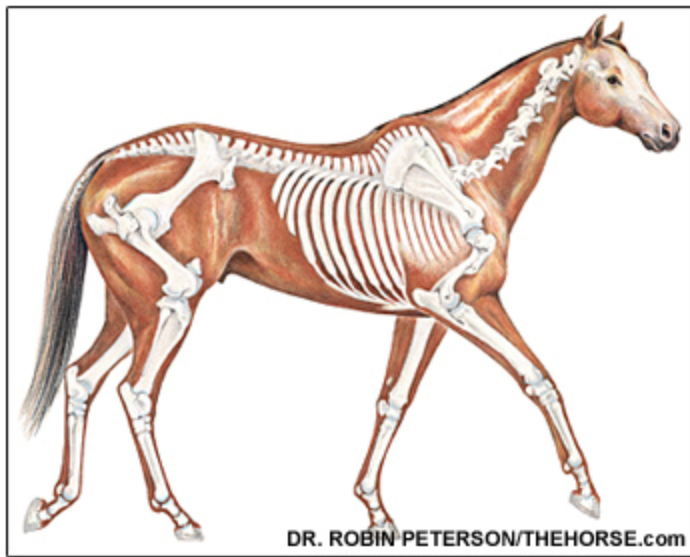


Comparing Horses & Humans

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Comparisons of humans to horses logically can start with the anatomy. We stand upright; horses stand prone on their four limbs. What we call our knees are the stifles of horses, and our heels or ankles are horses' hocks. Our foot is their cannon bone, and from the fetlocks to the ground are our fingers and toes. Our fingernail is their hoof, and our nail growth generates from the cuticle, their hoof from the coronary band. The hoof is the weight-bearing structure so susceptible to laminitis (founder). Humans don't founder, although a diabetic's loss of blood supply to the legs has some comparable pathology.

The forelimb is complex in the horse, with the head and neck being a crane-like structure that causes 60% of a horse's body weight distribution to the forelimbs. Therefore, impact is greatest on the front legs (except when pushing off from behind).



Equine skeletal anatomy

What we really call the horse's knee is our wrist. From our wrist to the first knuckle is their single cannon bone, with the splints along the side being remnants of our other palm bones. Again, each finger is analogous to the horse's single fetlock and hoof. Our hands and feet are well endowed with muscle. Contrary, the forelimbs and hind limbs of the horse are essentially devoid of muscle below their so-called knees and hocks, with the tendons and ligaments being a "spring loading" system of recoil that adds to their

efficiency of movement.

Because we stand upright and they are prone, this creates the forelimb concussion issue for the horse, but also loads the spring.

Horses don't have clavicles (collarbones), so the front limbs are held to the body by soft tissue alone (muscle, tendons, and fibrous sheets of fascia).

More on the Inside

Internally, the horse has lungs similar to ours, but a gastrointestinal tract that is more complicated. Humans are omnivores (eating both meat and plant material), while the horse is a herbivore (grass eater or grazing species). The horse stomach is relatively small (3-5 gallons) compared to the overall size of the animal, and it has a muscular valve from the esophagus to the stomach that prevents vomiting. If the valve is not stimulated, the horse can passively reflux up to the oral cavity. Humans can vomit, and sometimes learn to vomit at will.

The stomach of the horse is divided into two sections, a glandular and a non-glandular (squamous) section, separated by a demarcation called the margo plicatus. Humans have a uniform stomach similar to that of pigs; in fact a pig gastrointestinal tract is often used as a research model for human research. All these species get gastric ulcers, principally from stress and confinement.

The lobes of the liver are similar in both species except that the horse has a bile duct that empties into the duodenum, but unlike us, horses *do not* have a gall bladder.

Horses and humans have similar small intestines divided into the duodenum, jejunum, and ileum. The small intestine is about 70 feet long in the adult horse; and the stomach and small intestines are responsible for initiating the digestive process. The horse's gastrointestinal tract is subject to parasite infestation that can cause problems. An example of this is a tapeworm infestation where the valve of the ileum enters the cecum and colon. The cecum is a large "blind sac" in the horse, analogous to the human's relatively small appendix.

The cecum and colon of the horse combine to provide digestive hind-gut fermentation. The colon is about 35 feet long in the horse and unsecured enough to displace or twist, causing mild to severe colic.



Other Organs

The horse's eyes are located to where vision is almost a complete arc with only a minimal blind spot in the front and one down a line in the back. This allows for predators to be spotted from the rear, and we often learn unexpectedly that the horse can generate its "spook" or flight response from a perceived threat that comes from behind. Human eyes are obviously focused to the front, like most predators, and our opposition can easily sneak up on us from the rear. Horses see some color, but significantly less than humans.

The Equine Ear

It is often said that horses see with their ears. This is true in that their visual to mental focus can be observed by where they point their ears, except when in an intense mental state such as anger or aggression. Outside of the occasional ear wiggling by a comic, we must turn our heads to increase our sound reception.

Horses are obligate nasal breathers; they do not breathe through their mouths. Therefore, the long nostrils and nasal passages have very important roles in air filtration, warming of the air, and humidification. These air-purifying features of the head help horses tolerate much of the adverse air environment of stall confinement. This upper airway system is most often overloaded in times of high heat and humidity. Humans, on the other hand will adjust by mouth breathing (or by turning on the air conditioner)!

Horse's lungs are like ours, a large left and right lobe, with a smaller accessory lobe on the right side. The microstructure of bronchii to the alveoli (air sacs) are also essentially the same. Both species can develop enlarged air sacs (emphysema). The major difference in infectious insults is in the gravitation of infection and particles to our lower backs as opposed to the horse gravitating low to the chest near the elbows. An example of this would be aspiration pneumonia. This is again due to the differences between our upright vs. their prone body position. This distribution aspect of pathogens becomes more equal to the horse when humans become "bedridden."

Horses need their heads down grazing and eating for gravity to aid in mucus elimination from their longer tracheas to the head. It has been shown that tying the horse's head up--such as during transport--increases the potential to develop respiratory disease. We would need to stand on our heads to duplicate the horse's clearance mechanism. No wonder our respiratory hacking coughs seem to last forever!

The skin of horse's and humans are both relatively thin compared to many other species. But horse's can cheat our observation skills by having both hair and pigment to hide injury or disease. We must therefore examine the mucus membranes.

To the Heart of the Matter

Humans have type A hearts and horses have type B. These determinations were not made by psychiatry, but by anatomists and physiologists. The findings are the cardiac electrical conduction systems of a stalking predator versus a flight animal, the latter having an enormous ability for the athletic first response that can take a heart rate from resting to about 300 beats per minute coming out of a starting gate. Horses epitomize the controlled flight response adapted to human sport, and humans often try to emulate the horse's performance in their personal sporting ambitions.

The horse epitomizes the aspects of being a flight animal by its unique heart electrical conduction system, its spleen, and the act of birthing. The human is pale by physiologic comparison.

The horse shows status as a flight animal by its unique heart electrical conduction system, its spleen, and the act of birthing. The human is pale by physiologic comparison.

The heart of the horse is structurally similar to humans with the same four chambers and heart valves. The differences lie in the ability to contract the cardiac muscle fibers by activating electrical stimulation, not in a linear highway of conduction (type A), but that of a conduction system that reverses direction at the same time as flowing forward. The synchrony of cardiac muscle contraction in the horse is so swift that EKG interpretations used in human and other species diagnostics are not appropriate in the horse. For example, cardiac axis determinations used to localize infarcts or individual heart chamber enlargements in humans is rarely definitive in horses.

The use of EKGs to determine heart size in horses has been used through the years in horses and called the " heart score. " This is determined by measuring the ventricular width of an EKG by the average of three separate EKG leads. This methodology has been largely replaced by direct ultrasound measurements. Like humans, cardiac enlargement is a function of athletic fitness and has not been shown to have a direct predictability in untrained horses or humans.

The spleen of the horse is capable of storing 20-30% of the horse's red cells. Whole blood in the horse is about 8% of its body weight, or 9-10 gallons. They obviously don't need blood doping since the adrenalin of the flight response results in the contraction of the spleen. When this occurs, the general circulation is suddenly endowed with this tremendous red cell reserve of oxygen carrying capacity needed for additive oxygenation and energy. Humans athletes might cheat with blood manipulation because they can't comparatively do this.

This is just not needed in the horse and, adversely, erythropoietin (EPO) injections in horses can result in anemia and death as the horse builds antibodies to this foreign injection. These antibodies cross over to eliminate both the foreign and the horse's own erythropoietin. The result is a bone marrow that no longer gets erythropoietin stimulation, so a potentially fatal anemia may finally result.

Muscles in horses are like those in humans with fast twitch and slow twitch fibers. Fast twitch is associated with sprinting and slow twitch with stamina and distance. This is the same in humans and is most appropriately genetically pre-determined. A muscle biopsy (tissue sample) is the principle means by which muscle fiber types are proportionally determined.

Birth to Flight

The act of foaling separates the mare from all other species by an explosive process that takes 20-45 minutes to complete. No other domestic species, humans or otherwise, are comparable. The normal foaling results in a foal that is out and usually up and nursing within two hours. No other species does this. The human birthing can be long hours in the process--and a toddler takes one to two years to get up and moving on two legs. No other species has this flight preparation ingrained like the horse.

Must Stand

Horses are an ambulatory species that must stand and walk. Humans can go to bed for months to years with nursing care. Horses can't!

Generally, horses have about 72-96 hours of recumbency before life-threatening complications can begin to appear. Their size dictates that excessive ground contact causes skin, muscle, and bone secondary trauma. Slings might be indicated, but it is not consistently tolerated by equine patients.

Since humans can be verbally receptive, recuperation and rehabilitation can be instructed. Horses are essentially deaf-mutes dependent upon human interpretation of their needs. Some horses and some humans are better at communicating with each other than other species.

Take-Home Message

The horse is obviously different from humans. The horse to human bond grows perpetually both physically and emotionally by understanding and education. The instinctive behaviors of a horse include flight and claustrophobia (while humans have panic attacks!). Domestication of the horse is evidence that the horse might be more malleable than many humans.