**BLOOD VESSELS AND NERVES OF THE EQUINE DISTAL LIMB**

**GENERAL OVERVIEW OF BLOOD VESSELS**

The main types of blood vessels are: Arteries, Arterioles, Capillaries, Venules, Veins. These are described and compared on this page.

**1. Diagrams**

The following diagram summarizes the sequence of blood flow through the heart, arteries, arterioles, capillaries, venules, veins, then back to the heart:

The following diagram summarizes the structural differences between different types of blood vessels. More information about this also follows in the next section.
2. Structure and Functions of Blood Vessels

<table>
<thead>
<tr>
<th>Structure</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Arteries</strong></td>
<td>The walls (outer structure) of arteries contain smooth muscle fiber that contract and relax under the instructions of the sympathetic nervous system.</td>
</tr>
<tr>
<td><strong>Arterioles</strong></td>
<td>Arterioles are tiny branches of arteries that lead to capillaries. These are also under the control of the sympathetic nervous system, and constrict and dilate, to regulate blood flow.</td>
</tr>
<tr>
<td><strong>Capillaries</strong></td>
<td>Capillaries are tiny (extremely narrow) blood vessels, of approximately 5-20 micro-metres (one micro-metre = 0.000001 metre) diameter. There are networks of capillaries in most of the organs and tissues of the body. These capillaries are supplied with blood by arterioles and drained by venules. Capillary walls are only one cell thick (see diagram), which permits exchanges of material between the contents of the capillary and the surrounding tissue.</td>
</tr>
<tr>
<td><strong>Venules</strong></td>
<td>Venules are minute vessels that drain blood from capillaries and into veins. Many venules unite to form a vein.</td>
</tr>
<tr>
<td><strong>Veins</strong></td>
<td>The walls (outer structure) of veins consist of three layers of tissues that are thinner and less elastic than the corresponding layers of arteries. Veins include valves that aid the return of blood to the heart by preventing blood from flowing in the reverse direction.</td>
</tr>
</tbody>
</table>

3. Comparison between Arteries and Veins

<table>
<thead>
<tr>
<th>Arteries</th>
<th>Venues</th>
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<tbody>
<tr>
<td>Transport blood away from the heart;</td>
<td>Drains blood from capillaries into veins, for return to the heart</td>
</tr>
<tr>
<td>Carry Oxygenated Blood (except in the case of the Pulmonary Artery);</td>
<td>Transport blood towards the heart;</td>
</tr>
<tr>
<td>Have relatively narrow lumens (see</td>
<td>Transport deoxygenated blood only (except in the case of the pulmonary vein);</td>
</tr>
<tr>
<td></td>
<td>Have relatively wide lumens (see</td>
</tr>
<tr>
<td>Arteries</td>
<td>Veins</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td>Have relatively <strong>more</strong> muscle/elastic tissue;</td>
<td>Have relatively <strong>less</strong> muscle/elastic tissue;</td>
</tr>
<tr>
<td>Transports blood under <strong>higher</strong> pressure (than veins);</td>
<td>Transports blood under <strong>lower</strong> pressure (than arteries);</td>
</tr>
<tr>
<td>Do not have valves (except for the semi-lunar valves of the pulmonary artery and the aorta).</td>
<td>Have valves throughout the main veins of the body. These are to prevent blood flowing in the wrong direction, as this could (in theory) return waste materials to the tissues.</td>
</tr>
</tbody>
</table>

**SUMMARY OF THE DIFFERENCE BETWEEN ARTERIES AND VEINS**

**Arteries**

Arteries are tough, elastic tubes that carry blood away from the heart. As the arteries move away from the heart, they divide into smaller vessels. The largest arteries are about as thick as a thumb. The smallest arteries are thinner than hair. These thinner arteries are called arterioles. Arteries carry bright red blood! The color comes from the oxygen that it carries.

**Veins**

Veins carry the blood to the heart. The smallest veins, also called venules, are very thin. They join larger veins that open into the heart. The veins carry dark red blood that doesn't have much oxygen. Veins have thin walls. They don't need to be as strong as the arteries because as blood is returned to the heart, it is under less pressure.

Source: [http://www.ivy-rose.co.uk/Topics/Blood_Vessels.htm](http://www.ivy-rose.co.uk/Topics/Blood_Vessels.htm)
NERVES

STUDY: PLATE 22 AND 26 in your text; “Horse Anatomy, A Coloring Atlas”
STUDY THE GLASS HORSE CD SECTION ON NERVES.

NERVES WHOSE INNERVATION REACHES THE DIGIT:

BRACHIAL PLEXUS

A network of spinal nerves (a nerve plexus) that originates in the back of the neck, extends through the axilla (armpit), and gives rise to nerves to the upper limb. The brachial plexus is formed from the lower cervical spine and upper thoracic spine, all of which come from the spinal cord.

The nerves of the brachial plexus which supply the digit are the median and the ulnar nerves. On the medial aspect of elbow joint where pulse can be felt, the median nerve is lying just caudal to the median artery, but soon after crosses over to the cranial aspect of artery and runs down between the artery and radius under cover of the flexor carpi radialis muscle (medial flexor of carpus). Just as it disappears under this muscle, it gives off a large muscular branch. The superficial muscle covering the medial aspect of elbow and attached to fascia here is the pectoral muscle. The median nerve continues down behind the radius and divides above the carpus into medial and lateral branches.

The medial branch of the median nerve continues down through the carpal canal and becomes the medial palmar nerve. The lateral branch of the median nerve anastomoses with the ulnar nerve to form the lateral palmar nerve.

The palmar nerves run down the metacarpal region on either side of the flexor tendons, the medial sending an anastomotic branch over the tendons to the lateral (and may be palpable in live animal), reaching the lateral just above the level of the distal extremity of the fourth metacarpal bone.

Near the metacarpophalangeal joint, the palmar nerves become the digital nerves. Each digital nerve gives off a dorsal branch and continues as the palmar digital nerve which supplies most of the palmar aspect, e.g., the seat of 'navicular disease.'

PRECIS OF MOTOR INNERVATION:

- Suprascapular to extensor and lateral stabilizer of shoulder joint.
- Axillary to flexors of shoulder.
- Musculocutaneous to flexors of elbow.
- Radial to extensors of elbow, carpus, and digit
- Median and ulnar to flexors of carpus and digit
LUMBOSACRAL PLEXUS

The nerve of the lumbosacral plexus whose innervation ultimately reaches the digit is the sciatic nerve. It emerges from the greater sciatic foramen, runs back along sacrosciatic ligament, turns down behind hip joint. It gives off the peroneal nerve and continues as the tibial nerve.

The tibial nerve travels down the craniomedial aspect of the common calcanean tendon. It gives off a branch to the tarsal joint and divides into two plantar nerves.

The plantar nerves pass through the tarsal groove in company with the deep digital flexor tendon, then separates and comes to lie one on either side of the flexor tendons in the metatarsal region in the same way as the palmar nerve of the thoracic limb and are distributed in like manner.

The medial plantar nerve sends an anastomotic branch over the tendons to the lateral plantar nerve, reaching it at, or just above, the level of the distal extremity of the fourth metatarsal. Near the metatarsophalangeal joint, the plantar nerve becomes the digital nerve. Each digital nerve gives off a dorsal branch and continues as the plantar digital nerve which supplies most of the plantar aspect of the digit.

The peroneal nerve divides at the origin of the lateral digital extensor into superficial and deep branches. The superficial branch runs down in the groove between long and lateral digital extensors and becomes cutaneous on the dorsolateral aspect of tarsus and metatarsus. The deep branch runs down under the long extensor, gives a branch to the tarsal joint, and becomes cutaneous on the dorsal and lateral aspects of metatarsus to the level of the metatarsophalangeal joint.

**Precis of Motor Innervation:**

Gluteal nerves to extensors and abductors of hip.
Femoral nerve to extensors of stifle.
Obturator nerve to adductors of thigh.
Sciatic nerve: In addition to supplying some powerful extensors of hip and tarsus, the sciatic divides in upper part of thigh into tibial and peroneal nerves.
Tibial division of sciatic to digital flexors and tarsalextensors.
Peroneal division of sciatic to digital extensors and tarsal flexors.

Source: http://compepid.tuskegee.edu/syllabi/biomedical/Anatomy/apdanat/chapter3.html
# Pulse

The pulse rate of an adult horse at rest averages 22-44 beats per minute (bpm). A pulse rate of 50 or higher in an adult horse at rest may mean the horse is in physical distress. The average pulse rates for young horses are as follows:

- **Foals** (70-120 bpm), **Yearlings** (45-60 bpm), **2yr. olds** (40-50 bpm).

The horse's pulse rate will increase if he is excited or nervous, in pain, during/after exercise, or has a disease. The higher the heart rate, the more severe the condition.

## Monitoring the Pulse

A strong pulse can mean a few different things. If the pulse is stronger only in one leg, for example, chances are an infection—from a wound or abscess, for instance—is present. A bounding pulse in both front legs, however, is an early sign of laminitis, especially when the blood pressure is also elevated. Taking a horse's pulse isn't simply a matter of putting a finger to an artery, however. Equine blood vessels can be difficult to locate; you'll need to master a three-fingered technique to glean the most useful information. Be prepared: Taking an accurate reading of a horse's pulse requires lots of practice.

This technique is effective no matter where on your horse's body you take his pulse. Place three fingers along the artery, pressing hardest with the finger farthest from the heart, slightly less with the middle finger and barely pressing with the last finger. By largely restricting the artery with the finger farthest from the heart, you'll amplify the pulse somewhat, making it easier to feel. (Making the pulse stronger won't confuse your interpretation if you do it every time; it's the leg-to-leg and day-to-day comparisons that are important.) If you don't use this gradient pressure across your fingers, you may not be able to find a pulse, and even if you do, you won't be able to judge how strong it is.

1. You can feel a horse's pulse on both his front and hind legs just over his sesamoid bones. The closest pulse point to the hoof that is relatively easy to find, this is the best place to feel for the throbbing pulse that comes with laminitis. Place your three fingers on the inside of the widest point of his fetlock. You'll feel a large vein (which doesn't have a pulse) and possibly a nerve, with the normally thinner artery resting between them. Press the vein flat to feel the pulse in the artery.

2. Another pulse point on the front legs is located on the inside of the knee, just behind the bony "knob" of the joint. Again, you'll have to push aside a vein to feel the artery, but it may be easier to find the pulse at this location than at the fetlock.
3. The hind-leg pulse can also be taken on the cannon bone, where an artery lies between the splint bone and the leg bone. Look for the pulse about three quarters of the way up the cannon bone; farther down it's harder to locate. This is the easiest leg to pulse to find and a good place to practice your technique.

4. You can also place three fingers of each hand on either side of your horse's face. The artery you want to feel runs horizontally across the face, just below the cheekbones. Feel for it behind where the halter cheekpieces sit. This can give you a general sense of your horse's cardiac function and is extremely easy to detect.