Originally published in
The Eclectic Horseman
2010, issue no. 53

How Horses Work

Installment #3: The Anatomy of Straightness

by Deb Bennett, Ph.D.

Getting the Whole Picture

Often it has been mentioned in these pages that there are three pillars to horsemanship: feel, timing, and balance. But through carefully listening to the men who were our teachers, and through a careful reading of their books, I have come to believe that there are two more that "bracket" these: straightness, and spirit (Fig. 1).

You can envision these five pillars like a five-legged stool, and this is a good picture because if you kick one of the legs out from under it—as you might, say, if you don't happen to believe in "spirit" and you therefore reject that concept—it will still pretty much stand. In fact the horse will work, and might work pretty effectively, if you eliminate any one of the five. This explains why we have all seen people whose timing was way off, or who had never thought about "the timing of the aids," who own a talented or accommodating horse and can thereby stumble through a dressage test or a reining run and still pull a passable score. I've known a man who became president of a large horse association and rode every weekend in their shows, who was nothing less than a total brute and who not only didn't have, but utterly rejected the very idea of "feel." Sally Swift worked for years to get thousands of riders to improve their faulty balance on horseback—and yet very few of those riders were actually falling off of their horses before they met her. They were getting by.

Figure 1. The five pillars of horsemanship represented as a pyramid, with straightness at the bottom being most physical and most related to the horse's external appearance, and spirit at the top as being least physical and most related to the horse's inner life.

The point is that to help your horse the most, and often to fulfill any ambitions you may have around contests or shows, you will want to explore all five pillars. If you want horsemanship that is refined and excellent, you really can't leave any one of them out.

This article stands as a guide to the most physical of the five pillars: how to teach your horse to carry himself and his rider straight. Let me stop here to mention that I have published extensive information on this subject many times before, so I am not going to repeat anything here but the mere nuts and bolts (along with a new and valuable illustration: another "refrigerator picture").

I hope that, once you read this article, you will want to delve into the full story of straightness. If you have a computer connected to the Internet, I suggest that you go to the Equine Studies Institute Web site at www.equinestudies.org, click on "Knowledge Base," and download the following three articles:

- "Lessons from Woody"
- "True Collection"
- "The Ring of Muscles"

When you download these articles yourself, they come for free. If you do not have your own computer and printer, you might be able to go to your local copy and duplicating store, an Internet service point, or your public library and have the staff there help you download them. I mention this with a degree of urgency because there's more to getting your horse straight than you might realize. You notice that in the above list, the "Woody" paper, which introduces the topic of straightness, is linked to articles dealing with collection. Let me, then, tell you the punch line before you've heard the joke: it is impossible for a horse to offer collection unless it first moves straight.

Let me repeat that in a different way: no horse can perform a slidestop without straining itself if it doesn't go into the run-down straight.

Or again: no horse can turn the first barrel tight if it also has to "turn" its inside shoulder.

Again: no horse can exhibit a cadenced piaffe—or even a collected trot—if collection is taken from the animal rather than offered by the animal.

In short, for all disciplines, breeds, styles of riding, and activities, straightness is an absolute prerequisite to true collection.

What Collarbones Do

Horses and humans are built differently through the forelimb. We have collarbones, which are bow-shaped struts that articulate, at the near end, with the upper end of the breastbone and at the outer end with the shoulder joint. Among other functions, collarbones act to ensure that your shoulder joints are stabilized at a distance from the center of your chest. (A side story: I once had a student in a class who, upon hearing this, leapt up from his chair at the back of the room. Turns out he was a former English steeplechase jockey who had been spilled and broken his left collarbone so many times that fractures would no longer heal. As he stood there taking off his shirt in front of our astonished class, he explained that the docs had totally removed his collarbone, leaving him with strange physical powers which he proceeded to demonstrate! The man could cause his left shoulder to migrate, under the skin, all the way over to his breastbone, and likewise could cause it to migrate nearly all the way around in back to touch his spine,)

Reciprocally—assuming that your shoulders remain in place—collarbones act to guarantee that your breastbone remains centered between them.

Horses have no collarbones. The fore part of their chest is flattened from side to side; this confines their shoulder blades to a vertical plane and helps to ensure that, when the horse is running, the forefeet reach efficiently forward and back in a narrow plane. However, because they have no collarbones the horse's shoulder blade, shoulder joint, and breastbone are more mobile than ours.

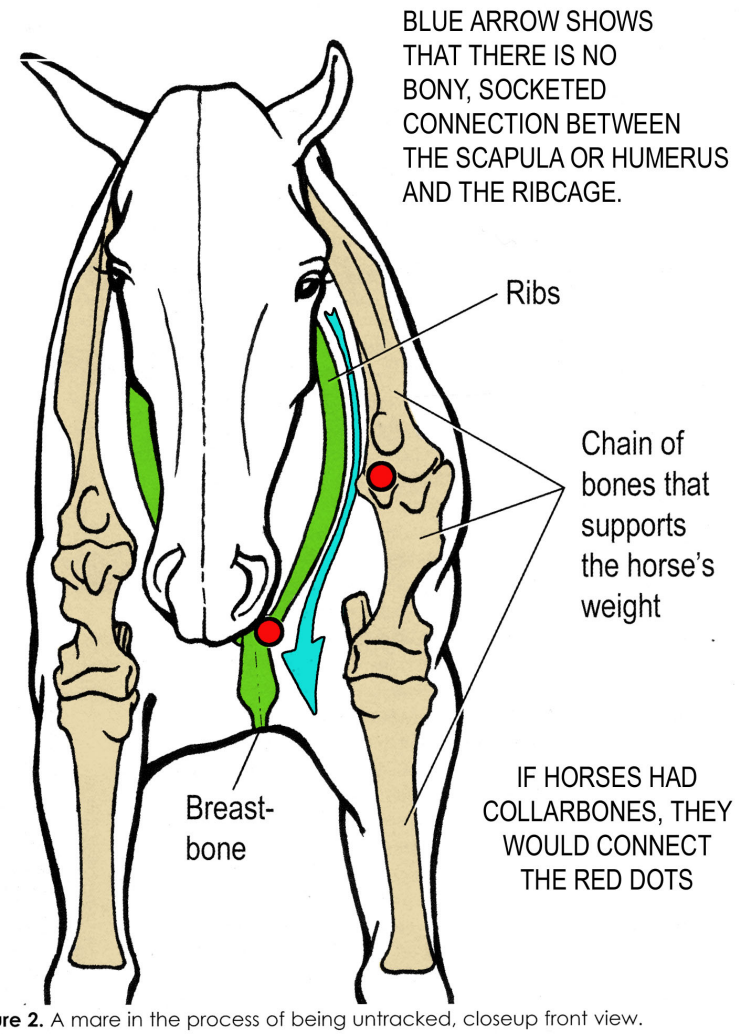

Figure 2. A mare in the process of being untracked, closeup front view.

It is of the greatest importance for riders to realize that, since there are no collarbones to fix the breastbone in place, a horse's chest can "sideslip" between its forelimbs. It not only can do this, it must do this for the animal to turn fluidly. Let's find out why this is.

Bones and Joints of the Upper Forelimb

All the illustrations of the horse presented in this article were made from the same photograph of a mare being untracked. She is bent to her right and her head is perfectly twirled to the right, so from the front you see a little more of her left ear, eye, and nostril. She is in a slow but attentive walk. The camera snapped just at the moment when she was reaching forward-and-toward the midline with her right hind leg, and forward with her left foreleg. The left fore hoof has already made contact with the ground and weight is flowing from the right side of her body to the left side. This is the crucial moment for understanding straightness, and a great image to help teach what "to straighten a horse" means.

Within the outline of the mare's body, you see the bone structure; in Fig. 2 it is shown very simply. The "rib" marked is the 2nd of the left side. There would also be a first rib located about one inch closer to the midline—this pair of ribs is not shown in any of the drawings because if they were drawn in, it would be difficult to show you where the head is. Not showing it makes no difference to the observations we'll make or the conclusions we'll draw.

First, use Fig. 2 to find for yourself where collarbones would go—if the horse had any. Place the tip of a pencil on the white dot marked at the edge of the breastbone. Draw a straight line to the white dot marked at the shoulder joint. If horses had collarbones like people do, they would strut from the shoulder joint to the breastbone, confining the breastbone to the center. You can see from Fig. 2, however, that the mare's breastbone is not centered between her forelimbs; instead, it is both shifted (to the outside) and tilted (to the inside).

Because horses don't have collarbones, we can draw the black arrow you see in Fig. 2 between the outer surface of the rib and the chain of forelimb bones. The arrow shows that, in a horse, you can slip a knife between the rib cage and the forelimb all the way from the top of the shoulder blade down to the level of the chest, and never cut through anything firmer than muscle or tendon. There is no bone-to-bone, socketed connection that holds the forelimb onto the horse's chest. The whole of the shoulders, and everything below them, is held onto the body merely by muscles and the tendons of muscles.

Elastic Sling Supports the Chest

Gray color in Fig. 3 shows the position of the two biggest "muscle complexes" that hold the horse's forelimbs onto its body. The uppermost and more important of these two sets is the serratus complex. In my dissection laboratory, students discover that this muscle actually has two parts. The first is composed of fibers that extend from the undersurface of the front half of the scapula forward, fanning out onto the lowest four neck bones. The second, much larger division consists of fibers that extend from the undersurface of the rear half of the scapula and fan out broadly to the rear, attach-

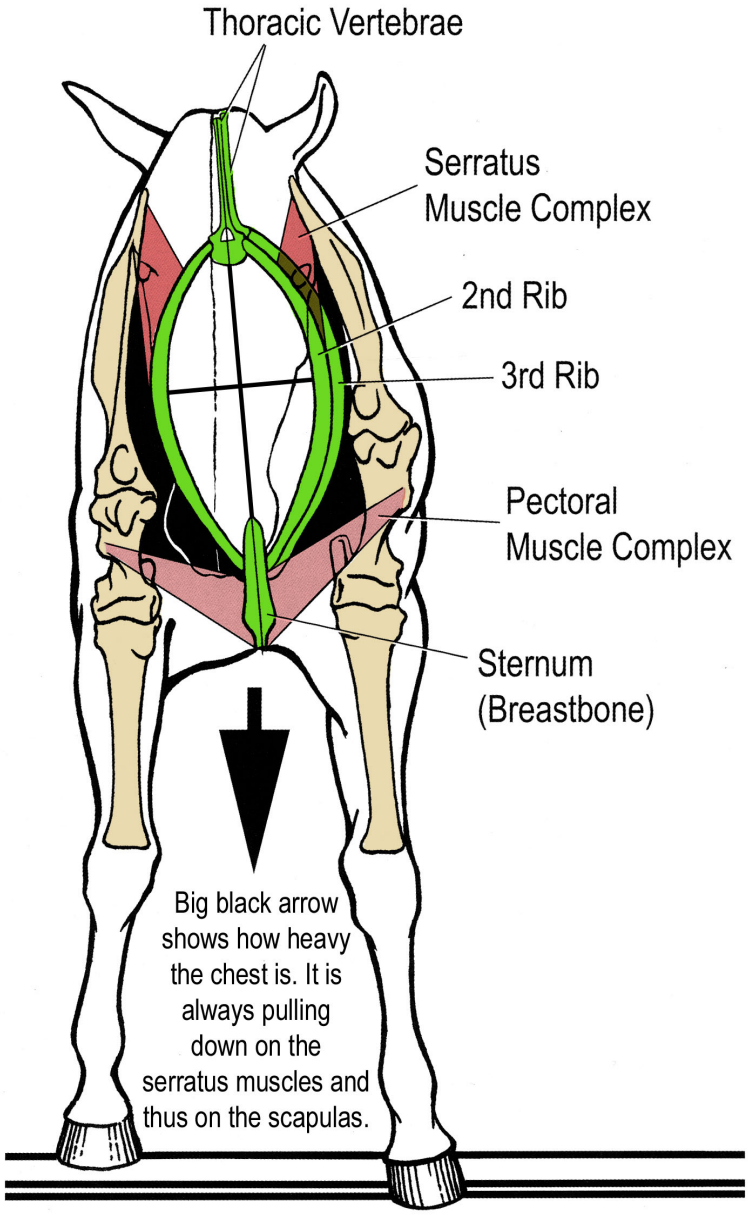

Figure 3. The same mare seen from the front. Two points are brought out in this image in addition to what is mentioned in the text. First, notice the crosshairs drawn inside the chest cavity. Note that the vertical crosshair connects the aligned breastbone and the dorsal processes ("spines") of the thoracic vertebrae. The crosshairs are tilted off-plumb by five degrees, simply as a result of the mare taking the normal steps in being untracked. Second, notice the area to either side of the rib cage that is colored black. When the horse bends as this mare is doing, its rib cage is displaced to the outside – this is why you can see the 3rd rib on the outside of the horse but not on the inside. Bending squashes the rib cage up against the inner surface of the outside shoulder blade and arm, while at the same time enlarging the space between the inner surface of the rib cage and the inner shoulder blade and arm.

ing to the outer surfaces of the first eight to ten ribs. In this drawing, you are seeing the whole mass of both parts in a "condensed" front view – like looking at an orchard, and seeing a whole row of trees from one end of a row.

The second big muscle complex that helps to hold the forelimbs onto the body are the pectorals. Only two of the four pectoral muscles are represented in this drawing, those that cover the breast and the fore part of the chest between the forelimbs. They connect the arm bone to the breastbone.

So much is obvious from Fig. 3. What is much harder to get across with a mere drawing is how heavy the horse's chest is. I don't know about you, but as a teacher of equine anatomy there has been many a time when I had to physically drag a carcass or try to lift it. Even after the forelimbs and the massive haunches have been removed, it takes a winch to lift the chest of a full-sized horse.

You must imagine, then, that the hollow interior of the chest of this mare – the part encircled by the ribs – weighs hundreds of pounds. It is therefore continually, throughout her life, pulling downward (black arrow) against the fibers of the serratus and pectoral muscles.

The downward pull tensions the fibers and has a tendency to pull both the arms and the tops of the shoulder blades in toward the rib cage. You can usefully think of the serratus and pectoral muscles forming an elastic sling which supports the heavy chest.

This is an outline of the relevant anatomy. Now let's look at how this relates to what straightness is.

Straight on Circles and on Straight Lines

Particularly in order to gain this understanding, I recommend that you review the above-mentioned "Lessons from Woody" article online. Very briefly, the biomechanical definition of straightness is this:

A horse is straight when its breastbone is centered between its elbows.

This definition applies literally when the horse is standing still. As soon as a horse moves, however, its chest swings with each step in its elastic sling like a fat man in a hammock. Thus, in the moving horse, we need to modify the definition:

A moving horse is straight when the amount its chest swings to the right with each step is exactly equalled by the amount it swings to the left.

This definition works great for horses that are moving in what are called the symmetrical gaits – walk, trot,

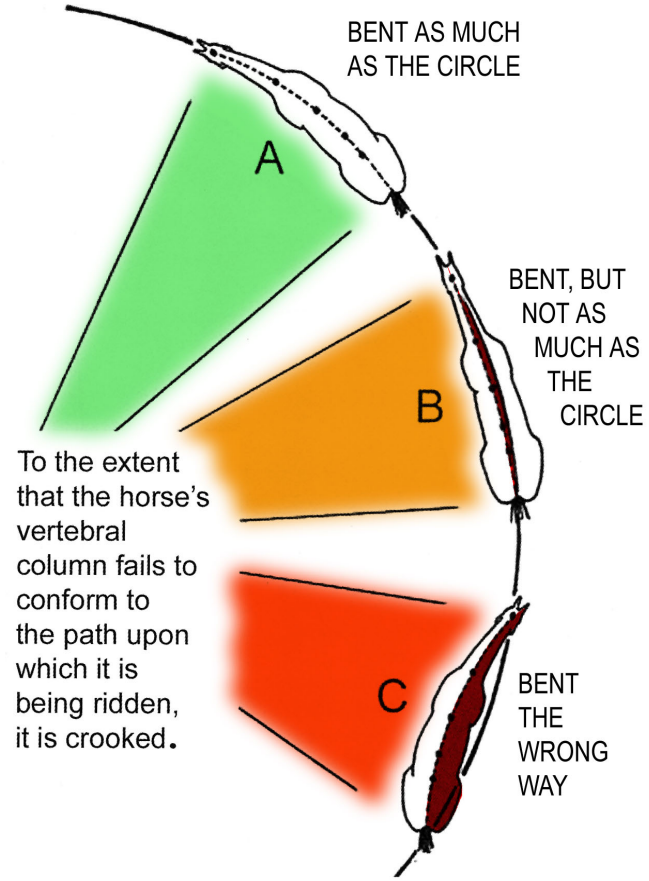

Figure 4. Horses travelling straight and crooked on a lefthand circle, seen from the top. Horse A is straight: the animal's spine conforms to the arc of the circle upon which it is being ridden. Horse C is obviously crooked; the big gray area shows the part of the horse that should be to the outside of the curve, but isn't. This would often be a horse owned by someone who hasn't heard how important it is for his ongoing soundness (and sanity) to travel straight. This sort of rider is usually easy to teach, glad to have the information, and readily makes the needed changes.

The difficult one will be Horse B, whose rider will often believe that her horse is straight when it travels this way. Her horse would be straight all right, if the intention was to travel upon a straight line, for horse B has equal weight in its inside and outside pairs of feet. What surprises the rider of Horse B is that when a horse is taken onto a circle and yet remains "straight" in this literal sense, she is actually teaching it to go crooked. She will then be frustrated (feel that her horse is "resisting") when she tries to get it to collect.

If she were instead riding Horse A, she would feel that he had more weight in his outside pair of feet than in his inside pair. She would feel that the horse sought and accepted contact on the outside rein without her having to take that contact; and that the animal was, overall, light, maneuverable, and easy to collect. Such desirable qualities are the fruits of straightness. Get your horse straight first and the doorway to collection will automatically open!

pace, and all forms of amble or "gait." It is the nature of those gaits to have the left and right halves of the body mirror each other with each stride. There are, however, two gaits—the canter and the gallop—that have "leads" and are thus called asymmetrical gaits. In those gaits, the outside pair of legs never reaches as far forward as the inside pair (that's what gives the appearance of the horse being on a "lead"). Thus, when a horse is on a left lead its chest is continually displaced to the right, and vice versa for the right lead; in these gaits the chest is always displaced to the outside. So, for horses moving in a canter or gallop, we need a further modification of the definition of straightness:

A horse moving in an asymmetrical gait is straight when the amount its chest swings to the right when it is on a left lead exactly equals the amount its chest swings to the left when it is on a right lead.

In other words, you really do have to follow the advice of every old horseman who ever wrote a book, and take care to exercise your horse at the canter equally on both the left and right leads. If you don't, you're building a crooked horse!

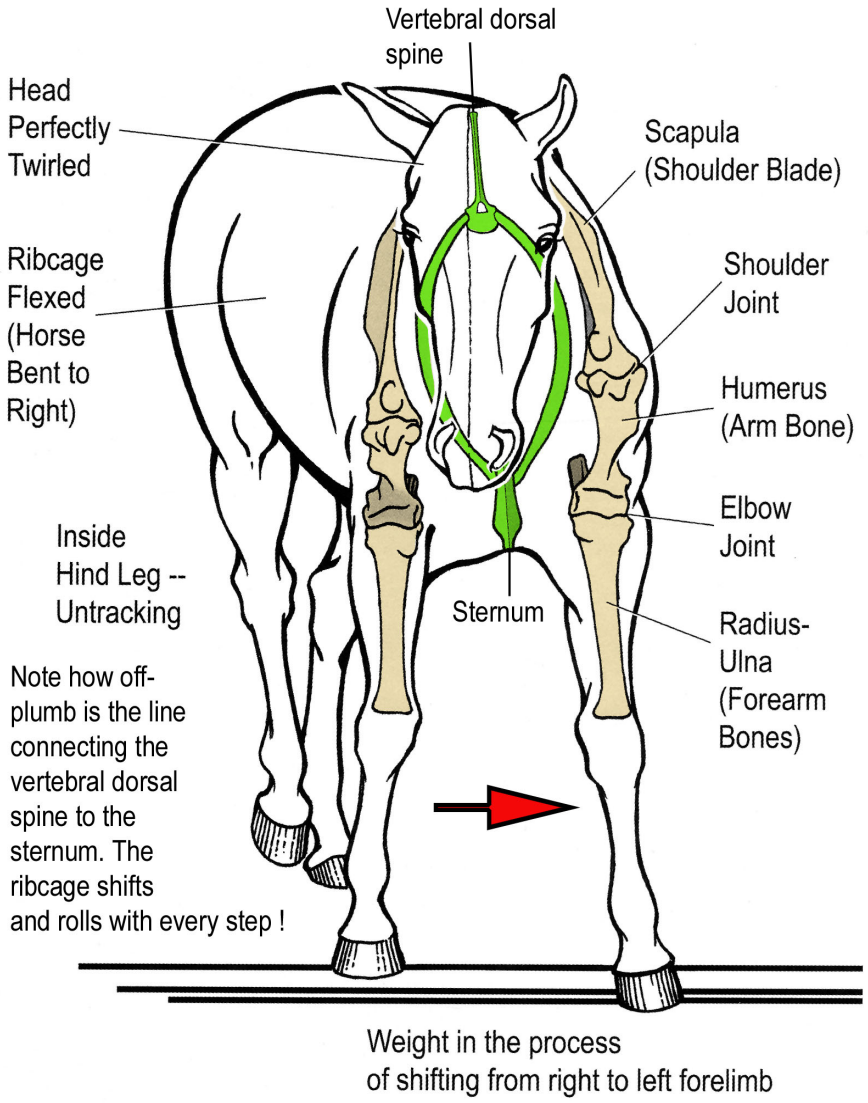

Figure 5. Full view of the mare in the moment of untracking. Note the perfectly twirled head, softly flexed rib cage, and inside hind leg crossing forward-and-under the body shadow. This is what a correctly bent horse looks like, outside and inside. Note the soft expression!

Whew! There seems to be a kind of hierarchy of understanding here—one realization piled on top of another. So, please hang in there for one more. Once you've got the picture, the above definitions work well when the horse is moving on a straight line. But as soon as the rider takes the horse onto a curved line – as soon as the horse bends to the arc of the curve he's being ridden upon – the horse cannot be "straight" with his chest swinging equally left and right. Instead:

A horse is straight when ridden on a curved line when, and only when, his chest swings more to the outside than it does to the inside.

"How much then," I can hear you cry, "do I have to displace the chest to the outside?" The answer is that the smaller the diameter of the circle upon which the horse is being ridden, the more the chest must be displaced to the outside. Fig. 4 shows the degree of error I see riders make: even the so-called "educated" rider will commonly underbend her horse by 5 to 15 degrees.

Remember that the horse's chest is very heavy. This means that when it is displaced to the outside, it causes weight to flow from the inside pair to the outside pair of legs. In other words, when the chest is displaced, the outside pair of legs carries more weight than the inside pair. Thus, if you are riding your horse upon a circle, you must feel that the animal is carrying 5% to 15% more weight on its outside pair of legs than on its inside pair. When ridden on a circle, the horse must anchor or "ground" itself upon the outside pair of legs (and especially upon the outside hind leg).

Curing Crookedness

I want to open this last section by telling a brief story. On one occasion some years ago, I overheard an 86-year-old horseman give a definition for straightness. All my complicated anatomy and biomechanics are overshadowed, I think, by the simplicity and straightforwardness of this old cowhand's thinking. I've never forgotten what he said:

"A horse is straight when it doesn't matter to him whether he works to the right, or whether he works to the left."

You see—I get to laugh at myself sometimes. And I used to love listening to this old man because he so often made me think, "ain't it the truth." So suppleness has something to do with achieving straightness, too: make sure that you bend your horse and get him straight on the circle as much to the right as to the left.

It might seem to you as if, in the brief space of this article, I have drifted away from talking about "straightness" into talking about "bending the horse on curved lines." The reason is that bending is the physical key to getting a horse straight.

If you're one of those folks that is plagued by literal-mindedness, you're going to have a difficult time with this. "Straight" does not mean ruler-straight; it means anatomically straight. An anatomically straight horse is one whose vertebrae all line up square to each other; one in which the bend, from poll to tail, forms as even an arc as is anatomically possible; one in which there is no point along the length of the spine where we can see or feel a kink or a sharp angle. And the only way to achieve anatomical straightness on a curved line is for the horse to bend his spine and rib cage as much as the line itself curves.

The image in Fig. 5 brings everything that has been said here together. The mare is in the very act of untracking. In this act, she will swing her inside hind foot forward-and-across to set it down under her navel. In doing so, she will necessarily press the thick muscles of her inner haunch (her "britches") against the wide rear span of her rib cage. To make room for that massive haunch, she must displace her rib cage to the outside, so that it comes closer to and pushes on her outside shoulder, as you learned from study of Fig. 3.

When she displaces her rib cage, it will cause her whole body to bend. As a counterweight to her shoulder and rib cage bending outward, her long neck will curve to the inside. In a supple horse that is calm, this will happen all by itself. If the horse is carrying a brace in its neck, the handler will want to twirl the head and may also need to ask for a little flexion at one or more joints along the length of the neck. As the brace goes out of the front end of the horse, it will also fade out of the back end, for the two are linked neurologically and biomechanically. The last section of the body in the ridden horse within which the brace typically fades out is the rib cage itself.

If this mare had been in the habit of travelling crooked —always leaning, let us say, to her right -- then asking her to untrack upon the right side will drive her to her own left, as you see happening in Fig. 5. Even the most braced and crooked horse will benefit from this, for it is the primary, universally applicable physical technique for eliminating crookedness and teaching the horse to carry itself straight.

Once you understand this, you will be able to help any horse you get on, for almost all ridden horses travel crooked most of the time. Crookedness has literally hundreds of negative manifestations (detailed in the "Woody" paper). All of them will diminish or totally go away once you begin riding the "snake trail" or figures-of-eight with this picture in mind.

And Now .... The Real Cure for Crookedness

I want to bring this article full circle by once again encouraging you to look at the "Woody" article. On p. 17 of that PDF document, you will see a photo of two riders going along at a canter. The rider in front rides a good broke old school horse who doesn't mind carrying a big flapping tarp. The rider in the rear is riding a 3-year-old Warmblood colt. Look at the ears and the whole body-expression of that colt: his mind and attention is totally focused upon that tarp. It is exactly as if the rider in front had used the tarp to reach down inside of that colt, pull attention and interest out of him, and then pull him along with it like a little kid would pull a toy wagon with a string.

Indeed, that rider is causing that colt to go straight: and she's doing it by no physical technique at all, but by means of the inner life that shines within all horses.

Our elderly teacher encouraged this practice and created an understanding in my mind of what it could mean to the horse if we would choose to incorporate this approach instead of just physically prodding and poking the horse all the time. He taught us insightful physical technique, but he never left the inner part out, either. What "following a drag" does is give the horse something to focus on, to attend to, to be interested in; it gives the ride meaning and purpose. So when you have learned the power of untracking to create a straighter horse, you will then regularly begin setting up situations in which the horse wants to go to a "target," or sees for himself the "snake trail" you intend to ride, or has a calf to follow. When you do that, you'll find that the degree of physical effort needed to help the horse to carry himself straight becomes much less or even falls to zero.