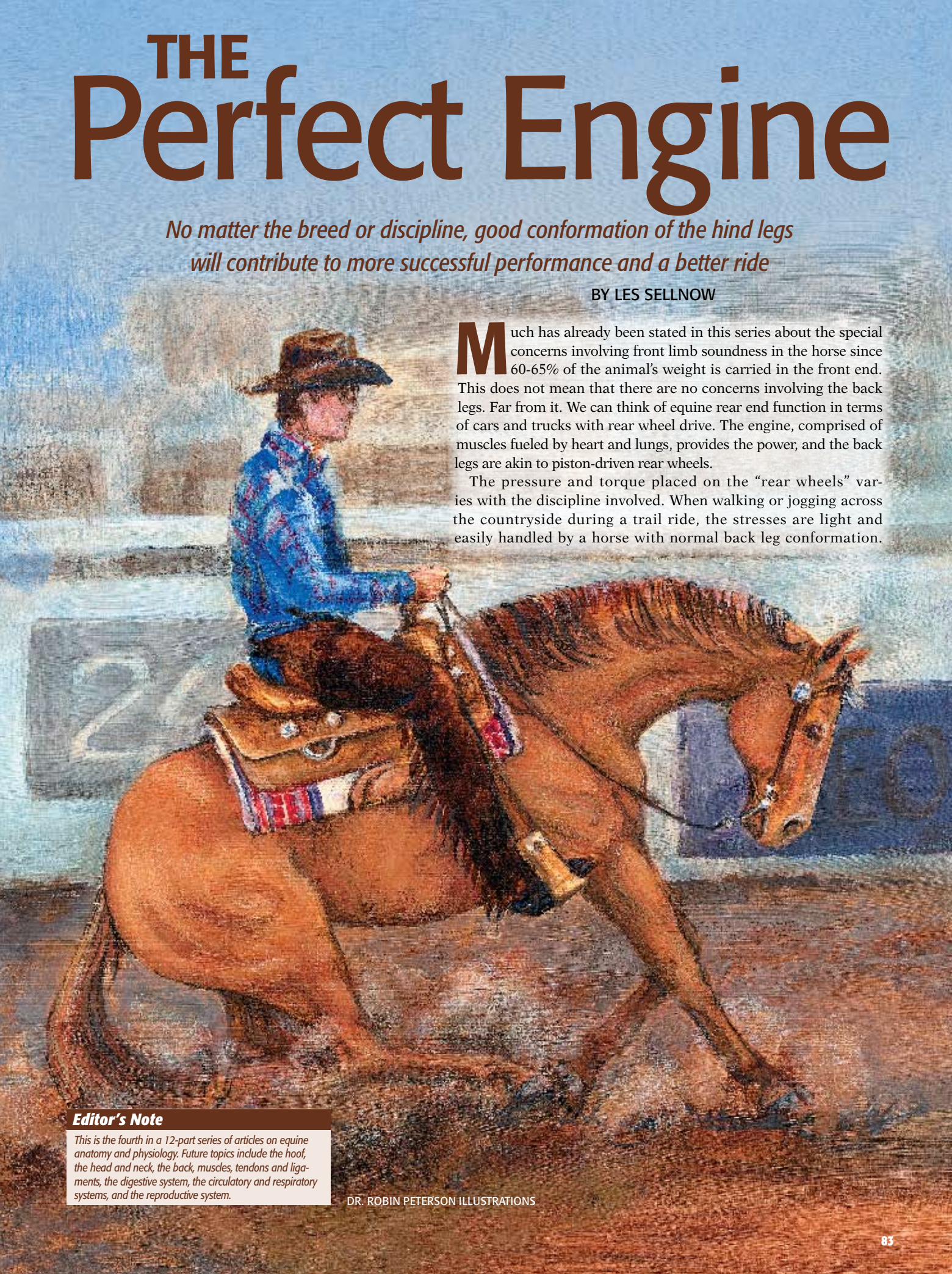
THE Perfect Engine

No matter the breed or discipline, good conformation of the hind legs will contribute to more successful performance and a better ride

BY LES SELLNOW

Much has already been stated in this series about the special concerns involving front limb soundness in the horse since 60-65% of the animal's weight is carried in the front end. This does not mean that there are no concerns involving the back legs. Far from it. We can think of equine rear end function in terms of cars and trucks with rear wheel drive. The engine, comprised of muscles fueled by heart and lungs, provides the power, and the back legs are akin to piston-driven rear wheels.

The pressure and torque placed on the "rear wheels" varies with the discipline involved. When walking or jogging across the countryside during a trail ride, the stresses are light and easily handled by a horse with normal back leg conformation.



Editor's Note

This is the fourth in a 12-part series of articles on equine anatomy and physiology. Future topics include the hoof, the head and neck, the back, muscles, tendons and ligaments, the digestive system, the circulatory and respiratory systems, and the reproductive system.

DR. ROBIN PETERSON ILLUSTRATIONS

However, if the discipline happens to be cutting or reining with the Western horse or dressage or five-gaited action with the show horse, it is an entirely different matter. Although different in nature, these four disciplines all put high demands on the horse's rear end.

It should also be remembered that, in addition to being the prime source of propulsion, the back legs also serve as the horse's brakes. Again, the stress put on those brakes varies with the discipline. It is vastly different, for example, in a reining horse than it is for one competing in dressage.

We'll take a look at how Nature has designed the rear portion of the horse's anatomy, especially the leg, in to understand why the animal can do what it does. We also will take a look at some of the problems that can develop in improperly conformed legs as a result of these stresses.

An excellent source on equine anatomy as it pertains to feet and legs is the fourth edition of *Adams' Lameness in Horses*, edited by Ted Stashak, DVM, MS, and featuring seven experts in the field as contributors.

Start at the Top

We will begin our visual dissection of the posterior portion of the horse's anatomy at the top, or spine, and work our way downward. Connecting to the spine is the ilium, the largest of three bones in the animal's pelvis. The ilium angles down and rearward, and it attaches to the femur or thigh bone. The angular shape of the pelvis determines what type of croup the horse has—flat or sloped.

The femur angles slightly forward and connects with the stifle, forming one of the more important joints in the rear leg apparatus. Connecting at the stifle joint, as we continue our journey downward or distally, is the tibia, which connects with the hock. Emerging from the distal portion of the hock is the metatarsus or rear cannon bone. This bone continues downward until it connects with the long pastern bone, which connects with the short pastern bone, which connects with the coffin bone. As with the foreleg discussion (see www.TheHorse.com.aspx?id=6623), there are several small bones in the lower hind limb that are important to the function of the leg. Where the cannon bone joins the long pastern bone, two small bones—the proximal sesamoids—lie on the back side of the cannon bone and act as pulleys for the flexor tendons. And where the short pastern and coffin bone join, a distal sesamoid bone, or navicular bone, acts in the same manner.

Where Does it Hurt?

The two key places where rear leg lameness problems are apt to develop are the stifle and the hock. Both play key roles in the horse's ability to propel itself forward, brake to a halt, and move backward.

If one were to rate them as to importance in this regard, the hock would perhaps be placed at the head of the list. The propelling force is transmitted by tendons passing over the hocks, delivering energy from the muscles for forward propulsion. On the other hand, the stifle serves much the same function as the human knee.

As mentioned earlier, the hock, or tarsal joint, is where the tibia joins with the metatarsal bone. The hock is a like the horse's

NORMAL AND PROBLEMATIC HIND LIMB CONFORMATION

When a horse's hind limbs aren't aligned as they should be, some internal structures are stressed more heavily, resulting in a greater risk of pain and lameness. For example, the cow-hocked horse will place extra strain in the medial side (inside) of his hocks, resulting in a greater risk of bone spavin, and straight hocks will not be able to absorb as much shock as they should.

NORMAL HIND END

STRAIGHT HOCKS

SICKLE HOCKS

NORMAL HIND END

COW HOCKS

BOW HOCKS

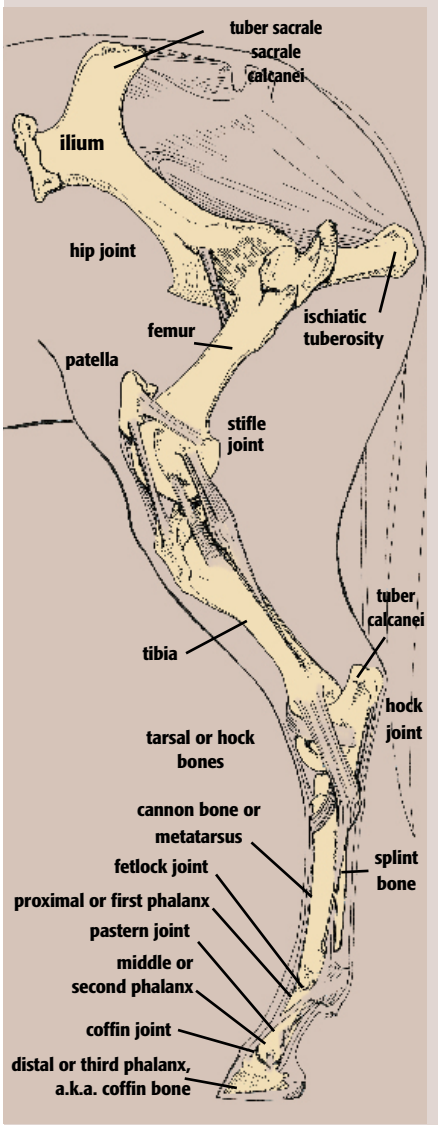
BASE-WIDE

knee on the front leg in that it is comprised of a number of bones—six to be exact. A difference between hock and knee is the fact that the hock bones lack the degree of motion noted in the bones of the knee. Like the knee joint, the hock joint is held together by a complex set of ligaments that enable it to function. The prime function of the hock is to provide rear leg propulsion.

The bones of the hock include: Calcaneus and talus on top of the central tarsal bone, third tarsal bone, first and second tarsal bones (which are fused), and the fourth tarsal bone.

The horse's stifle joint is the largest single joint in its body. One of its functions is to cause the rear limb to become rigid when the foot is on the ground. This is controlled via contraction of muscles above the patella, which releases the stay apparatus, and is the equivalent of a human's kneecap.

HIND LIMB ANATOMY



The type of activity with which the horse is involved has a great deal to do with the stresses and pressures that are placed on the hocks. Walking, jogging, or even galloping puts little undue stress on the back legs in general and the hocks in particular.

However, when one ups the ante with some activities, it all changes. One type of stress, for example, is placed on the hocks by five-gaited horses, particularly Saddlebreds. When performing at the signature gaits of rack and slow gait, the horse is moving in a four-beat rhythm. This means each leg strikes the ground separately. Put another way, it means that all of the horse's weight is balanced on one leg during each complete stride. Add to this the fact that five-gaited horses shift weight to the rear and elevate the front end while slow gaiting and racking, and one can quickly conclude that the stresses and strains placed on the rear end multiply.

When we consider some of the Western classes, the stress and strain placed on the rear end change in form, but are equally

severe. The cutting horse, for example, works almost completely off the rear end. Its back legs serve as both propulsion and brakes as the horse slides to a stop, then shoots forward or sideways as the cow turns and tries to escape. The process of turning while weight is suspended over the rear often places terrific torque on the hocks and can lead to soundness problems such as arthritis in the hock joint.

The reining horse also places stress and strain on the hocks during its pattern. There will be sliding stops, with most of the animal's weight transferred to the rear leg apparatus, and there will be spins, with one back foot pretty much anchored in place as the horse does 360-degree turns, often at speed.

Different Stresses

Back to English riding, we find that dressage horses also place added strain on the rear end as they perform intricate patterns. The same is true of the jumper. In that discipline, we generally think in terms of more stress being placed on the front end as the horse lands after taking a jump. However, in order for the horse to land it has to take off, and it is the rear end that provides propulsion for a soaring jump.

While we generally don't think that much stress is placed on the rear end of trail horses, being ridden either in English or Western tack, there are times when the demands are high. An example would be climbing a steep hill or mountain where a strong rear end is required for propulsion upward as well as forward. When descending a steep slope, a strong rear end and sound legs also are needed, this time to provide braking capability that allows a horse to travel downward slowly and safely.

What this all means is that, regardless of discipline, we want a horse to have excellent rear leg conformation so that it can tolerate the demands placed on it by respective disciplines and still remain sound.

(A discussion of the roles played by muscles, tendons, and ligaments to enable rear leg propulsion as well as braking action will appear in future articles.)

What to Look For

When examining the horse's back legs, we want to look at the limbs from the rear and the side. We'll start with a view from the rear. We want to see a horse that is evenly balanced. This means that the distance between its thigh area, as well as between the hocks, should be about the same as the distance between the rear feet as they rest on the ground. The back legs should be straight from this viewpoint. If a vertical line were drawn on a photo taken from behind, the line would go as straight as a plumb line from the center of the buttocks, downward through the center of the entire rear leg, all the way distally through pastern and hoof to ground level.

Now let's take a step to the side. From this viewpoint, we must keep in mind proper angle. The angle of the stifle and hock should be neither too straight nor too angular, but should present a well-balanced picture with muscles running smoothly down the leg to the hock.

If we call into play again our imaginary plumb line, we should be able to start it at the rear of the buttocks and drop a straight line downward to the hock and along the cannon bone until it reaches the ground three to four inches behind the heel.

What we are describing is ideal rear leg conformation. Unfortunately, few horses have perfect leg conformation, front or rear. Some deviations are minor and others are major. The type of deviation and

the severity goes a long way in determining whether the horse will remain sound.

Here are the four most common deviations in rear leg conformation that can cause problems:

Cow-hocked—With this condition, when looking at the horse from the rear, the distance between the feet on the ground will be greater than the distance between the hocks. A mildly cow-hocked horse can perform in most disciplines without severe stress. However, if the deviation is exaggerated, undue pressure will be placed on the hock joint (especially the medial or inside aspect) with each stop or strong propulsion forward, and there is the added danger of the horse interfering.

Bow-hocked—This is the reverse of the condition described above. Here, when looking at the horse from the rear, the distance between the back feet will be less than the distance between the hocks. While neither condition is desirable, base-narrow often presents more of a risk to the horse than base-wide. With hocks that are far apart, extreme strain is placed on the joint with each stride and lameness can quickly result in a demanding discipline. There is still another downside for the base-narrow horse. Rarely is a horse with this conformational fault a good athlete. The reason is quite basic—the horse is unable to make proper use of its muscles in either propelling itself forward or braking to a stop.

Sickle-hocked—When we look at a well-conformed horse from the side, we are able to drop our imaginary plumb line and it will travel vertically along the rear of the cannon bone, hitting the ground behind the rear hoof. With the sickle-hocked horse, there will be space between our plumb line and the rear cannon bone, almost from the upper point of the hock downward. A severe deviation with this condition places a great deal of stress on the rear of the hock and can quickly bring unsoundness. It should be kept in mind that in some breeds and disciplines—in particular draft horses for pulling—this conformation is preferred.

Straight behind—This the opposite of sickle-hocked. In this case there is very little angulation of the femur and the tibia. This condition is capable of placing heavy stress on the stifle joint and the hock. When these horses are used for roping, cutting, or reining, they are prone to injury because the rear legs are incapable of properly using muscles that are designed to help absorb concussion.

Back to the Top

Early on we mentioned that the shape or angulation of the horse's pelvis determines croup conformation. The conformation can range from straight to severely sloped, with a variety of degrees in between. The slope of the croup helps to determine the discipline for which the particular horse is designed. As a general rule, horses with a sloped croup will perform well in cutting, reining, and roping, and horses with level croups—such as the Saddlebred—are more apt to show up in gaited and fine harness classes or sometimes as racehorses.

Take-Home Message

No matter what the breed of horse and no matter what the discipline he performs, good rear leg conformation is highly important if a horse is to be a successful performer and remain sound.

ABOUT THE AUTHOR

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