EQUINE ANATOMY

HIND LEG STRUCTURE & MOTION

The hind end: Breeders work toward it. Trainers live by it. Horses depend on it. An expert explains it.

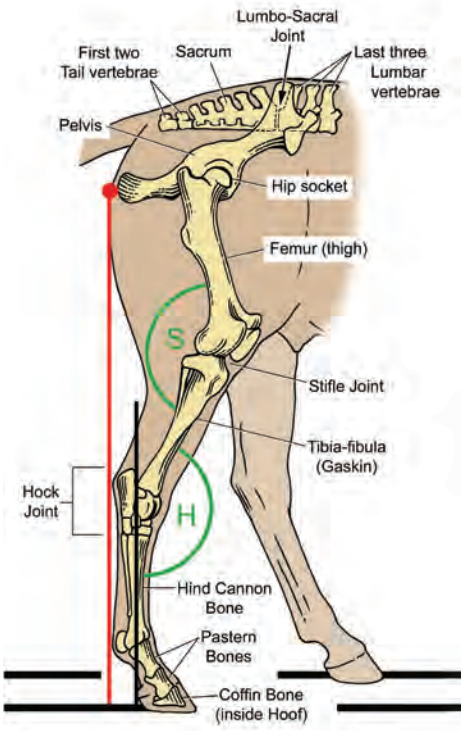
By Dr. Deb Bennett • Introduction by Stephen Kinney

In interviews on Morgan breeding in the early 2000s I would ask horsemen, "what would you change if you could?" One answer from a person who managed a prominent herd and often trained the horses he put on the ground has stuck with me, "I'm not breeding another mare until I can find a stallion to fix straight hind legs."

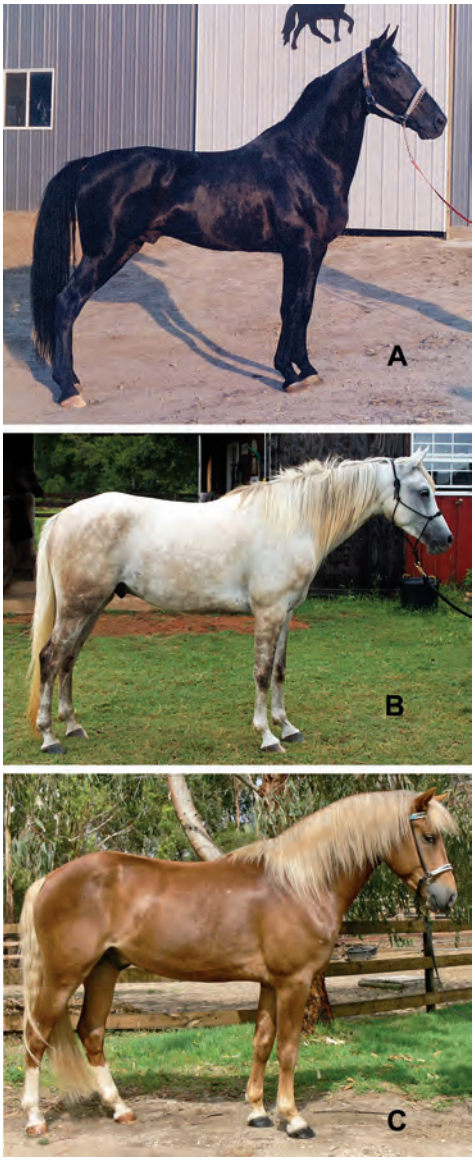
He was not the only Morgan breeder to share a similar observation. I took such observations to mean horses bred for and presented in the Morgan show ring at that time had developed a structural issue with hind leg angulation. However, the more I discussed these issues and the impressive efforts breeders have taken to remedy them over the years, the more I realized the limitations of my own knowledge. I was like a person with a cough who needed a doctor for a diagnosis. So, when I would bring up terms like "post-legged," "over-angulated," or "skating motion" I was a layman describing symptoms. To fully understand the causes, expert advice was required.

A few months ago I answered a phone call and the person on the other end identified herself as Dr. Deb Bennett. I knew "Dr. Deb's" reputation as a leading and widely published authority on equine

ABOVE: Morgan lovers refer to this statue as a standard of breed type. As this article explains, the plumb line demonstrates sound anatomy as well.



ABOVE: FIG. 1. Equine hind limb anatomy and terminology. The plumb-line test is also shown; red line represents ideal conformation; vertical black line bisects the hock-hind cannon functional unit. Green arcs show where angles at stifle "S" and hock "H" joints are measured. The lumbo-sacral joint is the uppermost movable joint of the hind limb. Flexion (coiling) of the lumbo-sacral joint and the joints between the lumbar vertebrae that lie just ahead of it determines the degree of engagement of the hindquarter. Engagement is not merely a question of bringing the hocks forward under the body, but the entire hindquarter, from the pelvis all the way down to the hoofs. Collection depends upon engagement of the hindquarter.



MIDDLE AND RIGHT: FIG. 2. Spectrum of hind limb lengths. Readers are invited to try the "plumb line test" on all the examples. **A.** Five-year-old Tennessee Walking Horse stallion. **B.** Seven-year-old Arabian gelding. **C.** Four-year-old Morgan stallion. **D.** 13-year-old Rocky Mountain gelding. **E.** 15-year-old Andalusian gelding. **F.** Eight-year-old Arabian mare. Horses C and D present the "middling" hind limb conformation discussed in the text (incidentally, the pedigree of D contains five crosses to Justin Morgan).

anatomy. When she called to discuss another matter, an opportunity presented itself. In the time since, Dr. Deb has generously spent hours on the phone sharing her knowledge. What results is a virtual seminar for readers where Dr. Deb illuminates the anatomical complexities of hind end structure and their influences on motion.

What follows are Dr. Deb's words, transcribed from a wide-ranging telephone conversation on July 24th, 2020. It started with a single question: What is correct hind leg angulation?

You can't ask the question that way because it implies there is one correct angulation. The word "correct" needs to be in quotes. What does correct mean? Correct is correct for the desired function. The perfect hind leg for a park horse would not be the same thing as a perfect hind leg for a racehorse or a jumper. Even within racing the perfect hind limb for a quarter mile sprinter, like a Quarter Horse, versus a classic distance Thoroughbred or a point-to-point horse that runs four miles would not be the same.

I will identify for you a general-purpose hind leg that will pretty much handle anything–that is our basis (Fig. 1). There is a range of variation and I'm going to describe the center of that range. If you move it in one direction, you are moving it toward one kind of functionality; if you move it in the other direction, you're moving toward something else. Also, as you leave center, you are risking certain kinds of chronic injuries which are directly the product of changes to the angulation and proportionalities of the hind limb.

Elements of the Hind Limb

I've just said "proportionalities." Your question related only to angulation, but you have to consider the relative lengths of all the elements that compose the hind limb. In simple terms, those are the femur, which is the thigh part of the leg; the tibia/fibula, the gaskin part of the leg; the hock and hind cannon, which are taken together as a unit for purposes of analyzing function, because there is no moveable joint in that length. The only moveable joint you have in the hock is its articulation with the gaskin. The hock bones stack up on the top of the cannon bone in such a manner that it cannot bend. Below that you have a unit which, for functional purposes we will just call the hind pastern and the hoof. Again, the coffin joint moves a bit, but the pastern joint between the long and short pasterns does not bend. Generally, in a sound horse we can put the long and short pastern bones and the coffin bone together as a unit, plus the overcovering of the keratinous hoof and call that a functional unit.

To summarize, you have four units within the horse's hind limb that are completely mutable in their possibilities for design: femur; gaskin; hind cannon and hock; and hind pastern and hoof. You can change the length of any of them. You can make the thigh longer or shorter. You can make the gaskin longer or shorter. You can make the hock-hind cannon unit longer or shorter. And you can do the same with the hind pasterns and hooves. When you do that you force the angulation. If the four elements of which the hind limbs are composed are of an average length, you are going to produce a hind limb that has a certain amount of zigzag in it. If you add length to any one of them, the horse is going to be higher at the top of the croup or else have more zig- zag in its leg. And the opposite is also true. If you take length away and design a horse with all or some of the hind leg components shorter, you are going to suck angle out of the hind limb, creating a straighter or less angulated hind limb (Fig. 2).

All of this depends on what else is going on in the body. And that's a good warning for us as we start this discussion. Don't forget the horse is not just a hind limb. Superior movement or greater athleticism is about the whole horse. Depending on what is going on in the front end you may or may not change the overall balance of the animal, but you definitely will change it if you make him what the Germans call "über-bauen" or "overbuilt"—high behind.

The Master Joint of the Hind Limb

The hip socket is actually not the uppermost moveable joint of the hind limb in any mammal—there is one lying above it, at the point where the hind limb joins on to the vertebral chain (Figs. 1 and 3). Officially the place where the hind limb joins to the body is the sacroiliac joint—your chiropractor is always adjusting your sacroiliac joint because it is always getting in trouble in humans, since we stand up when we walk and that puts stress on that joint. In the horse the sacroiliac is usually pretty problem free, although your equine chiropractor certainly addresses that joint in some animals. However, for good or ill, the sacroiliac joint is not a very moveable joint.

The crucial joint above the hip socket is not the sacroiliac joint but the lumbo-sacral joint (Fig. 3). This is a joint with large movement capability and this is crucial. The lumbo-sacral joint is the master joint of the hind limb and the seat of collection. It is a hinge that produces the coiling motion of the hindquarters and back necessary to galloping. Nothing desirable happens unless the horse flexes that joint. In a racehorse, the coiling of the loins—flexion of the lumbo-sacral joint—makes up for the lack of angle in the hind leg. Coiling advances or engages the *entire hind limb*—not just the hocks—relative to the position of the horse's heart. The entire limb moves forward a lot because the hinge is way up at the top. When you take hold of a broom by the top end of the broomstick, you only move your hand a very small amount to swing that broom. If you move your hand an inch, the lower end of that broom is going to move a foot.

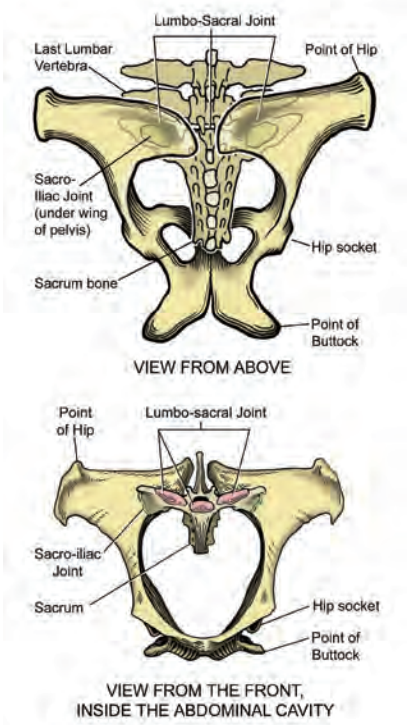
Basics of Hind Limb Structure

Now I'm going to give you a picture of the average, middle-ground hind limb that is best for almost any type of function. I encourage people to go out to the barn and take your horse's picture. Your camera should be positioned so that it is centered between the horse's shoulders and hindquarters. Most important, the horse needs to stand so the cannon bone of the hind limb nearest you is plumb vertical. This test will not work in any other way. If you try it on a horse in a stretched pose, you will get nothing out of this. If your horse is standing sloppily, like he is trying to turn or leave, that won't work either. The pose has to be honest, like you would see in a warmblood halter class. The hind cannon bone has to be plumb vertical. Now take the picture and either make a print or else put it up on the computer screen. Drag a vertical line into the photo and have it just touch the horse's buttock straight down to the ground (Fig. 1, Fig. 2C and 2D). Your purpose is to ask how does this plumb line interact with the back surface of the cannon bone? If the line just skims the back of the hock/hind cannon unit, this is a 100 percent reliable way to know you have the average, highly adaptable, highly functional hind leg. This is the horse that is not going to have spavins, that is not going to develop curbs. Nor are you going to see things like tendon strains. That is the hind leg that is likely to be soundest, no matter the performance demands you make of him.

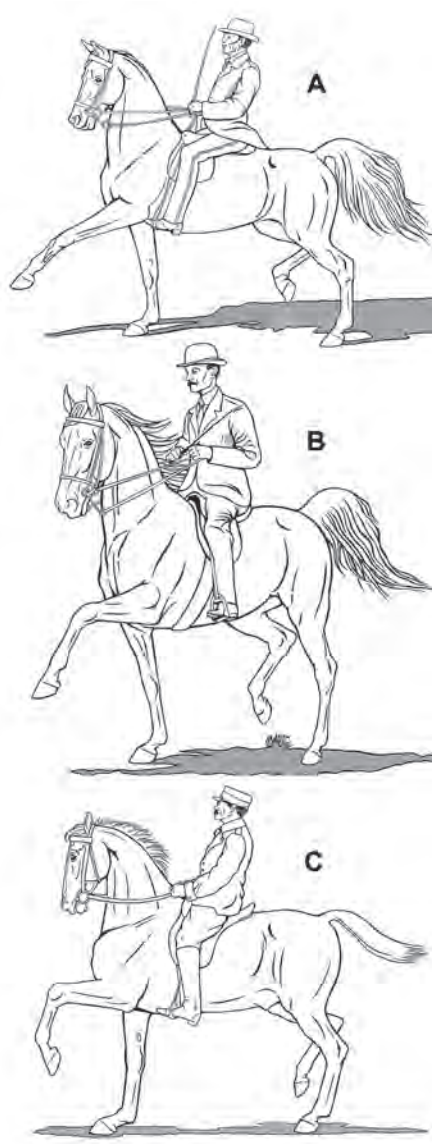
Variations of Structure

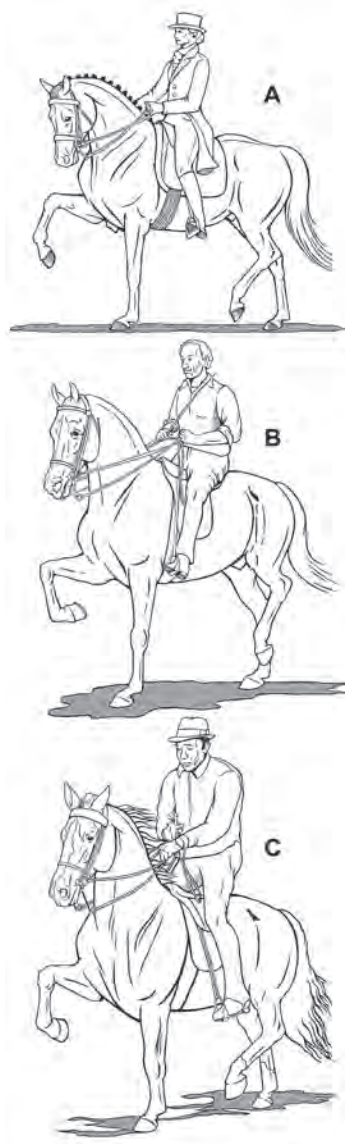
We're playing God here. We can redesign this hind limb at will. Maybe what we just talked about is not a description of your horse. Let's say you have a horse where the gaskin unit is pretty long—longer than the average (Figs. 2A and B). If you kept the angle of stifle the same but make the gaskin longer and he's still standing with the cannon vertical, that's going to push the hind cannon section back, so the plumb line instead is going to cut through the hind cannon segment. It may bisect the hind cannon or, at an extreme, fall ahead of the hind cannon. There are horses that have hind legs with that much length in them. In creating this horse, by adding length to the hind limb, we have closed the angle at the hock quite a bit and probably also closed it at the stifle. That's called a crooked hind leg. It's not crooked as seen from the back, but from the side. You can also say over-angulated.

But the term is prejudicial. Is a horse with that shape to its



ABOVE: FIG. 3. Lumbo-sacral anatomy in the horse. **A.** View seen from the top; head towards the top, tail towards the bottom. **B.** View from the front. The lumbo-sacral joint is designed as a triple hinge (pink) that can flex in only one direction: up and down, with the anatomically possible range mostly in the down direction. Green marks the sacroiliac joint, where the sacrum attaches to the pelvis. It is designed to join the hindquarter to the body but cannot make much movement.





MIDDLE: FIG. 4. Superb movers of a bygone era influenced by Baucher's teaching. **A.** American Saddlebred Belle Beach ridden by America's most famous and skillful 19th-century trainer, Tom Bass. Photo taken about 1910 when Bass was nearly 70 and his famous high-schooled mare about 20. **B.** American Saddlebred Princess Eugenia with Ed Moore up, photo about 1915. **C.** Algerian Barb stallion Mabrouk ridden by Capt. Ernest Beaudant, about 1917. All three of these horses are performing passage.

RIGHT: FIG. 5. Superb movers of the modern era. **A.** Andalusian stallion performing passage in dressage competition. This horse presents conformation and movement style similar to many Morgans. **B.** Morgan gelding performing park trot, photo from 1952. **C.** Morgan stallion performing park trot, photo from 1961. Note rounded (coiled) loins and forward placement of contacting hind hoof in all three (compare to Fig. 6).

hind leg not useful for anything at all? Most horses are useful for something, but by breeding a horse with long, over-angulated hind limbs you are getting into a conformational extreme and that always implies a health or a soundness trade off. As you move away from the average conformation, you are boxing yourself into a corner as to functionality. You are making a more specialized kind of hind leg. If the plumb line falls not down the back, but in the center of the hind cannon, that's about as much as I would want in any horse. What will that adapt the horse for? Sometimes you get a heck of a good jumper who is built like that. It can also help the horse in disciplines like English pleasure or park, but that horse has to move right otherwise. It is also sometimes useful in a gaited horse. But the Walking Horse breeders have hooked onto this very idea and have said, "Aha, here's how we can get a big hind step length," which they call the big lick. Extremely long hind limbs lead to dysfunctional horses that are prone to injure themselves because the more crooked you make the hind legs, the more bending stress you impose on the ligaments that hold the hock together. There is a limit. If some is good, more is not better. This is not the solution to your issues in building Morgan show horses. It is best to build the middle ground—the strongest and soundest hind leg.

Let's move the other direction and ask what happens if we make the gaskin segment shorter or the gaskin and femur shorter (Fig. 2E, F). The opposite of a crooked hind leg is called post-

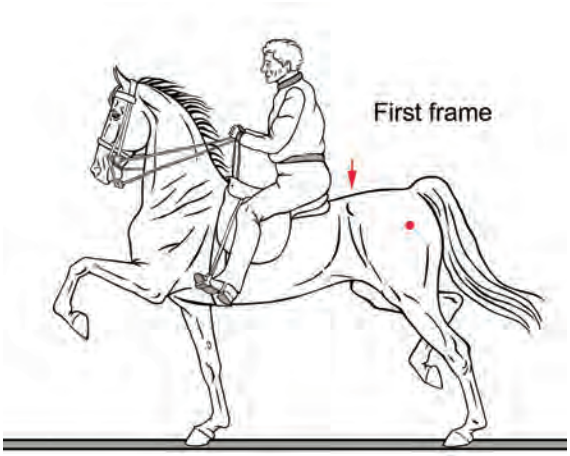
leggedness. That is created when you shorten the elements that compose the hind limb so that when you drop your plumb line it falls well behind the back skin of the hock/cannon unit. There are lots and lots of Thoroughbreds that are built that way, because a straighter hind limb is actually helpful in racing. It is almost the definition of the Quarter Horse that the thigh is shorter than in other breeds. They have practically all been bred this way, particularly in racing bloodlines. Why would a Quarter Horse want to have a shorter thigh? Their races are only a quarter mile. They have to come out of the starting gate like nobody's business with incredible thrust and maintain that throughout two furlongs. So, their effort is a bursting, explosive kind of effort.

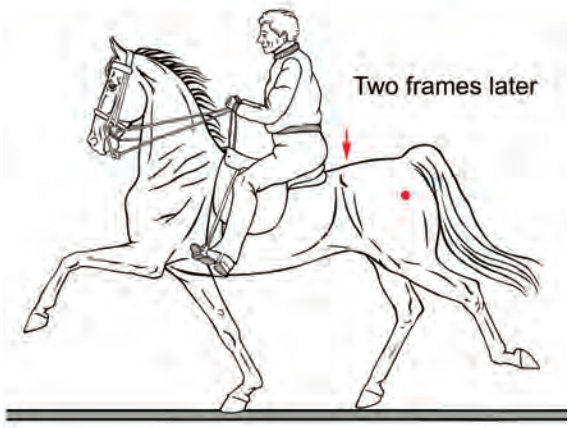
Is there one correct hind leg structure? No. I'm avoiding usages that might be prejudicial here. In other words, I don't want to use "ideal" or "good" or "best." What we say is there is something in the middle. A range around that central position. If you go to an extreme—like the walking horse breed has—you wind up with a horse that could not compete in Morgan show ring classes because the hind legs are so crooked. The opposite extreme is also seen in champion Quarter Horse halter horses today. Some of those horses are absolutely not rideable because the hind legs are so straight up and down that they are literally posts.

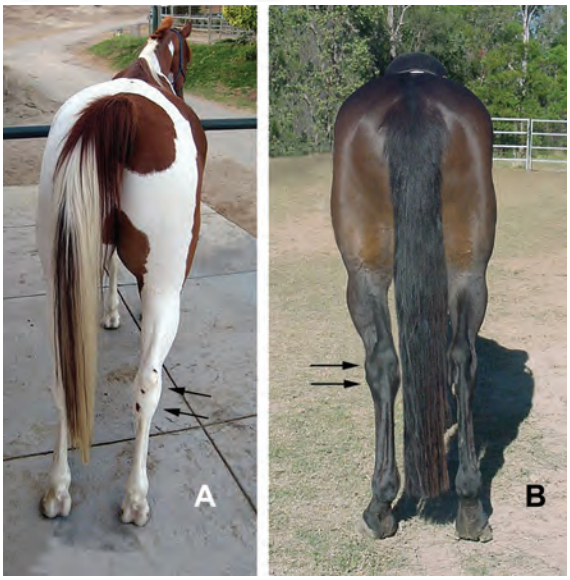
The Biomechanics of Galloping

How does the horse propel himself forward? It is impossible for a body to go forward unless it is pushed forward by frictional contact of the hind limb with the earth. You initially talked to me, Stephen, about "skating" in the trotting breeds. All that means is the horse is standing on his forehand and using his hind quarter hardly at all. It is dragging his hind quarter with its fore quarter, shifting the locomotory effort almost entirely to the two front legs. Correct, efficient locomotory effort is just the opposite; it is the result of contact of the *hind* limb with the ground (Figs. 4, 5). Apart from touching their legs to the ground a horse cannot move forward; if it moves off the forehand, it is just swishing its hind limbs through the air to no effect (Fig. 6).

When a Quarter Horse comes out of the starting box, he needs to make as many frictional contacts as possible in a very short period of time. The oscillatory rate of the horse's hind leg (the speed with which the limb swings forward and back) is strictly a function of the length of the femur. This is exactly the difference between a grandfather clock with a long pendulum and a cuckoo clock with a little short pendulum. One of them goes tik-tik-tik really fast and the other one goes tick-tock-tick-tock really slow. Likewise, different oscillatory rates are good for different things in terms of horse competition. The Quarter Horse wants to go like a bunny and make very rapid repetitions of the hind limb effort. That's what makes him win. And let me add—for those who want to look at the vagaries of the race world today—at one time the Thoroughbred ran long distances, four miles or even more. A longer thigh was a helpful adaptation. The average race today for Thoroughbreds is only four

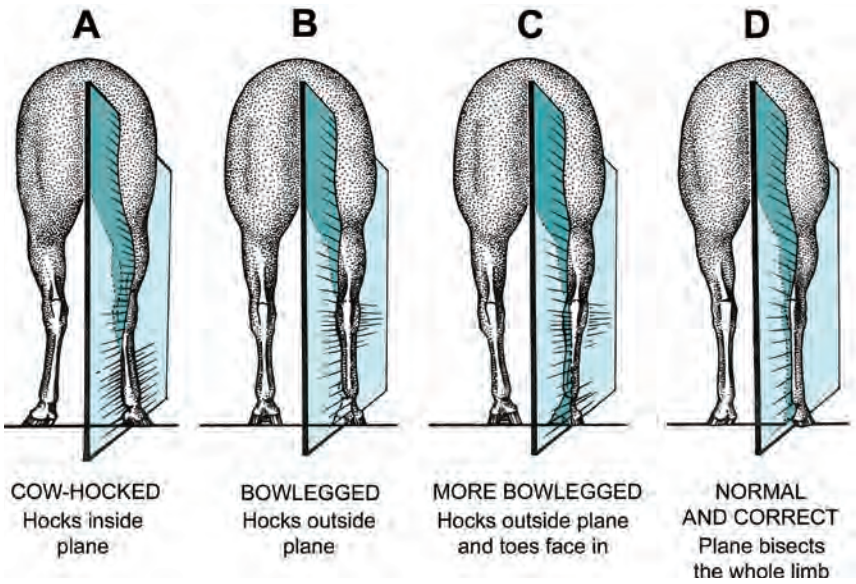






ABOVE TOP: FIG. 6. "Skating"—improper trot movement—has been well recognized as a problem in the dressage world for the past hundred years, with a number of recent biomechanical studies including my own. These images **(A, B)** taken from sequential video stills. Properly "skating" is called "over-rotation of the hindquarter." Recognizing it in a moving horse is easy: (1) Relatively hollow back and uncoiled, flattened, or extended lumbar span (red arrow marks position of lumbo-sacral joint); (2) Contacting hind hoof lies far behind the horse's hip socket (red dot) at the moment of heaviest contact of that hoof with the ground; (3) The hoof of the supporting forelimb is still on the ground after the diagonally opposite left hind has already been picked up; (4) When left hind hoof is picked up, the sole of the foot flicks upward and may flip clods of dirt into the air; (5) As a result of all the above, the trot loses its proper rhythm. By definition, a horse cannot be trotting if there is time during which its weight is supported solely by a forelimb.

ABOVE BOTTOM: FIG. 7. Narrow **(A)** vs. broad **(B)** hocks. Arrows indicate bony prominences of the hock. To measure breadth, put your thumb and forefinger around the hock at the level of the lower arrow. Note also the correct, normal stance of B contrasted with the functionally bowlegged stance of A.



ABOVE LEFT FIG. 8. The illustration of "correct" hind limb conformation from Gobaux and Barrier's *The Exterior of the Horse* (1892). No well-built horse stands this way, but this illustration and the bogus concept it teaches is today found in judging manuals—to the detriment of horses and competitors alike.

ABOVE MIDDLE FIG. 9. Farrier Sean Finn CJF lifts my gelding Oliver's hindlimb to remind readers of how a horse's hind limb really works. Note that when the hind limb is either lifted or brought forward, the stifle must swing outward in order to clear the ribcage. This is why there is a spiral tilt built into the equine hind limb, and well-conformed animals that have broader bodies and/or shorter backs have to have the hind limb plane angling outward more in order to move comfortably and well. Note also that when the limb folds, it folds so that the stifle and hock still lie within the same plane that defines the orientation of the limb when the animal stands (Fig. 10D).

ABOVE RIGHT FIG. 10. The plane that defines correct hind limb conformation passes through the hip socket and is angled outward enough to clear the last rib. **A.** Cow-hocked conformation with hock joint lying inside the plane but ankle joint lying outside it. **B.** Functionally, bowlegged conformation in which the hocks lie outside the plane while the ankles are bisected by it. This conformation is widely thought to be correct. **C.** Frankly bowlegged conformation in which the hock lies outside the plane but the ankles lie inside it. **D.** Correct conformation in which the plane bisects both hock and ankle joints (and also the stifle joint above); thus, all joints fold and unfold in the same plane.

furlongs and there are hundreds of races for three furlongs, making them barely different from the Quarter Horse. When you adapt your breeding horses to run over that distance, you are not breeding the same horse you would for the Belmont at a mile-and-a-half or the Maryland Hunt Cup at four miles over obstacles. So, it is no surprise that today's champion Thoroughbred flat-racers are barely distinguishable in conformation from race-bred Quarter Horses.

The Biomechanics of Secretariat

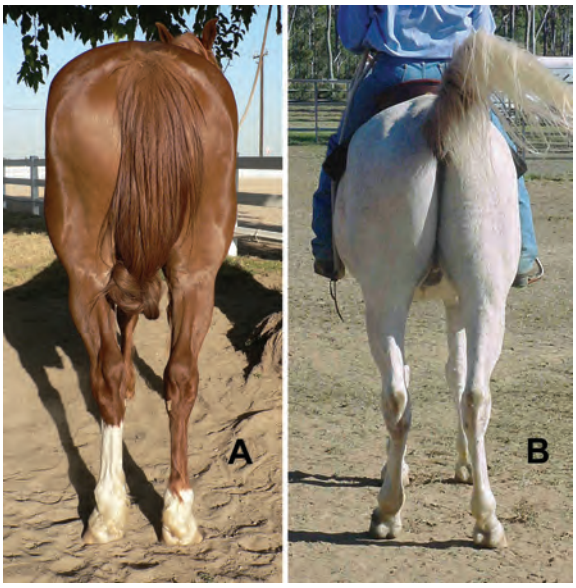
There is a film showing Secretariat, the fastest Thoroughbred racehorse of all time, running in various races. In that film you can see how Secretariat flexes his back, how fluid that is, and compare that to horses with stiff backs in the same race. Because their backs and hind limbs were stiff—in other words because they could not coil the loins as much—they could not advance the hind limb as much as Secretariat and they therefore could not achieve the same thrust.

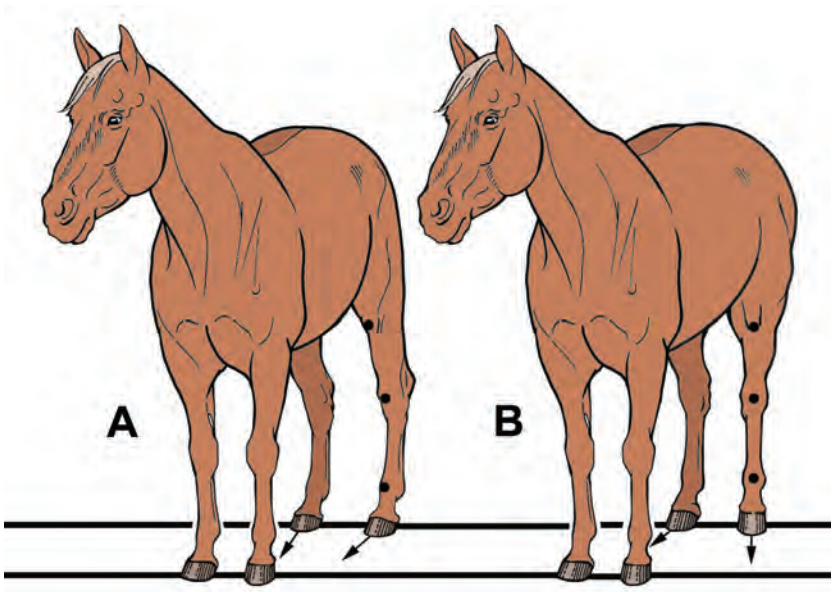
This is not going to sound right until you think about it, but all superior racehorses run in collection. They extend also. When they coil, that is the essence of collection; when they uncoil, that is the essence of extension. With every stroke they coil and uncoil their bodies. If you want to look at the extreme of this, you would look at dogs or cheetahs who can go faster than horses. A cheetah is approximately half or even a third the withers height of a horse and yet it can outrun him by twice the speed. The fastest a horse can go is about 36 miles an hour. A cheetah can run approximately 68 or 70 miles an hour. Why? It has a more flexible back than a horse and therefore can coil so fully that its hind paws actually reach ahead of its nose. That is the secret of speed. You cannot talk about the hind limb in isolation from the rest of the body, because it is attached to something. That something is going to have a big effect on how the whole thing functions. The horse does not primarily run by means of its legs!

The Biomechanics of Trotting

I know this is of great interest to your particular readership—what sort of horse is going to succeed in show ring competition. The first thing to be said is that your saddle seat and your fine harness horse, absolutely, do not want a short thigh. The same applies to the dressage horse as well. These are disciplines that call for big, somewhat slower oscillatory motions of the hind limb. What you do want is the middling, average build I've described.

This surprises most folks to hear, but saddle seat and dressage are twins. When the Huguenots were expelled from France in the early





ABOVE LEFT FIG. 11. A. The author's gelding showing correct conformation, good bone substance, and normal stance. Oliver was 19 when I took this photo. Incidentally, Oliver is the mostly-Morgan "Rocky" shown in Fig. 2D. **B.** Ten-year-old Arabian mare with cow hocks. Note her hind legs form the letter "A," Oliver's form the letter "H."

ABOVE RIGHT Fig. 12. Two Quarter Horses showing bowlegged **(A)** vs. correct **(B)** hind limb conformation and stance as seen in front view. Black dots mark joint centers; arrows show orientation of the limb planes.

19th century, they were unable to bring any of their horses to America with them, but they had money and they bought up plantations and they are the basis of the Antebellum South. They brought the high French culture and the horse training that went with that which was largely derivative, first of the Master of Versailles, François Robichon de la Guérinière, and a little bit later of the famous French trainer François Baucher, to whom both saddle seat and some varieties of dressage owe a great debt. We have in Baucher and his many American students and followers a considerable body of knowledge of how to produce very fancy moving horses, elegant high movers (Fig. 4 A,B,C; see also Fig. 5 A,B,C for examples of modern show competitors moving correctly at the trot).

Those old Southern plantation owners also wanted the kind of horse Baucher was riding—the French Anglo-Arab—but given that there were zero Arabians bred in the United States until just before the Civil War, they had to use their knowledge to breed a horse from the gaited Thoroughbred and Colonial Hobby blood that was available. And they outdid themselves. The resulting American Saddlebred horse is one of the few breeds in which it is extraordinarily easy to produce passage. They naturally do it. And they have the most elegant, powerful, balanced, flowing canter—a reach-y, elastic gait unlike that of any other breed except the most elite, saddle-adapted Thoroughbreds. The best Morgans also have the long thigh, like the ASB, but combine it with more substance and a very biddable temperament.

For your show ring or dressage horse, the centrist or average is the healthy hind limb. It is neither post legged nor over-angulated. The only fiat on that is that the horse has to have sufficient substance. A good, strong hind leg has a particular look.

The Legs Viewed from Behind

What is that look? The best way to see it is to move around to the back (Fig. 7). One of the deficiencies we see right across the board in American horse breeding is that we do not breed a wide enough hock. Correct, engaged, powerful, athletic movement puts a lot of stress on the hock joint—though not more than a substantial hock can easily handle. If you want a horse that will passage and that will perform a park trot—both requiring a similar degree of engagement of the hind quarters—that needs to be a horse that will not have any twinges of unsoundness or pain while it is performing. We've all had that little joint twinge when we are playing ball or soccer. Horses with thin hocks have that all the time. Discomfort leads to the horse not looking forward to his time with you, not giving you 100 percent. He thinks you don't understand. Horses work on a gradient between comfort and discomfort and a tiny amount of [variance] makes a huge difference. Physical discomfort very quickly leads to an objection or reluctance from a horse. If you are not picking up on the fact that he's uncomfortable—or worse, if you think he's resisting you—he has to take measures to get through to you.

The hock joint has a width dimension you can palpate—the skin that overlies the hock bones is not very thick. It is a bony joint. If you put your thumb and index finger around the joint, there is a place where it is the widest. That is what I mean by wide hocks (Fig. 7).

When you move behind the horse, we have been repeating errors that were established in a text entitled "The Exterior of the Horse," written in the 1890s by two French veterinarians named Gobaux and Barrier. Their text contains the first really organized,

well-illustrated, systematic presentation of the skeleton and conformation. However, among a lot of good information they also present a totally spurious, unrealistic, rigged-up drawing of the horse in rear view (Fig. 8). That drawing was made by a draughtsman or engineer. No horse should ever stand the way an engineer would want him to stand in rear view, like a table with the hocks facing straight backward and the stifles and hind toes facing straight forward, parallel to the midline of the body. No mammal does. That includes you and me. Dogs don't stand that way. Camels don't. Elephants don't.

Imagine that plumb line we started this conversation with dropped again, but this time you're looking at it from behind the horse, and what you see is that engineer's idea— the hock pointing straight backwards, the hind feet pointing straight forward. If you want something that is going to prevent a horse from performing properly or collecting comfortably, just build him like that.

Every bone in a horse's hind limb is built with a slant or twist in it. The bones are not like table legs, and the horse's hind limb absolutely does not fold parallel to the midline of its back (Fig. 9). That is what's wrong with [the Gobaux and Barrier] illustration. And all of our halter classes are misjudged in all our breeds because of it. We misjudge them in front view and in rear view because we are all still working from this paradigm wherein we are looking in the wrong place for a plumb line. The hind limb of a horse in rear view can only adequately be described by a plane, not a line (Fig. 10). The planes that bisect the right and left hind legs must *not* parallel the plane that bisects the spine. Instead, the limb planes must angle outward as they face forward. That means that the horse's hind feet must orient outward when seen from the front, and its hocks will angle toward the midline when seen from the rear.

It follows that most people's idea of what is meant by a horse being "cow hocked" is way off. That does not mean that there is no such thing as cow hocked. There is. A cow hocked horse is a horse in which the hocks, when seen from the rear, are closer together than the ankles (Fig. 11B). So that what you see from the rear is the letter "A." You definitely want to see the letter "H" from the back, but that does not mean you want the hocks facing straight back at you. If they are it means the stifles and hocks are oriented parallel to the horse's back, and the horse will function as if he is bow-legged behind (Figs. 10B, 12). That kind of conformation will kill your English show horse.

It will also kill your reining horse. Around 1990 I got a phone call in my office at The Smithsonian Institution (where I worked at the time) from a rather famous reining person who had read my *Principles of Conformation Analysis* in which this is explained. He said, "you're the first person who ever explained this sensibly." He stated that straight-hocked, post-legged horses who stand with their hocks facing straight back—and there are many in the Quarter Horse breed—can't slide (Fig. 12). They cannot sit down. Because that tilt that is built into the joints of the hind limb forbids it.

Parting Wisdom

We as breeders have the power to create almost anything, but you don't want the horse to have to overcome too much. Breeders need knowledge, experience, and enough humility and wisdom to pay attention to what nature has to teach, and to make it the top priority in creating great riding horses. ■

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