The Mysteries of Self-Carriage

You know what it is. But how do horses achieve it?

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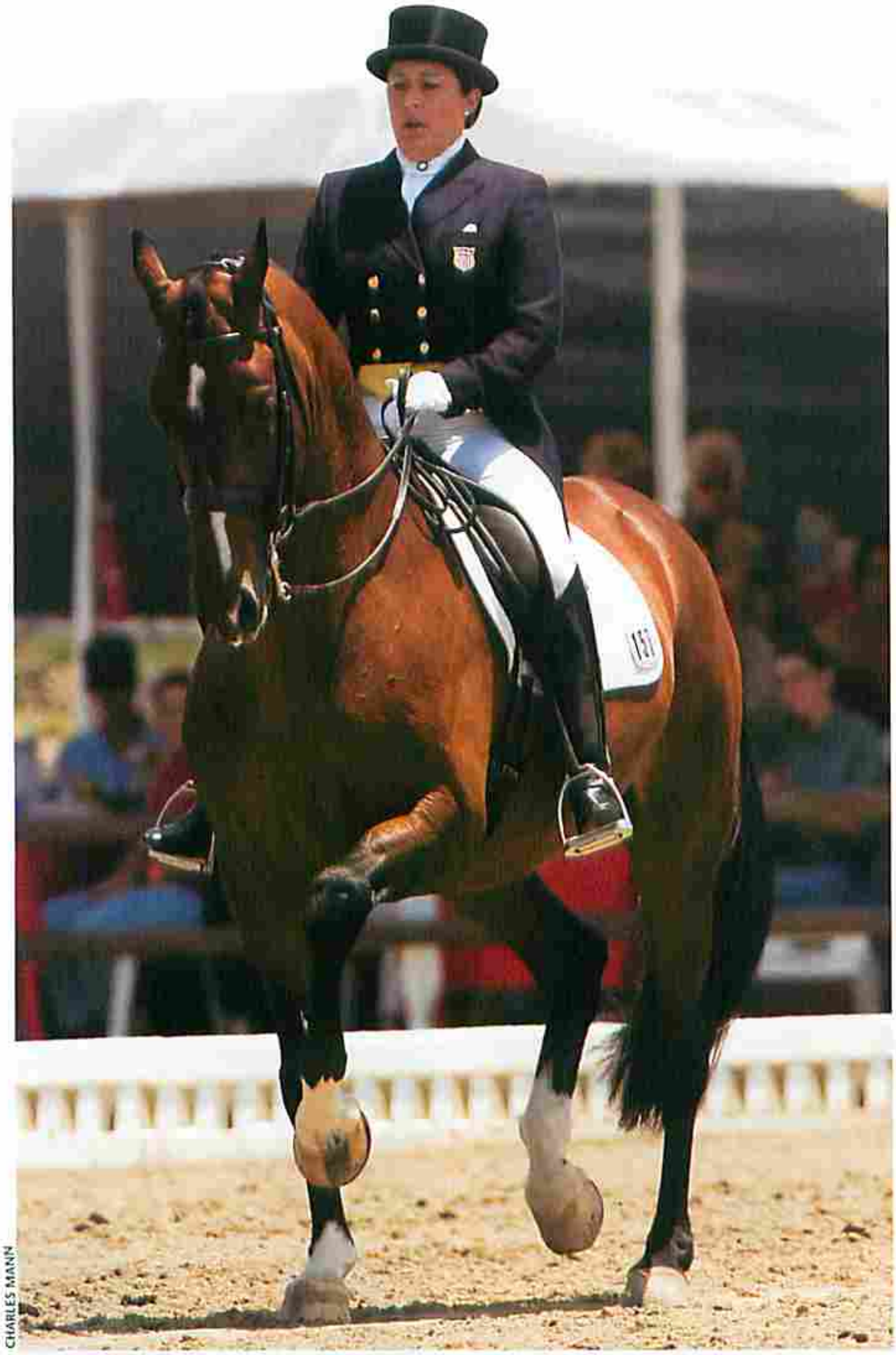
ILLUSTRATIONS COURTESY OF THE McPHAIL EQUINE PERFORMANCE CENTER


CHARLES MANN

Lightness and ease: Hallmarks of self-carriage, as shown here in passage by Shelly Francis on Jasper at the 2004 U.S. Olympic dressage selection trials

SELF-CARRIAGE IS ONE OF THE ULtimate goals of dressage training. Riders and trainers recognize the look and feel of self-carriage: the elevation of the forehand, the lowering of the haunches, and the lightness and ease of the movements. However, the mechanics of how a horse achieves self-carriage have not been adequately explained in the equestrian and veterinary literature. One of the questions we are addressing in our research in the McPhail Center relates to how the horse changes his body mechanics to be able to carry himself forward in lightness and self-carriage.

In order to understand the mechanics of self-carriage, our research is looking at aspects of conformation and weight distribution as well as of the effects of training on the horse's movement patterns.

Conformation

Horses are born with different types of conformation, and this affects the ease with which the forehand can be lightened. From practical experience, we know that horses with "uphill" conformation—with their withers higher than their croups—are usually easier to train for dressage than horses that are croup-high.

The relative heights of the withers and croup are determined by a number of factors, primarily the lengths of the individual bones of the limb and the angles between them. For example, a post-legged horse has very little angulation between adjacent bones, making his croup higher than that of a horse with bones of the same length but with more angulation between them.

When a horse moves, he lowers his croup by increasing the angulation of his joints so that his hind limbs become more compressed. At the same time, he lengthens his front limbs by maintaining a large angulation of the joints, thereby holding his withers in a more elevated position.

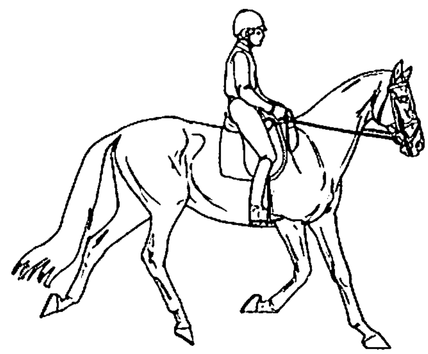
Weight Distribution

The average horse carries 58 percent of his weight over his front limbs and only 42 percent over his hind limbs. So horses are, by nature, front-heavy. As a horse becomes more collected, his center of gravity shifts rearward slightly. However, this shift is not great enough to equalize the weight distribution between the front and hind limbs.

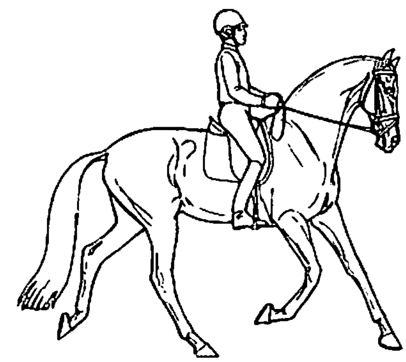
Furthermore, the "weight" on the limbs also reflects the effect of the muscles that generate propulsion by pushing against the ground. The muscles in the front limbs must push hard against the ground to maintain the elevation of the forehand, while those in the hind limbs control flexion of the joints to allow the sinking of the croup. Therefore, we would expect to record higher forces in the front limbs in collected gaits than in working gaits as a result of their important role in elevating the forehand. At the same time, higher forces are recorded in the hind limbs because they are carrying slightly more of the horse's weight.

Training

An untrained horse moves quite differently from a trained horse. Many untrained horses travel "on the forehand," with their withers relatively low and their forehands rolling forward over their grounded front limbs in every stride. A dressage horse is trained to lower his croup by compressing the joints of his hind limbs and, at the same



On the forehand: The horse moves "downhill," with his withers sinking between the scapulae



"Uphill" movement: The horse's withers are elevated between his front limbs. As a result, his hind hoof contacts the ground before his diagonal front hoof.

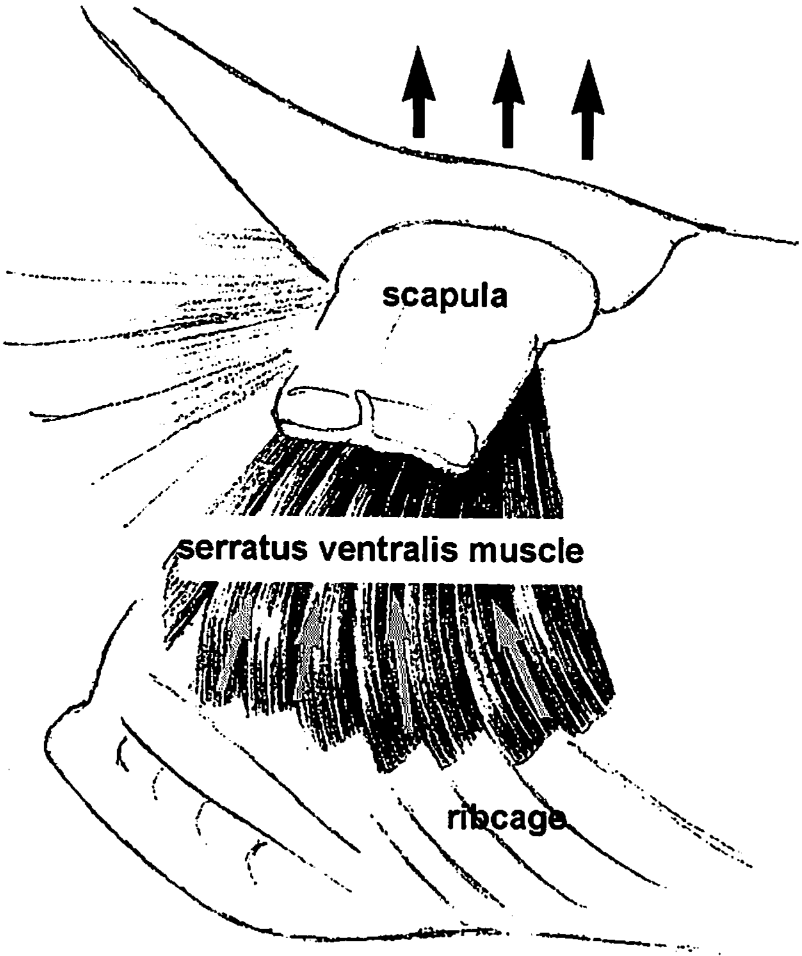
time, to elevate his forehand by pushing upward through his shoulders. The result is an uphill carriage that gives the impression of loading the hindquarters and lightening the forehand. To compare the outline of a horse on his forehand with that of one moving in self-carriage, see the illustrations above.

Role of the Muscles

Self-carriage is achieved through controlled tension in appropriate muscle groups. You may have heard of the "muscle ring": the circular group of muscles that control longitudinal suppleness and roundness of the vertebral column through the horse's back and neck. Tension in the abdominal and sublumbar muscles maintains the roundness of the back. The abdominal muscles encase the abdomen from pelvis to ribcage and sternum, and contain the viscera within the abdomen. Contraction of these muscles increases pressure within the abdomen to "stiffen" the trunk and to assist in flexing, bending, and rotating the thoracolumbar region. The sublumbar muscles are located directly beneath the lumbar vertebrae, running from the underside of the vertebrae to the pelvis and femur. When these muscles contract, they also contribute to the roundness of the back and to engagement of the hind limbs.

The importance of the abdominal and sublumbar muscles is well recognized. Less well understood is the significant role played by the muscles in the upper part of the front limbs, which attach those limbs to the body. Tension in these muscles controls the height of the withers by suspending the trunk between the horse's shoulder blades.

A major anatomical difference between horses and humans is that the



The front limb has been removed for the purposes of this illustration, leaving only the upper part of the scapula (shoulder blade), to show the attachments of the thoracic part of the *serratus ventralis* muscle to the inner side of the scapula and to the ribs. Contraction of this muscle raises the ribcage (gray arrows), which lifts the withers between the scapulae (black arrows).

horse lacks a clavicle (collarbone). Your clavicle forms part of your shoulder girdle, which attaches your arms to your body. Without a clavicle, the horse has no bony connection between his front limbs and his trunk. Instead, strong muscles connect the inside of his shoulder blades to his rib cage and act like a sling to suspend his thorax between his two front limbs. Muscles that play a major role in this process include the *serratus ventralis* (see illustration above) and the pectoral muscles. These muscles are referred to collectively as the "sling muscles."

When these sling muscles contract, the trunk and the withers are pulled upward between the horse's shoulder blades, thus elevating the trunk and the withers relative to the croup. When the sling muscles relax, the withers sink between the shoulder blades, elevation of the forehand is lost, and the horse appears "down in the withers." One of the goals of dressage training is to teach the horse to use his sling muscles to raise his withers and to maintain this raised position throughout the stride.

Tone in the sling muscles increases with correct training. As a result, some horses grow a little taller at the withers in the first few months after starting work under saddle, as the sling muscles become stronger. Conversely, if a horse is laid up for a long period, the sling muscles tend to lose their strength and the horse may shrink a little.

Locomotion

The sling muscles are particularly important in those gaits with an aerial phase: trot, canter, and passage. In these gaits, the horse bounces off the ground into a moment of suspension, during which all four limbs are airborne. His body is highest in the middle of the aerial phase, after which it descends. In the diagonal stance phase that follows, the downward motion of the trunk must be slowed and then reversed, causing the horse to rise into the next aerial phase. The limb muscles act as springs: They absorb concussion as the horse's body descends, then rebound to bounce him off the ground into the next aerial phase. The sling muscles "catch" the trunk, slowing its downward motion, then reverse the direction of movement and generate upward propulsion.

As training progresses, the sling muscles become stronger. They can hold the horse's withers higher throughout the stance phase, especially during those stance phases when his trunk would normally sink between his shoulders. This phenomenon is an important component of the mechanics of self-carriage. In association with the stronger action of the sling muscles, there is a change in the way the front limbs push against the ground. An untrained horse's hooves remain grounded as his body weight rolls forward over his limbs, with both the front and the hind limbs contributing to providing forward propulsion. In contrast, the well-trained horse gains most of his forward propulsion from the hind limbs. The front limbs act as propulsive struts to push his forehand upward, rather like a pole vaulter's pole. Instead of pushing the horse forward, the thrust from the front limbs is directed upward to elevate the forehand, thereby pulling the front limb off the ground soon after it passes the vertical position. Acting in cooperation with the sling muscles, the muscles of the front limbs ensure that the forehand stays elevated throughout the stride.

Riding for Self-Carriage

It is easy to feel the elevation of the forehand when you ride a horse that is in self-carriage. By giving a half-halt early in the stance phase, before the horse's trunk sinks to its lowest point between his shoulders, you facilitate the uphill orientation of his trunk, which in turn encourages him to compress the joints of his hind limbs and to maintain his elevation in front.

In the trot, the horse's body is lowest in the middle of the diagonal stance phase, so the half-halt should be given soon after the diagonal limb pair contacts the ground, not during the middle or later part of the stance phase, when it would tend to put him on the forehand.

In the canter, the lowest point in the stride is during the diagonal stance phase. The half-halt should coincide with the touching down of the diagonal limb pair, which is the second beat of the stride. A half-halt given at this time encourages the horse to push backward and upward with his front limbs and to maintain tension in his sling muscles. This combination of actions keeps his withers lifted and discourages him from rolling over his forehand.

A horse moving in self-carriage gives the appearance that his front limbs are moving in front of his body. In the collected trot, his front hooves leave the ground soon after his limbs pass the vertical position. In the collected canter, the limb to watch is the leading front limb, which lifts off just after it passes the vertical position.

A consequence of the elevation of the forehand is that diagonal dissociation increases, meaning that the hind hoof contacts the ground before the diagonal front hoof. When a horse's forehand is elevated, his front hoof does not reach the ground until the joints of his diagonal hind limb have been compressed. This dissociation is evident in the illustration on page 15 of the horse in self-carriage.

In the past, the role of the horse's front limbs in self-carriage has not always been fully appreciated or described. The McPhail Center's findings are not intended to imply that the hind limbs are not also very important in establishing self-carriage. The joints of the hind limbs play a crucial role by compressing to lower the haunches during weight-bearing, which increases the relative elevation of the forehand. It is the combination of front- and hind-limb actions that ultimately results in the highest level of collection. ▲

MEET THE EXPERT

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