The evolution of the horse from a tiny, four-toed animal, perhaps no more than one foot tall, to the variety of equines in existence today, is one of the wonders of nature. During that process of change, the horse evolved over many thousands of years from an animal that predators hunted for food to an animal that became a servant and friend for mankind.

Today's horses are designed to do one of two things—pull a load with their shoulders or carry riders on their backs. The type of horses utilized for these respective tasks varies a good deal; one is large and ponderous and the other is lighter-boned with less muscle mass. Even within these two types, there are significant differences.

For example, the conformation of a roping or cutting horse is different from that of the American Saddlebred. Yet there is a basic sameness to anatomy.
In this article of our 12-part series on equine anatomy and physiology, we will attempt to paint a picture of how today's horse is constructed and what this means in the realm of form to function. We will not be quoting a lot of sources, for the most part, because the information to be presented is an amalgamation of what has been recorded in thousands of scientific papers, textbooks, and manuals as knowledge has been gained and disseminated through the years. However, we would be remiss in not calling attention to two valuable sources upon which we shall draw through the years. However, we would be remiss in not calling attention to two valuable sources upon which we shall draw heavily. Both are written at the layman level. They are Horses and Horsemanship by the late M.E. Ensminger, BS, MA, PhD, and The Coloring Atlas of Horse Anatomy by Robert A. Kainer, DVM, MS, and Thomas O. McCracken, MS, both of whom were at Colorado State University.

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There are some similarities between human and equine anatomy, but there are a great many differences as well. For example, the human knee and the equine stifle have a lot in common. The equine radius is similar to the human forearm. The equine carpals or knee bones are similar to human wrist bones. And the equine splint bones compare to human fingers. There are some similarities between human and equine anatomy, but there are a great many differences as well. For example, the human knee and the equine stifle have a lot in common. The equine radius is similar to the human forearm. The equine carpals or knee bones are similar to human wrist bones. And the equine splint bones compare to human fingers. There are some similarities between human and equine anatomy, but there are a great many differences as well. For example, the human knee and the equine stifle have a lot in common. The equine radius is similar to the human forearm. The equine carpals or knee bones are similar to human wrist bones. And the equine splint bones compare to human fingers.

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**Planes of the Horse**

**Transverse Plane**—Passes through the head, trunk, or limb perpendicular to the part's long axis. Example: An ultrasound image gives a transverse view of the limb.

**Dorsal Plane**—Passes through a body part parallel to its dorsal surfaces.

There are subtle shifts in terminology as we move about the equine anatomy. For example, the two writers point out, "Distal to and including the carpus, (knee), dorsal replaces cranial and palmar replaces caudal. Distal to and including the hock, dorsal replaces cranial, but plantar replaces caudal." This means that when you are talking about the lower limbs, you use the word dorsal to mean frontward instead of cranial, and instead of using caudal to mean rearward, you use palmar (for the front limb) or plantar (for the hind limb).

The solar surface of the hoof is the part that contacts the ground. When looking at a horse's limb from the front, an axial structure is located toward the axis (center of the limb) and an abaxial structure is located away from the axis.

**Classifying the Horse**

Before leaving our Atlas authors, we’ll pass along their explanation of proper terminology for this animal we are discussing, along with what they consider to be identifying characteristics:

- "Horses and their close relatives, donkeys and zebras, are in the mammalian order of odd-toed, hoofed animals (Perissodactyla) as are their distant relatives, rhinoceroses and tapirs. The horse, Equus caballus, is an equid, a member of the horse family Equidae. The adjective equine is frequently used improperly as a noun."

- Characteristics of equids include:
  1. Highly specialized limbs, each with one digit (the third) and with the main muscle mass of the limb situated close to the body's trunk.
  2. Large paranasal sinuses in the skull. Cavity outpocketings of the auditory tubes that extend from the nasopharynx to the middle ears.
  3. Guttural pouches, which are large outpocketings of the auditory tubes that extend from the nasopharynx to the middle ears.
  4. High-crowned permanent teeth that grow for a long time—a feature used to determine the age of a horse.
  5. A simple stomach followed by a long small intestine and a large, complicated large intestine where fermentation of feed occurs.
  6. Well-developed skin glands.
  7. Large heart and lungs.
  8. A uterus with short horns and a relatively large body, and a prominent depression in each ovary where the egg cells are released.
  9. A large, vascular penis and a complete set of male accessory sex glands.

There are similarities between human and equine anatomy, but there are many differences too. For example, the human knee and the equine stifle have a lot in common. The equine radius is similar to the human forearm. Equine carpal (knee) bones compare to human wrist bones. And equine splint bones compare to human fingers. There is also a similarity in the cooling process during exercise—both humans and horses cool their bodies via sweating. Yet, the two are worlds apart when looking at the digestive process.

**Skin**

When discussing equine anatomy, what better place to start than with the skin, the horse's largest organ, ranging from 12-24% of the animal's total weight depending on age. It serves a number of functions. It protects underlying tissues from injury, drying, water absorption, and bacterial invasion. Another important role involves thermoregulation (regulation of body temperature). The skin also excretes water and salts through sweat glands, senses the environment, and synthesizes vitamin D in response to sunlight.

The skin consists of various cellular and tissue components. There are two layers, the epidermis and the dermis (subcutis), with the epidermis being the outer layer. The two are attached by collagenous and elastic connective tissue.

The main activity of the epidermis is to produce two types of protein—keratin and melanin. Keratin, the principal component of the epidermis, is a simple protein characterized by its insolubility (it won't dissolve) and fibrous structure. It serves a supportive and protective function, including the shedding of water. Melanin is the dark, shapeless pigment of the skin and hair.

Another cell type in the epidermis is the...
Nerve endings in the dermis, just under the epidermis, are called sensory nerves and carry sensations of pressure, pain, heat, and cold. In contrast, motor nerves cause the sweat glands to secrete.

When sweat reaches the surface of the skin, it evaporates. This has a cooling effect on the body. However, when severe heat exhaustion occurs, the body temperature can rise to a dangerous level. In such cases, the rate of sweating is increased, but the resulting drop in body temperature is not enough to compensate for the body’s heat production. This results in a decrease in the volume of blood that is carried to the surface of the body. As body temperature reaches such dangerous levels, the air in the lungs is heated and moisture is added to it, which increases the rate of sweating. However, this process becomes less effective as the body temperature rises. In such cases, the body temperature can rise to a dangerous level, which can result in death.

Dandruff—This is a condition where the skin becomes scaly and the hair is often lost. In some instances, the hair will fall out. Grooming can help to stimulate the sebaceous glands, increase the exposure, and prevent these disease-carrying pests from attacking the animals in their charge. From the equine head, we move to the neck. There are seven cervical vertebrae in the neck, with the spinal cord running through them. The neck bends into the back at the withers.

Skin Problems

The skin, as the first line of defense against the elements, is under almost constant attack from one source or another. In many cases, the condition is often the result of poor diet, and the horse produces a great deal of irritation to the horse and can lead to more serious consequences. Here are some of the attackers that make war on equine skin.

Dermatitis—This is an inclusive term for inflammation of the skin that can be produced by various irritants, burns, allergens, trichomonas, vitamins, and systemic diseases. When dermatitis results from an allergic reaction to a substance, it is known as dermatitis or hives. The symptoms are generally characterized by an itch, which is usually accompanied by redness, swelling, and sometimes a rash. In some cases, the skin may become thickened, and the hives may be accompanied by fluid collection, which can be painful. It can occur in any area of the body, and it is not considered all that rare. It is important to note that the horse can be affected by any of the substances that can cause dermatitis, including airborne allergens, dietary changes, and environmental stressors.

Skin Problems

There is more involved in the thermoregulation department than just sweating. An intricate system of blood vessels must be activated to transport blood to the surface of the body to allow for easier parturition. Humans have binocular vision only. The angles at which the bones connect are connected at joints. There are three pairs of ribs in the horse—the aponeurosis and the ecartine glands. The aponeurosis glands are spread throughout the skin, while the ecartine glands are found only in the frog of the hoof and, thus, play a role in the skin, while the eccrine glands are found in the hair follicle. Associated with hair follicles is the superficial layer—known as the stratum corneum. This is the superficial layer of skin, and the most important organs of sense. There are 34 bones in the equine skeleton, most of which are long bones, with the head being a one-signal bone. Bones have binocular vision only.

The horse has unique eyes—they are both monocular and binocular. Monocular means that the horse can see objects with one eye. As a result, the brain can only see two images simultaneously. With binocular vision the horse can focus with both eyes and the brain is receiving only one signal. Humans have binocular vision only.

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Dander—This is a condition where the skin becomes scaly and the hair is often lost. In some instances, the hair will fall out. Grooming can help to stimulate the sebaceous glands, increase the exposure, and prevent these disease-carrying pests from attacking the animals in their charge.

Insect-Biting Insects—During the summer months, each hair follicle is attacked by one type of biting insect or another. They spread diseases such as West Nile virus, equine infectious anemia, and encephalitis. Responsible horse owners should take all the steps to prevent them. These bites are often accompanied by blisters that are painful and give the skin a death sentence. There, in short form, is a description of the equine skin and its functions. In the next chapter, we will concentrate on different parts of the horse’s anatomy with a greater depth of understanding.

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types of equine joints—synovial, which are movable; cartilaginous, which are slightly movable; and fibrous, which are immovable. The joints that connect the horses’ front leg bones are synovial. A synovial joint consists of two bone ends, covered by articular cartilage. The cartilage within the joint is smooth and resilient, allowing for frictionless movement. Ligaments keep the bones in proper support and relationship.

In the rear legs, we’ll start at the spine where the ilium, the largest of three bones in the pelvis, connects with the spinal column. The ilium angles down and rearward to blend into the femur or thigh bone. The femur angles slightly forward to the stifle. Beginning at the stifle (comparable to the knee in humans) is the tibia, which continues downward to the hock. From the hock to the pastern is the metatarsus or rear cannon bone, which connects with the long pastern bone; next is the short pastern bone, and lastly the coffin bone. Both front and rear limbs are connected and supported by ligaments, tendons, and muscles that provide attachment and mobility.

Nature didn’t do the horse many favors when designing the way in which it processes food. Its stomach can hold only small amounts of food—eight to 16 quarts at a time. The stomach empties into the small intestine, a tube that connects with the large intestine. The small intestine is approximately 70 feet long, with a capacity of about 12 gallons. The large intestine of the horse is divided into four parts—the cecum, which is about four feet long and one foot wide; the great colon, which is about 12 feet long and 10 inches wide; the small colon, which is about 10 feet long and four inches wide; and the rectum.

In the reproductive department, the main sex organs of the mare are two ovaries that produce eggs, which are housed in follicles. When an egg is mature, it leaves the follicle and travels through the infundibulum and oviduct to the uterus. If fertilized, it grows within the uterus from a minute structure into a foal that is born through the vagina.

The primary sex organs of the stallion are the two testicles, which produce semen and testosterone, and the penis.

A horse’s respiratory system is designed—as is the case with other mammals—to exchange oxygen and carbon dioxide. Air enters the nostrils, passes through the long nasal cavity over the pharynx and larynx, then enters the trachea that carries it to the lungs.

A horse’s cardiovascular system consists of blood, a series of blood vessels through which blood flows, and a heart that pumps blood throughout the horse’s body. Blood is comprised of red blood cells, white blood cells, and platelets. The red blood cells have a protein known as hemoglobin that binds oxygen and conveys it to the muscles. The white blood cells function in the immune system by defending against foreign invaders, such as harmful bacteria, and the platelets are involved with blood clotting.