse's withers and the back part was approximately six inches from the loin area. Use of these saddles often resulted in broken backs during the days of jousting (Hyland 1993:51).

The "Connolly" saddle is thought to be the prototype for medieval warfare and Renaissance tournament saddles that arose from slight modifications from its ancient Roman design. The front horns allow more weight to be placed behind the lance thrust than possible with a saddle pad. Also, the security offered by the horn allowed for lateral sword slashes to be more effective. This saddle underwent minor changes in the early Middle Ages so that the outward shape showed the continuous front pommel arch and cantle. The tree of the medieval saddle was crude; it was composed of two rectangular pieces of wood placed on the horse's back. In order to alleviate the pressure and prevent lesions from the saddle, a thick pad was needed due to the insufficiently contoured tree (Hyland 1994:5).

Saddles during the beginning of the Middle Ages were fairly simple, with low rolls at the pommel and cantle to ensure the knight maintained his position. Mounted warfare did not have a significant impact on battle until the middle of the 11th century, when saddle design greatly improved. Increasing the cantle height was the first improvement the saddle underwent. The cantle resembled the back of a chair so that the rider was more secure in his seat. A dismounted warrior was a disastrous event, for the heavy mail armor made it almost impossible for the knight to regain his footing. Later

saddles then went a step further by incorporating high cantles and pommels that literally wrapped around the warrior so that he remained in his saddle (Steffen 1968:51).

The saddle of the knight was designed to enable the rider to sit in a straight-leg position so that the greatest impact might be delivered with the lance. This meant that the cantle and pommel of the saddle were very high and were curved round the rider's hips to give extra support and protection. The breast band was sometimes strapped round the rear arcon, and double girths were used to support the saddle against the impact, with one of the girths sometimes passing over the top of the saddle. In the second half of the 15th century the arcons were reinforced by iron plates.

The development of heavier armor eventually led to the development of horses that were able to carry enormous weight. However, these horses also possessed a pounding gait, so there was also a need for more solid equipment. Lightweight saddles could not withstand the rigorous body movement of the rider and his opponent delivering blows with weapons (Hyland 1994:9).

Changes were gradual. Trees, for example, were to be well glued and reinforced with rivets. It was also required that they be sinewed above and below, and that the underneath should be covered so that the horse's sweat would not damage the sinews. This led to covering the tree with shredded ox sinews.

Medieval riding saddles were high and not uniform in shape. A common feature was the high front saddle bow which forced the rider to hold the reins high. In traveling and hunting saddles, the saddle bow was lower. In battle and jousting saddles, the saddle bow ran into pommels of various shapes, like a shield, protecting the uncovered parts of the rider against thrusts (Wagner 2000:65).

The cantle also served as a back rest and either followed the line of the horse's back or split down the middle in a heart shape. Battle saddles had a higher cantle with arms on each side that covered the rider's hips. The high back helped the rider remain in the saddle when attacked by a lance. These types of saddles were common during the second half of the 14th and first half of the 15th centuries. During the Renaissance, however, it was only found on jousting saddles (Wagner 2000:65).

The sides of the saddle were ornamented in addition to the cantle plates. Cantle plates were studded with nails and decorated with Gothic forms such as quatrefoils or rosettes. The saddle itself was held in place by one or two striped girths. Crupper and breast-straps kept the saddle from slipping forwards or backwards with the movement of the horse. The crupper and breast-straps were placed horizontally by a system of large and small straps. The straps and trappings were ornamental, with metal discs and tacks and complemented the color of the saddle (Wagner 2000:65).

The equitation of the Middle Ages brought about the development of the *selle à piquer*, or "spurring saddle," in France during the Renaissance. According to some authorities, the *selle à piquer* received its name because it was used by the picadors of the bullring, while others maintained that it served to fix the rider's position when he spurred his horse on, (*piquait le cheval avec l'éperon*). The *selle à piquer*, which was also known as royals or demi-royales, preserved a sort of rudimentary cantle. This saddle was built precisely to satisfy the needs of the rider of the Middle Ages-the knight-and continued to be used throughout the Renaissance period. It was designed to form a sort of cradle in which the knight was set securely in place and could better resist the shock of his adversary's lance blows during jousting tournaments. Additionally, there was also a *selle*

à piquer specifically for wild horses, buckers and unbridled jumpers in order to assure the rider's stability against the risk of being thrown off (Gianoli 1967:97).

The saddle became lighter once heavy armor was abandoned and riders sought faster, more manageable mounts. The influence of equitation brought about the revolutionary changes that occurred throughout the French cavalry. Noteworthy proof of this can be seen in the changes made to the saddle by La Guerinière, a founder of a school of equitation. La Gueriniere abolished the *battes* (batts) and *troussequins* (cantles), so that the saddle would be lighter and more accommodating to the changing needs of the horsemen who preferred to be unrestricted and free to manage his mount with precision, speed, and agility. This new close-fit saddle, known as the *selle à la française*, does not resemble the former one except for a very short and low *battes* that surmount the front arch of the saddle (Gianoli 1967:97).

These French saddles were built with the intention of facilitating the positioning of the horseman and his movements in control of his mount. On the contrary, the English saddle was designed to provide minimal burden to the horse while still allowing the maximum freedom of movement to the rider and the greatest contact with the horse (Gianoli 1967: 98).

Stirrups

In Europe, the stirrup was matched with a contoured saddle and this combination gave the horseman a decided advantage. Now secure in his seat, the rider was free to concentrate on striking the enemy. The saddle and stirrup provided the leverage to use

weapons such as the battle ax, long sword, and heavy lance. These weapons facilitated “shock combat” since they hit the target with the energy from the mass of the charging horse. Also in Europe, riders used spurs and curb bits in order to maintain control when only one hand was free for the reins (Gies & Gies 1994: 55-57).

The short seats and forward placement of the stirrups forced the rider to ride with an almost straight leg. There was no room to bend the knee. However, this position allowed the rider to deliver better thrusts with a sword and also use the forward hung stirrup as a stabilizer (Hyland 1994:7).

Stirrup leathers were long to allow the rider to brace his legs forward at full length with straight knees, his feet well home in the stirrups and his body braced against the cantle. Italian stirrups were usually of iron, in a bucket shape, to provide extra protection for the feet, the Italian armors normally having mail sabatons (Wise 1976).

Spurs

Spurs are thought to be an older technology than stirrups, used almost since man first rode horses. The earliest spurs were U-shaped pieces of metal at the back of the ankle with a short spike at the center; these were called prick spurs. During the first half of the 11th century (the late Saxon period), spurs had long, slim necks ending with tiny goad points. This style was then succeeded by the large, quadrangular goads of the second half of the 11th century, the broad base of which was intended to provide resistance in order to prevent damaging the horse. Spurs were not meant to be used as cruel punishment devices or to actually prick the horse; instead they are designed to act as aids when riding properly trained horses (Wilkinson 1978:69).

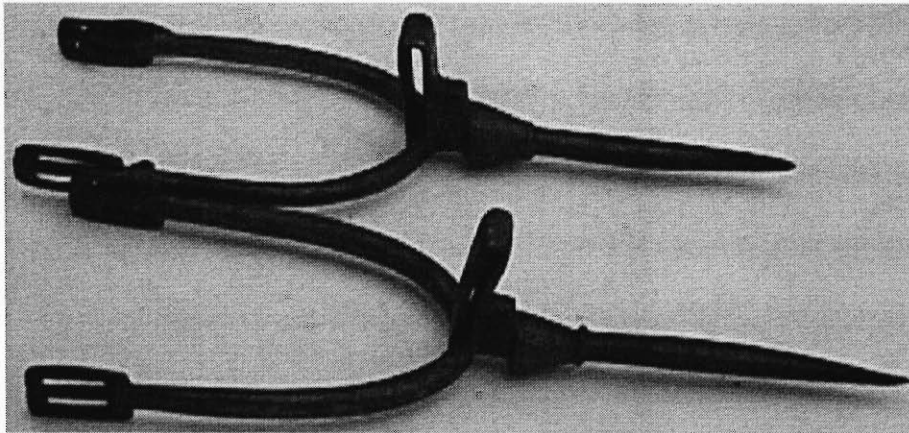


Figure 11. A Prick Spur. It is artifact HAM 681.1.

The style that was popular throughout Western Europe during the 12th century was spurs with necks formed almost entirely into large and relatively heavy quadrangular lozenge-shaped goads. Another prevalent trend which increased in popularity until the mid-13th century was spurs with slightly curved sides that were extended over the rider's ankles. This style was eventually replaced by deeply curved sides. Iron spurs were usually plated with tin to brighten their appearance and protect them from rust. Since this tin coating was generally very thin, only traces remain in excavated findings.

The earliest appearance of rowel spurs emerged during the 13th century. Although these spurs followed the same general form as the prick spurs already in use, they soon began to replace them. The rowel was a rotating, spiked wheel that was fitted, while the neck extended to reach the flanks of the horse, which was under the armor. Rowel spurs possessed riveting terminals to which the spur leathers were directly attached. Prick spurs did not possess these rivets, yet they usually outlasted the rowel spurs. The ring terminal, which was worn to the outside of the rider's foot, held an attachment for a long leather that ran down and under the rider's foot before passing up through the slot terminal on the inner side of the foot, and then across it to be buckled. Until the mid-14th century, this

arrangement remained quite popular throughout all of Western Europe. They were usually very small, slender spurs with small rowels and deeply curved sides. Prick spurs almost completely disappeared by the second quarter of the 14th century, and were even more rare throughout the remainder of the Middle Ages and the Renaissance(Clark 1995:128).

Copper-alloy began to be used in combination with iron for the varying parts of the spur because when the spurs became wet, the metals would corrode together if made of similar materials. This would have restricted the free movement of the spur, particularly the rowels. By the mid-14th century, huge rowels with many points were also becoming more fashionably. The rowels found later in this century were even larger and had even more points, until they began reducing in size throughout the 15th century (Clark 1995:129).

With the dawning of the Renaissance came a progression in spur styles, as the necks of spurs were becoming longer. This complemented the ongoing trend towards lengthening and pointing every other article of clothing or equipment that could be pointed, including the toes of boots and shoes. This development was not restricted to the wealthy knight class, for many of these large spurs were found in excavations of non-military sites as well. This is a testimony to their popularity among riders of all kinds—civilians and soldiers. This style is unlikely to have resulted from the development of horse armor, which only relatively few of the richest knights could afford. It was more of a fashion trend. These spurs also had sides that arched horizontally around the back of the rider's heel, while the front portion curved deeply under the ankle (Clark 1995:129).

Apart from these, until the mid-15th century, most spur sides continued simply to be curved, sometimes rather sharply. The sides gradually became less strongly curved after about 1450, so that by the last quarter of the century many of them were horizontal and fairly straight, although their front ends often turned upwards to the terminals (Clark 1995:130).

Although spurs were utilized for functional purposes, they also possessed a fashionably important aspect in society. Spurs were often seen as the status symbol of the horseman. For instance, gilded (covered with gold) spurs generally denoted those of the knightly aristocratic class. As part of the formal ceremony of being initiated into knighthood, a man had gilded spurs buckled to his heels. Additionally, only knights had the privilege of owning gilded spurs. Many mercenary soldiers were falsely claiming to be knights, which ignited controversy during the late 14th and early 15th centuries, because they were wearing golden spurs without ever having been knighted (Clark 1995:124).

It still remains unknown whether jousting spurs differed from military spurs. Nevertheless, it is assumed that jousting spurs were most likely very fashionable and brightly ornamented. Participants in the sport sought the crowd's favor through the brilliance of their costume, spurs included. For example, a spur in the Royal Armouries collection (London, United Kingdom), which is believed to be a jousting spur, is exceptionally fine, large, long and composed of tinned iron. Its curved sides form a pointed crest, along with a six-pointed star rowel with an elaborate buckle and attachments (Clark 1995:124).

Horse Armor

Horse armor was not widely used between the 6th and 12th centuries when mail trappers appeared. A loose cloth called a housing covered the horses that were used during the Crusades. One part covered the head of the horse and its withers or shoulders; the other covered the crupper, or hindquarters behind the saddle. If made out of mail, this equipment was called a trapper. But the weight and expense of this equipment limited its practicality. A saddlecloth with slots was used sparingly in the 12th century. The leather or iron armor placed on the horse's head was termed testiers or shaffrons. The Crusader horses were thought to have worn a curb bit while earlier horses had only used a snaffle (Robards 1997:98).

Examples of horse caparisons, a decorative cover placed over a saddle or harness, may be seen as early as the end of the 12th century. These coverings were divided into two parts that met at the saddle. They were of cloth, being full and loose, and reached down to the horse's fetlocks. Most covered the horse's head as well as its body, although some ended behind the horse's ears. The purpose of these coverings is now uncertain but it is believed that they were designed to prevent light infantry from hamstringing the horses with their long knives and the spearmen from galling the horses with their spears.

Caparisons seemed to burden the horse, and had a tendency to hamper its ability to turn and run. Despite this, knights continued to outfit their steeds in multiply yards of this richly decorated cloth that had heavy folds which wrapped around the horse's legs and impeded movement. Some had hoods that covered all of the horse's head except for the muzzle, with openings only for the eyes. Even the tail of the horse was covered. The cloth used was of substantial weight and weave in order to withstand the rigors of

combat. Caparisons were also heavily decorated with embroidered designs and motifs symbolic of the rider's identity (Steffen 1968:52).

By the first quarter of the 13th century the fabric was being reinforced with plates of horn or metal. Leather and quilted caparisons were also in use, and about the same date there is the first reference to horse armor of iron, probably the shaffron, or head-plate, which was coming into general use. The shaffron might cover the entire head or just be a plate on the face. Some had spikes protruding from the forehead or holes to place the plumes.

Mail caparisons appeared in the mid 13th century. These were also divided in two parts like their predecessors, but the front part was shortened to knee level because of the excessive weight. However, these were rare because of weight and cost, and leather or quilting remained the most common material. By the 14th century there is mention of the peytral, or breastplate, being made of iron, cuir bouilli (a lighter metal version otherwise similar to iron) or hardened leather.

Leather and quilted caparisons remained in common use during the 14th century. Sometimes they were reinforced by a shaffron, with a spike projecting from the forehead, and a laminated neckpiece of plate or mail known as a crinet, covering the neck. Horses also wore a peytral on the chest, flanchards, or two plates hanging from the saddle, and a crupper to guard the rear of the horse. The crinet was originally only a crest for the horse but then developed to cover the whole neck. Some of the textile caparisons now finished just above the horse's shoulders, leaving the head and neck to be protected by the plate of armor. Most heavy cavalry wore only a open-faced helmet, a shot-proof breastplate, a

back plate, and sometimes a bridle gauntlet, which covered the left arm up to the elbow(Wilkinson 1978:78).

The textile caparison gradually went out of use towards the end of the century and the pieces of plate armor took over, although these pieces were often *cuir bouilli* instead of iron in the interests of lightness. During the first half of the 15th century, the horses' furnishings were influenced by the increasing use of plate armor. After about 1450, in addition to the shaffron, crinet, and peytral, plates began to be fitted to the saddle to protect the flanks of the horse (flanchards) and along the horse's back (the crupper). The crupper sometimes had a spike on it to prevent light infantry jumping up behind the knight (Wise 1976).

Steel horse armor that completely clad a horse first appeared around 1450. Owning a horse was a large investment, as well as a significant status symbol. Therefore, a knight understandable took great pains to protect his horse in battle. Harming the horse of an opponent was considered an unchivalrous act because the horse was considered a valuable trophy that was meant to be captured, not destroyed. If a horse was purposefully harmed during a tournament, the knight was instantly disqualification. However, knights in battle often discovered that their steeds were vulnerable to foes such as archers. Archers usually did not feel compelled to obey the code of chivalry since a warhorse was of little practical value to them. With the 13th century came the emergence of horse trappings, which were used mainly as protection from missiles and arrows. Horse trappings were originally made of fabric, and later of mail. This development paralleled the armor designed for knights. Solid elements of armor were gradually introduced during the 15th century. These included shaffrons to protect the face of the horse, crinets

for protecting the neck, peytrals for the front chest, cruppers for the rear, and flanchard side protection. Many of these early armor elements were often made of hard-boiled leather instead of steel plates.

New tactics developed that emphasized a more lightly armed cavalry over traditional heavy cavalry. The amount of armor worn was reduced between 1550 and 1600, until it became completely discontinued (Grendler 1999). A German fluted “Maximilian” style armor for man and horse from 1520 that is on display in the Tower of London Armouries (left) can be seen in the figure below. The armor for man and horse from 1548 was made by Kunz Lochner of Neremberg, Germany (center). One of five complete horse armors for both man and horse are located in the Metropolitan Museum of Art in New York, NY. This particular set is from Italy around 1575 (right). The illustrations are compliments of <http://www2.truman.edu/~capter/jins343/medi.htm>.

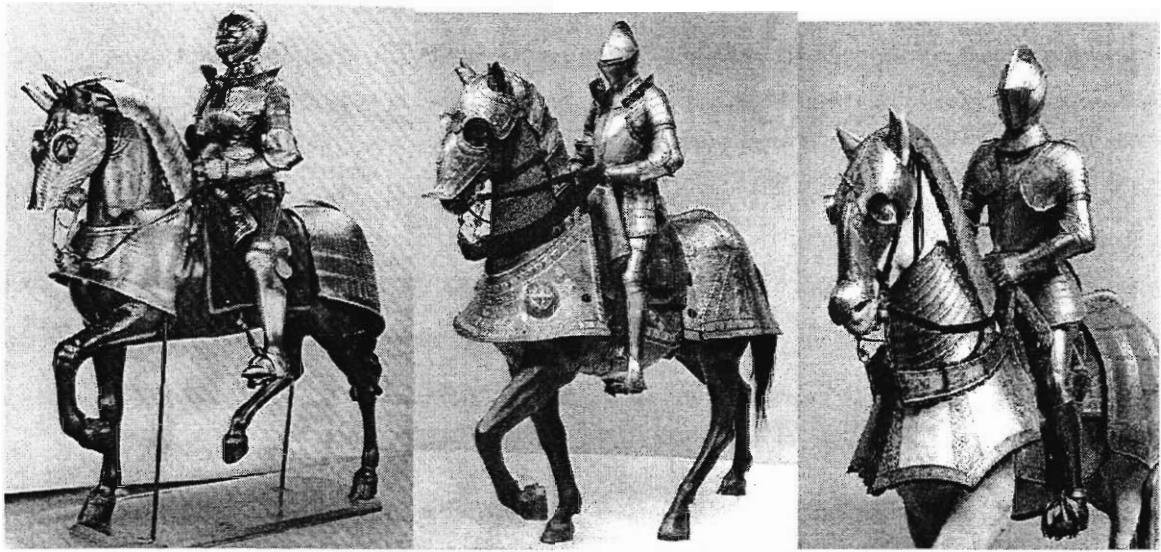


Figure 12. Renaissance Horse Armor from the 16th Century

The Orient & the Near East

The Mongols, the Khans of Persia, Mamluks of the Middle East, and Ottomans all had equestrian backgrounds. Equitation was an integral part of a Mamluk's training. The most important skill was to learn to ride a horse instinctively so that a rider could maneuver weapons efficiently and be able to place the horse to advantage in a mass charge or hand-to-hand combat. A rider first had to learn how to mount with and without a saddle and military equipment. The rider then learned how to ride a horse with only a horse-cloth called a *jull*. There were several types of saddles, one being lightweight and shallow because it was used on younger horses. The other, being the preferred version, was the *Naceri* saddle because of its pommel, cantle, and shallow seat design. It was easy to get into and out of and, in addition, allowed the rider to lean back in order to avoid an incoming weapon. It also gave more flexibility to the rider's movements when delivering a blow (Hyland 1994: 124).

The horse was largely distributed throughout Asia Minor through the influence of the Persians. Although the Romans occasionally were victorious against the Persians, Persia never fell captive to them. Despite failing to conquer Persia, Rome still adopted many of its equestrian customs from this empire. Persia was particularly known for their use of heavy cavalry, even though they also possessed one of the top-notch light cavalry mounts for archers (Hyland 1994:3).

Battle chargers were the usual mounts at the height of the middle ages throughout the Orient, especially the Islamic sphere. In addition to speed, these horses possessed sharp reflexes and were quick to react to dangerous situations. They were also powerful enough to carry a horseman in heavy armor. Therefore, stallions were considered to be

valuable ‘military equipment’. Although stallions were used frequently in heavy front-line cavalry, mares and geldings were also used in Islamic culture (Ohler 1989: 16).

Chinese art glorified the horse, especially those in battle. Chinese warhorses were then adopted by Korea and Japan. Respect for the horse, along with its ever increasing value, was oftentimes fought over in order to improve imperial studs or to simply confirm its earned status as a coveted charger. The Turks, Huns, and Mongols considered a horse such a vital element to their success and survival that warriors were buried with their horses. Similar to their role in other countries, the horse continued to be seen as a symbol of prestige (Gordon-Watson 1999:21). The Moghuls also cultivated a rich equine tradition. Much of their equestrian equipment did not undergo significant changes over the centuries.

Technology

Saddles

There were two basic types of saddles used by the Moghuls. The *khogeer* dates to the end of the rule of the Moghul leader Akbar. The saddle was a thick, felt pad with the front section split and raised, allowing protection for the rider’s knees. The pad also had loops for attaching a breast collar. The girth was secured to a buckle, fixed into a knot, and then run over the saddle. A variation of this style was two separate felt pads attached by strong straps over the spine, the whole unit over a felt pad, the *aragheer*, which absorbed sweat and kept the back safe. There were a number of additions such as a shaped cantle, pommel or seat. Large circular flaps that offered protection for the rider’s legs against sweat, as well as barrel protection for the horse against friction from the

armor on the rider's legs was also offered. The girths were made of soft folded cloth or deerskin. Sometimes, a *charjama*, or shaped broadcloth, was used over or under the *khogeer*. The wealthy used elaborate saddles with circular saddle flaps on rigid trees. These saddles were able to handle fully armored riders because of their ability to disperse the weight efficiently over the horse's back without applying any pressure on the horse's spine (Hyland 1994:175).

From Asiatic sources, there has stemmed significant and sophisticated innovations in saddlery. Chinese art, particularly those specimens which have survived from the T'ang dynasty (618-906 A.D.), provides clear representation of this. A 7th century tapestry displays a saddle with a front arch clear of the withers that conforms to the horse's back, and a cantle encasement to provide a seat for the rider. Another example, dating to 706 A.D., a statuette from the tomb of Princess Yung T'ai, in which the horse's equipment is depicted with stirrups. The raised, slightly flaring saddle bow is protecting the rider's thighs, while the cantle encases both the hips and the upper legs of the rider in order to secure the seat. The later European saddle shadowed this design—complete upper leg protection was incorporated with the presence of a front arch, while security against the being thrown out of the saddle was offered with a cantle that extended laterally upwards to cover the hips (Hyland 1994:7).

The illustrated texts of the Moors and Persians demonstrated that the oriental cultures rode in a more balanced position that allowed the leg to absorb some of the shock inflicted from a weapon thrust. While the Orientals rode short with a bent knee, the Europeans rode stiff-legged, thus locking themselves rigidly in the saddle. No muscle or back movement of the horse was able to be felt in a western saddle because it was raised

so high off the horse's back. An eastern saddle, in contrast, allowed more refinement in horsemanship because better interaction between horse and rider was facilitated by placing the saddle closer to the horse's body (Hyland 1994:8).

Bits

The bits used by the Moghuls were either snaffle or curb, though in many varieties. Snaffle bits could be plain rings, jointed with burred cannons, unjointed with a squared mouthpiece, and unjointed with movable spikes called *choukra*. Curb bits could be joined with a jagged-edge mouthpiece or they could have a single mouthpiece with port with a jagged upper edge. Most of the bits had single reins stitched together. The looped section could be slipped over the pommel in order to free the rider's hands. Archers usually used the thin thong attached to one finger and linking it to the reins, allowing the archer to have some control even when busy with the bow. Some bits had double reins and most were severe. Other equipment included a quilt or *artak*, a *yalposh* or mane cover, saddle-cloth, leg-ropes, and headstall (Hyland 1994:175).

Stirrups

The stirrups used today are most likely descendants of those invented in China around the 4th century A.D. This technology, like so many others, was brought from China to Europe, where it was valued for its assistance in mounting a horse. Stirrups were triangular or arched and could have wide treads (Hyland 1994:175).

Horse Armor

Horse armor was constructed from a variety of materials. It could have been a multi-layer hide, a combination of mail and plate, mail trappers, quilted materials, or metal studded fabric. The horse armor for the horse of an army commander consisted of a quilted trapper, mail caparison, metal shaffron and a crinet. Caparisons could be richly embroidered or set with jewels. Some of the shaffrons were animal masks though the functional parts were made of quilted fabric and reinforced by leather and metal (Hyland 1994:177-178).

Equestrian Sports & Amusements

In addition to providing a vital means of transportation throughout military and civilian life, a vast array of recreational activities also emerged because of the horse. This allowed for some leisurely enjoyment when off the battlefield or the farmland.

Polo (Gianoli 1967:343-344)

According to legend, the game derives from the Tibetan custom of hunting a species of muskrat in the fall. The animal was pursued on horseback, harassed to keep it from returning to its hole, and chased until it succumbed from exhaustion and the blows of the hunter's clubs. During the summer when these animals had migrated to the safety of inaccessible regions, the hunters diverted themselves in mock hunts in which they pursued a ball fashioned from a round root (*pulu*) or goathide. Tibet would therefore appear to be the birthplace of polo according to this story.

Polo was widely known in the 4th century B.C., as evidenced by a gift from Darius III to Alexander the Great. Prior to Alexander's invasion of Persia, Darius sent him a ball and mallet with an invitation to play a game more appropriate for his age. Alexander thanked Darius for the gift, but explained that as far as he was concerned, the ball represented the earth, and he had no intention of letting the mallet slip from his hand (Alexander then went on to defeat Darius in 333 B.C.).

During the 4th century B.C., polo was played with from fifty to a hundred men, and invariably ended in a free-for-all, if not an outright battle. There is a wealth of evidence in literature, sculpture, and ceramic art that polo was popular in China, Turkestan, and of course Persia, and had spread as far east as Japan, down to Egypt, west

to Constantinople, but no further until its English discovery in India during the 19th century.

Polo requires a rider to have complete mastery of his horse, a very light hand, and great dexterity with the mallet; all this aside from the tactics and strategy he must learn through experience. The ball, a moving object, must be hit to a determined point while he controls and directs his horse, all the while defending himself, his mount, and the ball from the opposing player who is attempting to recover the ball and play it in the opposing direction. The horse is unrestrained and left to move freely whenever maximum speed is required, but is then tightly controlled whenever there is a change of direction or halt to be made. Accordingly, the bit for a polo pony must be fairly hard and unyielding, which means that it should be employed with a great deal of delicacy and sensitivity, especially at the moment the player is about to hit the ball.

As previously mentioned, the horse used for polo, invariably called a pony, must have the courage to propel forward at full speed against an opposing team and prepare himself to sustain the shock of physical encounter. The pony must be flexible and completely responsive so that he can pursue the ball, pull up short, thrust to the left or the right, take off without hesitation, and have the intelligence to grasp the game to the point where he almost instinctively moves or anticipates his rider to command him to do so.

Hunting (Gianoli 1967:350-356)

Ancient Times

The Egyptians hunted every sort of animal by chasing them on horseback or in light carts. They even drove or flushed them with the help of dogs, sometimes in packs,

such as the Ethiopian greyhound (resembles the foxhound). The Assyrians considered the saddle horse indispensable. Together with the Babylonians, they hunted on accomplished horses or pursued game in their famous, solidly built carts. They used alans (a dog breed similar to a heavy mastiff that originated from an ancient French tribal unit) for chasing onagers and deer, and molossians (a dog breed similar to a heavy mastiff that was native to ancient Greece and also used in ancient Rome) for attacking lions and leopards.

The Greeks also used horses for the chase, and went armed with lances, and very occasionally, bows and arrows. They considered the use of nighttime traps and nets vile and detestable, and disdained to employ them because according to Plato, a man should defeat a beast through courage and skill. The people of Thessaly fought the wild bulls of the plains from horseback while the Macedonians fox-hunted. Famous emperors such as Alexander the Great, Hadrian, and Trajan amongst others, were all passionate hunters and excellent horsemen.

The Middle Ages & The Renaissance

A significant portion of time was spent on horseback during the Middle Ages and the Renaissance. Accordingly, it follows that their principal outdoor recreation was their passion for hunting on horseback. When not engaged in war, the hunt was certainly the most appropriate pastime for a knight because it undoubtedly possessed military overtones. This sport was not without risk, especially when hunting boar, and also proved to be an exhilarating and aggressive test of one's endurance, horsemanship and skillful targeting. Bonds of comradeship were forged during hunting expeditions, which served

as useful ties that could be extended into the political and war areas as well (Ayton 1999:33).

Hunting, particularly of hawks, was also a mark of distinction among royalty, as well as gentlemen in general. This sport could not have sustained its long legacy within the use of the horse. The proceeds from excise, barratry, and prostitution were applied in great part to maintaining hunting, including all the expenses of keeping hounds, game wardens, and horses reserved for the sport. For the maintenance of these hounds and horses, every citizen, whether cleric or layman, was paid a small indemnity, though subject to fines and even imprisonment or death by gibbet if the animals, which were periodically inspected, were thought to be underfed, sick, or mistreated. Another outstanding form of hunt that emerged was stag hunting.

The chase continued to interest the rulers of England, France, Germany, and the Eastern empires, as well as the Crusaders, who upon their return to Europe brought back Moorish hunting customs and a taste for Arabian horses. The Roman countryside has been a great place for hunting ever since the 8th century when the restoration of the order of Rome and its surrounding areas took place. Hunters even included prestigious religious leaders such as popes, cardinals, and abbots.

The Circus (Gianoli 1967:363)

It was not until the middle of the 18th century that the circus as it is known today began to evolve, with a well-schooled, richly caparisoned horse as the main attraction. However, the early Panathenaic games (held during 446/5 B.C.) on horseback bore some resemblance to the Circus Maximus (where equestrian events had found their place

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for the men who were experienced in war to display the mounted combat skills that they had acquired during fighting. Contests often proved fatal, and during the 1340s, the *mêlées*-style tournament was disappearing and being replaced by jousting (Ayton 1999:35-36).

By the 14th century, special armor was designed for tournaments. Horses wore plate-armor shaffrons, or head pieces, that sometimes covered the horse's sight so that the horse would not be startled. In German tournaments, horses wore *stechsacks*, or padded neck and chest defenses against lance blows. Tournament saddles did not have the high cantles found in the saddles used in real combat. One German saddle placed a knight almost a foot above the horse's back. Two curved wooden bars supported the rear of the knight's thighs, keeping him upright. The front of the saddle rested behind the horse's withers and protected the front of the knight's legs (Robards 1997:129).

During the Renaissance the emphasis in tournaments had shifted to more sporting, social, and festive concerns. Tournaments involved a wide variety of well-regulated forms of combat, each which generally required a different type of specialized armor. Tournaments involved contests on horseback fought with lances (Grendler 1999).

CONCLUSION

The Early Equestrian Technology IQP is a comprehensive study of the evolution and development of horse equipment throughout the ages. This project was completed in conjunction with the Higgins Armory Museum. Artifacts were photographed and cataloged as they related to horses and riding. The emergence of the horse as a novel means of warfare was documented from ancient civilizations through the Middle Ages and finally into the Renaissance. Additionally, the role of the horse throughout the Orient and the Near East was documented as well. An adequate amount of background information is also provided within the text to assist the reader in placing the artifacts in the proper historical and cultural context. The research is available in web format for viewing and educational purposes.

Time was the biggest restraint in the completion of this project. The museum's library provides a substantial source of information regarding equestrian technology. However, because the museum has limited hours, it was difficult to arrange schedules that coincided, as museum hours often conflicted with the team's class hours. Obstacles were also encountered in terms of research availability—material on the Renaissance period was not nearly as abundant as material on the Middle Ages.

The breadth of this project incorporated many aspects that went beyond simply horse armor and equipment. For example, the anatomy, physiology, and psychology of the horse were included to provide the reader with a more thorough understanding of the horse and its mechanics. The team had no previous knowledge or experience working with horses, so the latter sections also helped them to gain a deeper appreciation of this magnificent animal.

Glossary

Biga -Greek war chariot, has a closed box in front, two wheels, and a panel that is highest in the front

Cantle- back part of saddle

Cataphract- heavy armored trooper whose horse may also be armored

Cavalry- troops that fight on horseback or in armored vehicles

Chariot- an ancient vehicle used in battle, races, and processions, horse drawn and two wheeled

Chevauchee- a destructive, fast-moving military plan

Curb- a type of bit that acts on the mouth, chin groove, and poll

Cursarius- the best heavy hunting horses because of their speed, strength, and stamina

Destier- the “great horse”

Ephippium- saddle pads

Gilt- iron or bronze

Girth- fabric, perhaps leather, that goes around the horse’s body to secure the saddle

“Great Horse”- A powerfully built and more expensive horse from the 14th century that has a stature of 15-18 hands in height

Gyrus- Roman training ring

Hackamore- A bitless bridle that works by nasal control

Hand- method used to measure horses,

Hippika- Gymnasia mounted exercises used as training strategy for the Roman cavalry

Hock- knee level

Knights- professional soliders

Martingale- leather strap from noseband to girth to prevent a horse from throwing his head back

Phalerae- discs with integral attachments on their underside for fastening individual leather pieces together

Pommel- front part of the saddle

Psalion- a hackamore

Selle a piquer- a spurring saddle

Shabracque- adorned cloth used to make parade saddle pads

Shaffron- protective head armor for the horse

Snaffle- a bit that uses a single rein, acts on the tongue and the bars or the lips and mouth

Spatha- a long, slashing cavalry sword

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