

THE PHYSIOLOGY OF TROTTING BREEDS-VERSUS-RUNNING BREEDS

Why we breed for trot. Why we judge the trot.

Why we train the trot: Part Three

By Stephen Kinney

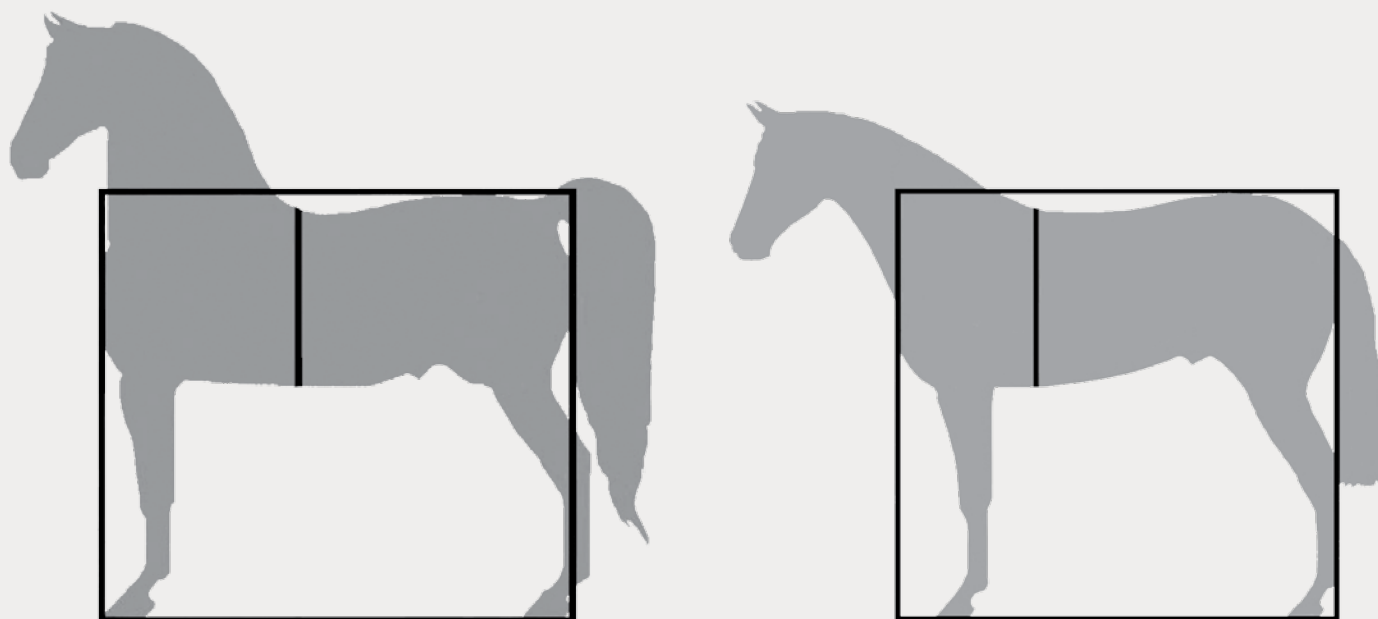
Artist and sculptor Denise Peterson has developed a fascinating theory pertaining to form and function in equine athletes. Her point of view describes how the horse evolved into two basic types: trotting horses and running horses. When you think of the equine species in this way, it helps make a lot of sense as to how the horse has aided its human companions over the generations, whether this involved fleeing enemies in the desert sands, pulling vehicles for transportation, or being a candidate for the various disciplines described in horse show prize lists. Denise Peterson has executed the artworks illustrating this article as well.

Denise, you are an artist and a sculptor. What do you have in your resume that provides you the expertise to address the differences in equine physiology?

I've been drawing horses since I was five or six. I always wanted a horse of my own so I used art to create my own "stable." It drove my teachers nuts. One in particular who was sure I was completely ignoring the class was amazed to discover that I had written down nearly everything he said and had filled every empty space with

drawings of horses.

Horses are one of the most difficult subjects to portray and an equine artist, especially one who does sculpture, must have an in depth understanding of how a horse is put together if they are to create an accurate rendition of their subject. I learned early on that horses with a similar type moved in a similar manner and the longer I studied conformation and form to function, the more this truth became apparent.



SILHOUETTES OF THE TROTTING HORSE (left) AND RUNNING HORSE (right)

Trotting Horse: Several things worthy of noting include the far forward position of front legs and resultant high neck position; the fact a plumb line dropped from base of the withers would intersect the underline about half way between elbow and stifle; the croup is longer and flatter as opposed to sloped; and the fact a plumb line dropped down the point of buttock would intersect the hock; Running Horse: In this diagram note that the foreleg sits further back of the horse's front end; the fact that a plumb line dropped from base of withers would transect the horse's undercarriage just behind the elbow; the point of hip is high as point of wither; and the plumb line dropped down the point of buttock lands just behind the cannon bone.

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TROTTER VERSUS RUNNER: FRONT (left) AND REAR (right) LEGS

Front Leg Skeleton: Note the angle of scapula to humerus in a runner is closer to 45 degrees, while the humerus of the trotting horse is closer to the perpendicular; Rear Leg Skeleton: The rear leg of a runner is straighter, meaning it will work like a “gondolier’s pole” in moving its load over the ground; The trotting horse has more angulation, aiding its function of transferring weight to the hind end and squatting to act like a loaded spring.

You make a distinction between trotting breeds and running or galloping breeds. Give some examples of breeds that fall into each of these categories.

OK. Running breeds include Thoroughbreds, Quarter Horses, and the original running horse, the Arabian from which they descend. Remember, Arabians were needed for flight from enemies in the sands of the desert. They had to run to survive.

Trotting type horses include Morgans, Standardbreds, Saddlebreds, Hackneys (both horses and ponies), and Dutch Harness Horses as well as the “baroque” breeds such as the Lippizaner, Freisian and Andalusian. The Morgan, often called America’s Baroque Breed, was instrumental in the development of most of the other American breeds such as Saddlebreds, Standardbreds, and Tennessee Walking Horses.

What functions went into the natural selection process that separated equine breed types into these two classifications?

Ability to execute the jobs for which they were needed with efficiency dictated conformation and form to function.

To be efficient, runners are built to move with a long, low stride and all four legs do their part in moving the horse forward in the gait, though the hind legs do more work than the front legs do.

They have a “laid back shoulder” with their bottom line being about the same length as the topline, the point of the buttock is lower than the point of the hip which allows the runner to use his spine to store and release energy from the hind quarters. A plumb

line dropped from the point of his buttock will fall behind the hock and his hindquarter is very muscular. They have long cannon bones and a long, low-set neck. If you look at their silhouette, the runner’s body fits into a square.

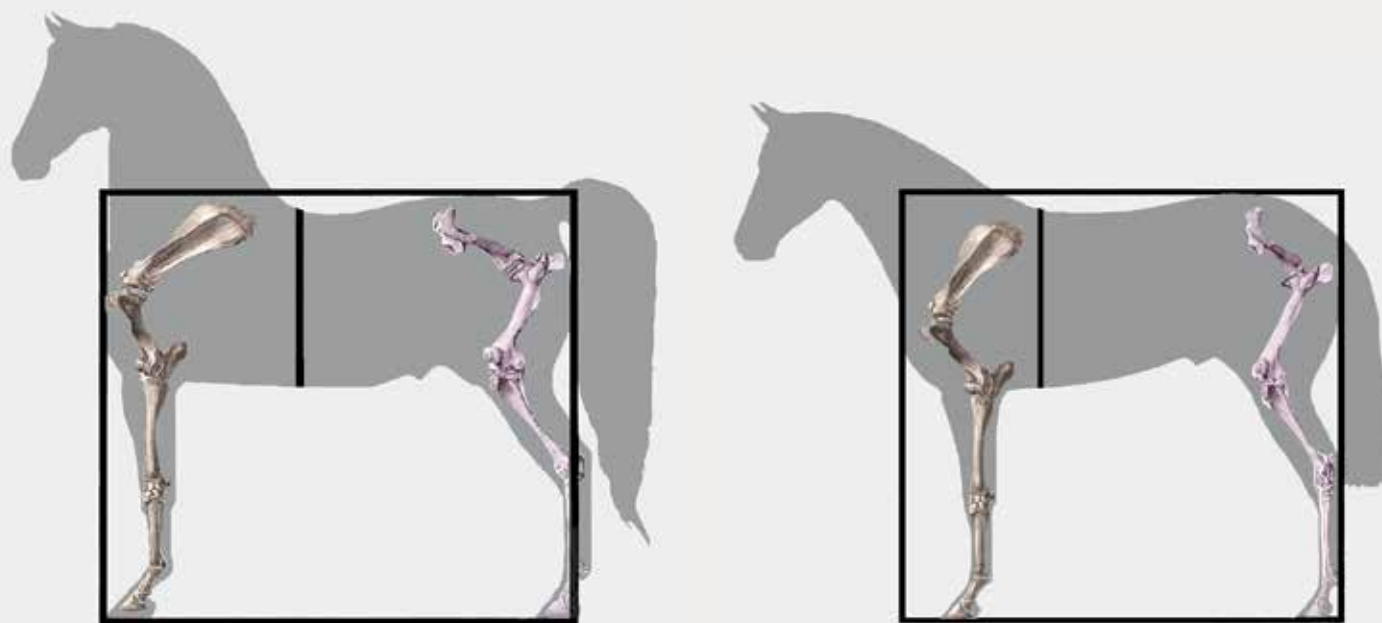
Again, trotting-bred horses move in such a way to maximize efficiency. The humerus bone is very close to being perpendicular to the ground. This puts the front legs at the front of the body and gives them a high, round stride. A plumb line dropped from the last hairs of the withers will fall far behind the elbow, almost halfway between the elbow and the stifle, giving the impression that the horse is longer on the bottom than he is on the top.

His back is shorter and he is close coupled. A line drawn from the point of the hip to the point of the buttock is closer to being level, giving the trotting horse a rounded croup and a high-set tail, rather than the steeply sloping croup and low set tail seen on Thoroughbreds and Quarter Horses. A plumb line dropped from the point of the buttock will bisect the hock. The set of their pelvis also gives them a deep hindquarter. Add to that a shorter cannon bone, and the resulting silhouette is rectangular rather than square.

The Morgan breed type standard brags of a laid back shoulder, but don’t most breeds make the same claim? Why do all breeds have a shoulder closer to the horizontal than to the vertical?

A straight shoulder in any breed gives the horse a short, choppy stride. The shoulder blade and the humerus bone only have a certain arc of motion, a straight shoulder has a limited range of

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ANATOMICAL STRUCTURE OF THE TROTTING HORSE (left) AND RUNNING HORSE (right).

motion and cannot function in an efficient manner to propel the horse forward.

I've read your points about the differing configurations of shoulder bones (scapula and humerus) of the trotting breeds versus the galloping breeds. Can you elaborate on where they differ?

OK. First let's define a couple of terms. The scapula is the large, flat bone that underlies the horse's shoulder. It is also called the shoulder blade. The humerus is the bone that connects the scapula to the elbow.

The difference between a trotting horse shoulder and a running horse shoulder is not the angle of the scapula but, rather, the angle of the humerus bone where it meets the scapula. In the running breeds the angle of scapula to humerus is something close to 45 degrees. In a trotting horse, the humerus bone is almost perpendicular to the ground, which puts the front legs at the front of the body. This is what gives them a high, round motion, compared to the running horse with his long, low stride.

Another distinction is easily observed. Both types probably have similar ranges of motion, but to do its job the trotting horse moves the forearm up and out; in execution of its job, the running horse takes a long, low stride underneath the horse. You will observe that the shoulder bones of a trotting horse, when in motion, push up into the neck; the shoulder bones of a running horse pull downward, over the rib cage.

Why do all trotting breeds bend their knees when they trot whereas galloping breeds tend to have straight legged trots?

In the trotting breeds, the front limbs actually do very little to attain speed at the trot, the high, round action basically keeps the front legs out of the way of the hind legs. Look at racing Standardbreds. They race with a high-checked head and a high,

round gait with their front legs. The same goes for Hackneys and Saddlebreds. Even Clydesdales, who are draft horses, are bred for a stylish trot.

How do trotting horses use their physiology to do their work (which includes carrying riders and pulling a vehicle) as opposed to how runners use their legs? The running breeds tend to be high over their hips with sloping croups. The trotting breeds seem to be level in that area of their anatomy.

As a running horse moves forward, each leg in turn is swung forward in a low flat arc, hits the ground and stays straight as the connecting muscles pull the leg backwards, propelling the animal forward with two points in the gait when all four feet are off the ground.

A trotter gets most of his speed from his hindquarters and his stiffer shorter spine. Each hind leg in turn, pushes forward. The set of angles in the trotting horse hindquarter allows him to load his hindquarters by squatting down rather than arching his back to bring his hindquarters underneath him as a running horse has to do.

This is well illustrated when you consider where the rider sits on the horse, runner versus trotter. The rider on a racehorse or a jumper sits with his weight balanced over the withers of the horse. The rider on a Morgan (or any of the other show breeds who move with high, round action) sits back and puts his center of balance so that it helps the horse rise up and lighten its forehand.

How did this develop?

It is form to function—you breed what you need. Breeders select for the set of attributes that makes the horse suitable for the use to which they intend to put him. Over generations, especially in a "closed book" (registry), the selected for traits become more homozygous and are therefore passed on to later generations with a higher level of success.



TROTTER VERSUS RUNNER

LEFT: A Standardbred horse (the great Googoo Gaagaa) trotting as the front leg reaches an extreme in its range of motion. Note that the shoulder bones push up into the neck participating in the “up and out” motion of the front arm. The shorter, stiffer back dictates that the hind legs—which do most of the work—are spring-like. The croup drops rather than the back rounding; **RIGHT:** A Thoroughbred race horse (Secretariat, quite possibly the greatest one of all time) running. Note how the shoulder pulls down toward the rib cage and all the motion is under the horse. The running horse has a longer, rounder back and takes a longer stride behind.

Do you have any theories about why the trotting breeds have high set necks (and, conversely, running breeds carry their necks more parallel to the ground)?

A running horse has a low set neck that is used as a pendulum to help carry the animal forward in much the same manner that you use your legs and body to make a swing go higher. You will very rarely, if ever, see a successful distance runner who has an upright neck as that is the sign of a sprinter at best.

With trotting horses it seems that the more perpendicular the humerus bone, the higher the horse’s head carriage is and it’s all

about getting the front end elevated, which increases efficiency at the trot.

Do you ever speculate that form over a breed’s evolution was selected partially by the equipment they carried—i.e. harness horses conformed to parts of the harness; Baroque horses had to carry a curb bit; etc?

The equipment didn’t push breeding choices, rather, the equipment evolved as a way to increase the ability of the horse to do the job for which he was bred. ■

Previous articles in this series include: “Channeling Gladys Brown Edwards,” August 2012 and “How They Trot High,” September/October 2012. Both articles are archived at www.morganhorse.com/about/breed-magazine/archives/.

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