

A NATIONAL 4-H COUNCIL PUBLICATION

horse science

an educational resource



4-H HORSE PROGRAM SERIES



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BEHAVIOR AND NATURE

Cavy. A collection of horses.

Cribbing. Biting or setting teeth against manger or some other object while sucking air.

Haw. A third eyelid or membrane in front of eye, which removes foreign bodies from the eye.

Headshy. Applied to a horse that is sensitive about the head; jerks away when touched.

Herd bound. A horse that refuses to leave a group of other horses.

Pointing. Standing with a front leg extended more than normal, a sign of lameness.

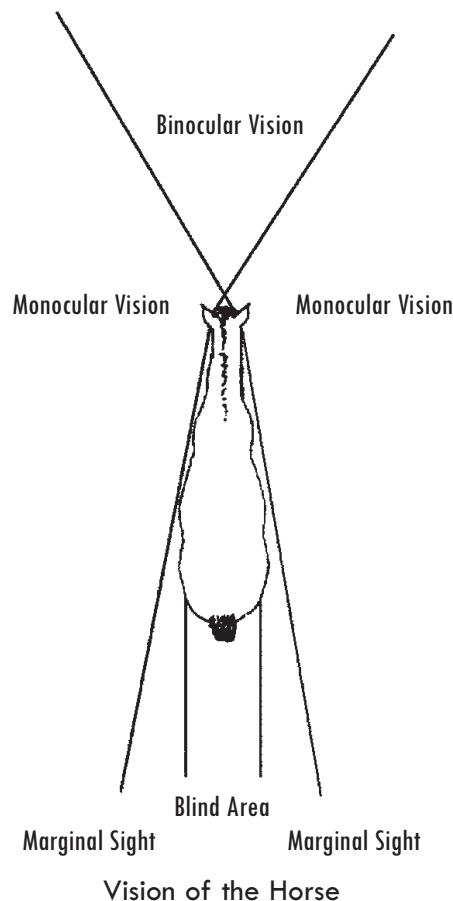
Since the time of ancient civilization, the horse has served man well. The horse was first a war machine and that was its principle role until World War II. Likewise, the modern age has also relieved the horse of heavy duty as a beast of burden. Now equines serve man in a greater way than ever before as a means of recreation and escape from pressure and tension of present-day living. This great versatility is possessed only by the horse because of its (1) anatomical structure and function, (2) speed and endurance, and (3) fear of being hurt. The combination of these characteristics has made it possible for man to obtain performance from the horse far beyond what is possible with any other animal.

ORIGIN OF THE HORSE

The horse had its beginning about 58 million years ago. The original home was in what is now the Great Plains area of North America. The horse evolved in three stages into its present form. The original ancestor (Eohippus) was only about 12 inches high with four toes on each front foot and three toes on each hind foot. Eohippus had a short neck, even teeth, and was well-adapted to living in a forested and swampy environment. As the earth underwent geologic changes, the horse evolved into a second stage (Mesohippus). Here it became larger (about 24 inches high), developed longer legs with only three toes on each foot. The middle toe was the largest. Mesohippus developed teeth suitable for grazing on the prairie and greater speed and endurance for finding forage and water as well as for protection and survival. These changes resulted from gradual adjustment to changing surroundings over millions of years.

Fossil remains have definitely established that the horse originated in North America beginning with Eohippus. There may have been an earlier five-toed ancestor, but no fossil remains have so far been found.

The third and final stage in the evolution of the horse into the present form (Equus) also took place in North America but this species completely died out for reasons yet unknown. Fortunately, some of the population escaped to Asia during the Ice Age (about one million years after Eohippus) by way of what may have been a land bridge in



Vice. An acquired habit that is annoying, or may interfere with the horse's usefulness, such as cribbing.

the Bering Strait area between Alaska and Siberia. It was, therefore, in Asia and Europe that the horse completed development and was domesticated. Horses did not return to North America until brought by the Spaniards in the Sixteenth Century.

An important point is not how the horse developed into the present form, but why. Besides having to go further in search of feed and water, the horse also had to be able to run faster and further to escape enemies. The horse is not the fastest animal on foot, but possesses great endurance. The horse is, therefore, a creature of the open country and to this day, its first reaction to any strange or frightening object or situation is to panic and run away. This great fear of the unusual, plus the speed and endurance developed at the gallop, has made the horse a most valuable animal to man. But, it has also made it one of the most dangerous. Unlike a bull or lion, the horse seldom attacks directly. In a instant of fright, a horse can become completely unreliable and even pay no attention to its own safety. It might, therefore, be said that the modern horse must depend on man for safety.

The name eohippus or “dawn horse” is derived from the Greek work “eos” meaning dawn. The word horse comes from the Anglo-Saxon word “hors” meaning swiftness.

FUNCTIONAL DIVISIONS OF THE HORSE

The Head and Neck

The head and neck serve the same purpose on the horse as on other animals. As far as behavior is concerned, the most important feature of this portion of the horse’s physical make-up is the eye.

The eyes of the horse are rather large and set wide apart on the sides of the head. This gives the horse monocular vision or the ability to see separate objects with each eye at the same time. This increased side vision helps protect the horse from predators, so it can see danger coming from either side without turning its head. The horse can see anything behind it that is not narrower than its body. The areas not in eye sight, such as directly behind its hindquarters and directly below its head, are called “blind spots”.

The horse has binocular vision when looking at the same thing with both eyes at once. The horse uses binocular vision when interested or excited enough to lift its head and point the ears forward. In such case, the object must be some distance away and not closer than four feet. The horse cannot see directly downward and therefore can’t see what it is eating. Neither can a high-headed horse see the ground directly in front of it.

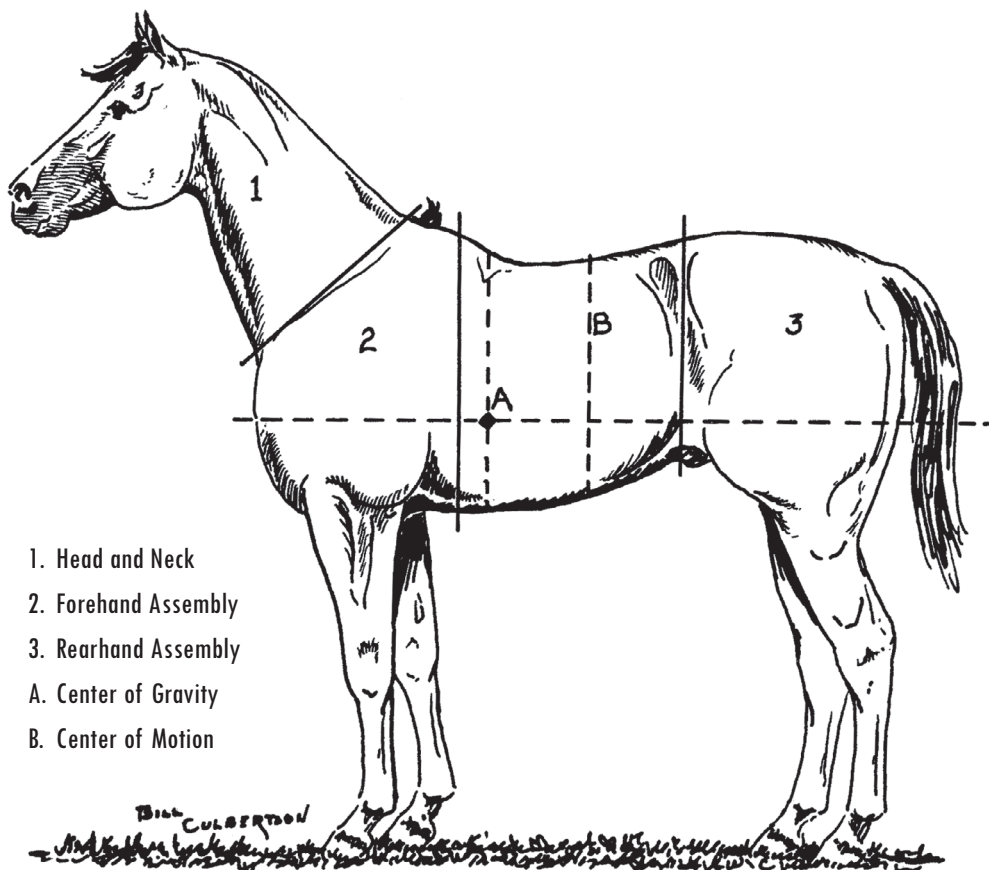
The horse, having the ability to make a quick getaway, has no need for acute vision as does man. However, the ability to see objects on either side at once, and to the rear, has been a prime feature of the horse’s ability to survive. A grazing horse can see almost all the way around its body.

It is believed that horses do not all have perfect eyesight. No doubt, poor eyesight may have an effect on the behavior of certain horses. Shying at unfamiliar objects may be the result of faulty vision. It takes time for a horse to adjust its eyesight to a dark stall, trailer, or building.

The eyesight being very sensitive to quick movements, alerts the horse to possible danger. Any training procedure involving quick motions, such as roping or polo must be started slowly and accelerated only after the horse has become familiar with the motion.

The Forehand Assembly

Although no one foot or leg has a single function, the front feet and legs serve primarily to support the horse at rest. In motion the front feet and legs also pull the horse forward. The horse's center of gravity is located at a point about six inches behind the elbow. At rest, the front feet and legs support 9 to 10 % more weight than the hind legs. The healthy horse at rest does not shift its weight from one front foot to the other, but is continually shifting weight between the hind feet. When one front foot is injured, the horse may shift weight to the other foot. As a result, the healthy foot may go bad from lack of exercise necessary to promote circulation. To keep feet healthy, a horse must have plenty of exercise. Stabled, or closely confined horses often become nervous and this may well be due to their feet hurting from lack of exercise.



- 1. Head and Neck
- 2. Forehand Assembly
- 3. Rearhand Assembly
- A. Center of Gravity
- B. Center of Motion

Functional Divisions of the Horse

The horse is suspended between its front legs. The front legs are not attached to the main skeleton by any joints, but held in position by muscular structures. This provides the horse with an almost perfect suspension system for the body. This, along with the elastic and expansive properties of the foot and the angle of the pastern joint, enables

the horse to absorb and dissipate a tremendous amount of shock when in motion. For example, an 1100-pound horse carrying 200 pounds weight and running a quarter-mile in 45 seconds with a stride of 20 feet will absorb and dissipate nearly a ton per second on the lead foot. In so doing, it leaves only a shallow hoofprint in the dust.

The Rearhand Assembly

This is the horse's powerhouse or propeller and serves to push the horse along in motion. The hind feet and legs also offer support at rest and catch weight at the end of flight in motion. Although the structure of the hind feet and legs is similar to that of the forelegs, less lameness and unsoundness occurs in the hind feet and legs because they support less weight and do less work. Proof of this is that the hind feet grow faster than the front feet.

While the horse's center of gravity is located about six inches behind the elbow, the center of motion is located approximately over the 15th vertebra. This bony structure is the most upright member of the spinal column and on a mature horse is about 10 inches behind the center of gravity. The horse in motion goes with these two centers in their relative positions. The position of the center of gravity can be altered by the rider shifting weight from side to side or from front to rear. The horse can even shift the center of gravity by raising, lowering or extending its head. In contrast, the center of motion appears to be rather fixed. A rider's weight, positioned as nearly as possible over the center of motion, offers the greatest stability and interferes with motion the least. Weight too far back lessens the horse's propelling power.

THE POWER OF ASSOCIATION

In the struggle to survive through the ages, the horse has learned to avoid or escape situations in which it might get hurt. Horses developed a great power of association. This is the basis of horse training.

To capitalize on the horse's power of association, signals or cues and punishment in training must be in proper sequence. For example, to teach a horse a particular movement or response, the appropriate signal must first be given and then followed immediately with some stronger force or punishment which will result in the horse responding in the desired manner. Once the horse has learned the lesson, the punishment must be stopped and not used again except as a necessary reminder. Reversing the sequence of signal and punishment will only confuse the horse.

Horses are born with a certain amount of intelligence which must be developed by training and good habits. What a horse knows must be taught by man and, depending on training, this can either be good or bad.

The horse may shy at unfamiliar objects. It may also shy at familiar objects not in their usual place. Regardless, the horse must never be punished in such situations or due to the power of association, it may develop a bad habit of shying at every strange object seen. With the horse's attention focused on the unfamiliar object, if it can think at all, blames the object for the subsequent punishment. Therefore, it is better to let the horse study the object until it learns it will not inflict harm and thereby gain confidence in the rider.

FUNCTIONAL ANATOMY AND ACTION

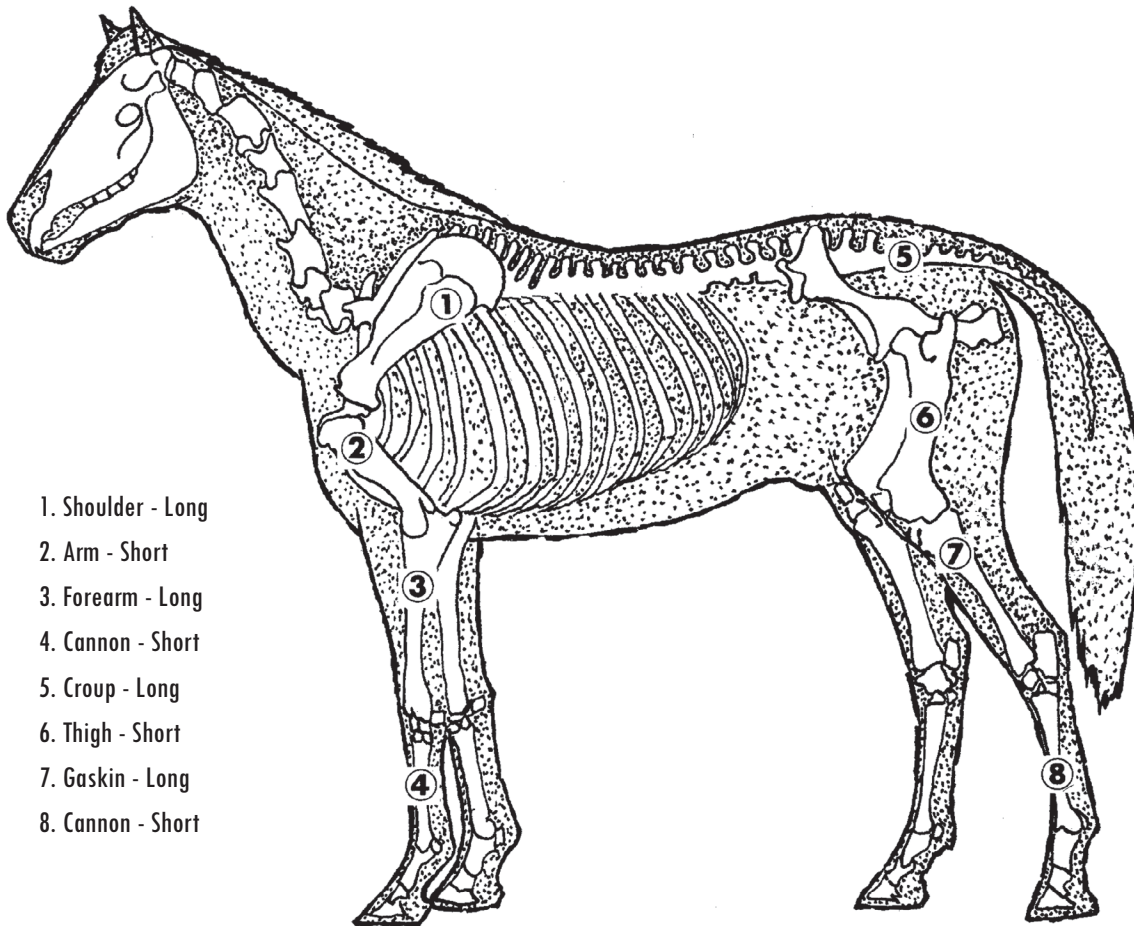
Bugeyed. Eye protruding; horse usually cannot see well.

Forehand. The fore part of a horse; the forelegs, head, and shoulders.

Symmetrical. Proper balance or relationship of all parts.

Since both conformation and action need to be included in horse evaluation, the basic conformation features tending to affect action must be understood. The relationship of body parts to performance (form to function) will be discussed with the body of the horse divided into four areas:

Head and Neck, Fore Quarters, Body or Trunk, and Rear Quarters.



1. Shoulder - Long
2. Arm - Short
3. Forearm - Long
4. Cannon - Short
5. Croup - Long
6. Thigh - Short
7. Gaskin - Long
8. Cannon - Short

Skeleton of Horse Showing Relative Position and Size of Bony Parts

HEAD AND NECK

The ideal head for each breed is described by the association publications. The descriptions all say the head should be broad in the forehead and between the eyes,

short from the eyes to the nostrils, and deep in the jaws. The head should be in proportion to the parts of the body of the horse. The proportion of the head tends to be an indication of body proportions. For example, a long narrow head indicates a long, shallow, narrow body. Coarseness about the head indicates a coarse body, lacking quality.

The ear should be medium size, attractively set and carried at a 45-degree angle to the axis of the head. Large, full, prominent eyes of a clear deep color are desired. Small blue eyes are considered weak. Small narrow, squinty eyes are often correlated with coarseness in quality and a lazy, sluggish disposition.

Large nostrils allow for a maximum air intake and are of prime importance because the horse cannot force air into the lungs through the mouth as is possible in other species of animals. All breathing of air by the horse must be done through the nostrils.

All horses, both long and short necked ones, have seven cervical vertebrae. The shape of the neck is due largely to the amount and shape of the muscle tissue. The neck should be long, lean, and attached high up on shoulders with prominent withers. The lower part of the neck should be attached above the point of the shoulders. The throatlatch should be clean cut and free from thick, meaty or fatty tissue to facilitate movement of the head at the poll and allow easy breathing.

Length of neck plays an important part in length of stride. Over the neck lie several layers of muscles, some of which control the movement of the scapula or shoulder blade, the arm, and indirectly the forearm. The muscles that control leg movements terminate at the knee. Cannon, pastern and foot action is controlled by ligaments and tendons. Longer neck muscles allow more muscle contraction extending the arm further and raising the forearm higher. This results in a longer stride. Another set of muscles extends from the front of the neck to the shoulder blade. Longer muscles here allow more shoulder blade movement and thus a longer stride.

A thick neck adds excess weight to the front end. This causes increased shock to the front legs because they ordinarily carry more of the body weight of the horse than the rear legs. A thick neck also decreases head movement.

FORE QUARTERS

The withers should be prominent, high and well defined. They should extend rearward about one-quarter of the distance from the point of the shoulder to the rear flanks. This is not possible unless the shoulder is long and has about a 45-degree slope. Such withers give the horse an opportunity to have a long stride besides providing a good seat for the saddle.

The shoulder should be long, flat and smooth, with a 45-degree slope. This allows for increased shoulder movement, which determines the arm movement and affects the stride. In a steep-shouldered horse, the arm does not extend very far forward during movement. This decreases extension of the forearm and gives a short stride. Accordingly, the slope of the shoulder increases length of the muscles and allows for more contraction and greater range of movement of the front leg.

The legs of the horse should be attached to the trunk to give the appearance of being on the four corners of the body. When viewed from the front, the canons should

descend from the center of the knees. Cannon bones should give the appearance of being flat when viewed from the side. This doesn't mean that the bones themselves are flat, but that the splint bones and large tendons and ligaments are set apart, and give support at the posterior of the legs.

The front feet should be large, symmetrical and set at the same angle as the pastern. The foot should be especially wide at the heel and have considerable height at the heel as long as it is in keeping with the desired angle.

When viewed from the side the best combination of length for the various parts of the front quarters calls for a long shoulder, short arm, long forearm and short cannon. This gives a longer, more elastic stride and more speed.

A steep shoulder coupled with a long arm, short forearm and long cannon is the most undesirable shoulder and leg structure. This gives a severely shortened stride. Steep shoulders are usually associated with short, steep pasterns giving a hard, jolting ride because of decreased shock absorption.

A long sloping shoulder also forms a more desirable base for neck attachment giving a better balanced, more attractive horse.

TRUNK OR BODY

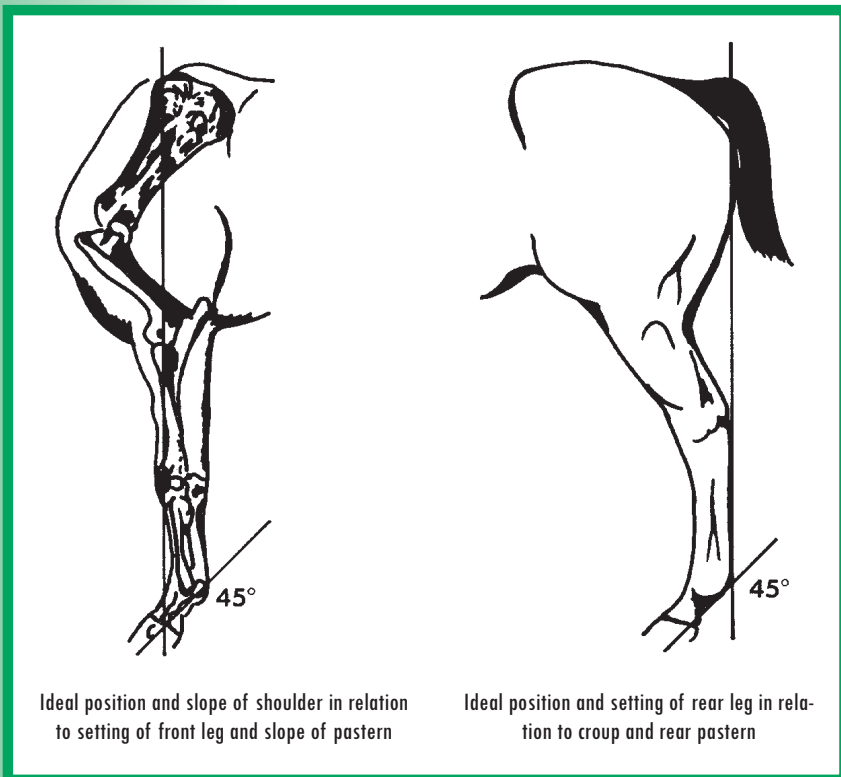
The trunk or body of the horse should be deep and broad. The back should be short and the loin wide and smooth. The back and loin together make up the top line which

must be strong to protect internal organs, bear the weight of the rider and transmit to the front end the propulsion generated by the hind legs. The loin has no bone structure for support, making it the weakest part of the top line. The loin is a bridge between the rib cage and the hips. In order for the loin to perform its function of transmitting power from the rear to front end, it must be short and heavily muscled.

The back, which must also be short and heavily muscled, gets additional support from the rib cage. Often weak backs result from weak loins.

A short back and loin coupled with desirable shoulder and withers results in a long underline. However, a long underline does not insure a large body capacity unless it is combined with long,

deep, well sprung ribs. This combination of short back and loin, long underline and long, deep, well-sprung ribs insures ample capacity for breathing and consuming feed. Length of underline also affects freedom of leg movement. A short underline can cause a horse



Ideal position and slope of shoulder in relation to setting of front leg and slope of pastern

Ideal position and setting of rear leg in relation to croup and rear pastern

to forge. This is striking the undersurface of the front foot with the toe of the rear foot.

REAR QUARTERS

The croup or rump should be long, wide and level. This is the area from the loin to the tail head. Although the slope of the croup differs with breeds, a level croup has longer muscles that enable a horse to take long strides, maintain speed for great distances, and have more power. A more sloping croup sets the rear legs further under the horse so it may make a quicker start with a powerful stride. Regardless of breed or slope to the croup, it should be long so the croup muscles can make maximum contraction. All muscles in the croup and thigh must be strong to supply the power from the rear quarters to propel the horse.

Adequate gaskin muscling is desired. The outer gaskin muscles help to pull the leg forward and enable propulsion, giving the horse a long, powerful stride.

The rear quarter is comparable to the forequarter in that a long croup, short thigh, long gaskin and short cannon gives the best stride.

ACTION

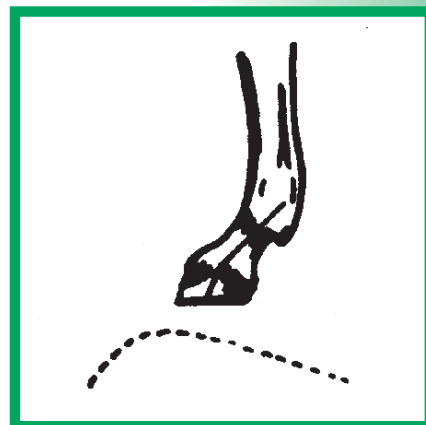
A long, straight, free elastic stride and coordinated, collected action is desirable. Excess lateral movement of the feet and legs reduces efficiency. Action is affected by the set of the feet and legs as well as by the anatomical characteristics already mentioned.

Examples of anatomical features relating form to action:

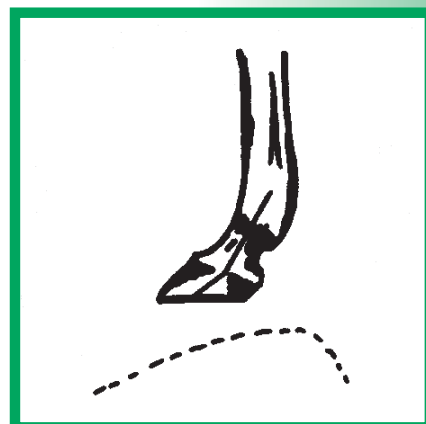
1. A thick neck and filled throat latch gives a lack of flexion of the head and slow, awkward turns.
2. Length and slope of shoulders tends to correspond to length and slope of pasterns. Properly sloped shoulders and pasterns (45 degrees) are related to a springy stride. Length of shoulders and pasterns is related to the length of stride.
3. Long forearms and gaskins are related to length of stride.
4. Horses standing straight on front feet are more apt to show straight stride and true action.
5. Short, straight shoulders give short, straight stride with concussion.
6. If the front legs are set far out on the corners of the body, a rolling, laboring action in front will result.
7. When points of the hocks turn outward, often a defect in action called limber hocks or rotating hocks occurs.
8. A calf-kneed position of the front legs gives a pounding gait and hard concussion of feet at completion of the stride.
9. Pigeon toed horse will paddle or wing out when traveling.
10. A splayfooted or toe-wide horse will dish or wing in when it moves.
11. A straight stilty angle of pasterns will give a stilty action and may give cocked ankles or other unsoundnesses such as sidebones.



Normal foot forms even arc in flight



Too stubby - high heel and short toe causes lengthening of first half of stride, long heel touches ground earlier which shortens last half of stride



Long toe - short heel causes shortening of first half of stride and lengthening last half of stride