

The Circulatory System

The circulatory system works for the horse mainly as a mode of transportation. Through the medium of blood, it carries oxygen, nutrients, and water to all of the cells, and carbon dioxide and waste from them. The blood also carries hormones and defense cells, and together with lymph, bathes the cells in fluid and works to maintain the body's heat. Together with the spleen, which acts as a reservoir of blood cells, the heart and blood vessels form the cardiovascular system. With a proper conditioning plan, this system can be in peak condition in 4 to 6 months, less time than other areas require. There are 3 essential parts to this system of the horse:

Blood:

- **Plasma:** fluid portion of blood containing serum and cells which aid in clotting
- **Red blood cells:** produced in bone marrow, contain hemoglobin which carries oxygen and carbon dioxide
- **White blood cells:** defense cells which fight germs in case of disease or injury

Heart:

- Hollow muscular pump made of cardiac muscle residing within the protective cover of the pericardium
- 4 chambers – left and right atria (upper chambers) and left and right ventricles (lower chambers)
- Dark red deoxygenated blood, carrying CO₂, arrives from the cells via the vena cava (vein)
- Collects in right atrium (upper) and is pumped down into right ventricle through one-way valve
- Pulmonary artery carries blood to lungs, where CO₂ is exchanged for oxygen
- Pulmonary vein carries bright red oxygenated blood to left atrium (upper chamber)
- After passing through a one-way valve into left ventricle, blood is carried through the aorta, the main artery

Blood Vessels:

- Arteries carry blood from heart - first the aorta, then large arteries which branch into smaller arterioles and tiny capillaries as they get further through body
- Capillaries are the smallest blood vessels, one cell thick, where oxygen and nutrients are dispensed and carbon dioxide and waste received from the cells
- To return to heart, capillaries combine into venules, then veins, then vena cava which goes to right atrium
- A cut artery will spurt blood with every heartbeat, while a cut vein will flow continuously

The Lymphatic System

Closely connected with the circulatory system, the lymphatic system carries fluid to the cells of the body, especially the legs, and helps the horse to maintain and regulate its body temperature.

- **Lymph:** clear fluid which contains white blood cells and bathes all cells of entire body
- **Lymph vessels:** thin-walled vessels to transport lymph throughout body
- **Lymph nodes:** bean-shaped masses of lymphatic tissue to filter lymph and produce lymphocytes and antibodies which act as defense cells to cope with infection (smaller nodes known as lymph nodules)
- Equine Infectious Anemia, Equine Viral Arteritis, passive edema of legs (stocking up), Lymphangitis, and Strangles all affect the circulatory and lymphatic systems

The Nervous System

The nervous system helps the body to perform basic or specialized functions by receiving, sorting, and transmitting nerve impulses. This 'command and control' system has 3 branches:

Central Nervous System: brain and spinal cord

Peripheral Nerves: nerves which run to muscles and all parts of body

- **Sensory Nerves:** receive stimuli (a stimulus is a change in the environment) and transmit them to brain
- **Motor Nerves:** transit instruction to muscles

Autonomic Nervous System: controls functions of internal organs without conscious awareness, allowing stomach to digest, heart to pump... The sympathetic and parasympathetic systems control reflexes and automatic reactions which are also done unconsciously (blinking, shivering, twitching...).

- Basic nerve cell is neuron, the body of which has branches called dendrites, and long fibers called axons
- Junction where one neuron's dendrite touches the axon of another is a synapse
- Together these parts work like a relay system, passing information received from stimuli from muscle to neuron, or from one neuron to another through chemicals.
- Acetylcholine chemical stimulates muscles to contract, while the chemical acetylcholinesterase prevents the constant action of acetylcholine
- Pesticides such as fly spray, dewormers, and flea and tick dip for dogs may contain cholinesterase inhibitors, which build up in the system over time. An excess amount can block the release of cholinesterase, causing seizures or muscle spasms due to the continuous flow of acetylcholine

- Tetanus, Rabies, Equine Encephalomyelitis, Equine Protozoal Myelitis, Rhinopneumonitis (EHV-1), West Nile Virus, and Botulism all affect the nervous system