

Online HorseCollege



Student Workbook

3.H.12 Musculo-Skeletal System

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Musculo-Skeletal System 3.H.12 Workbook

Students are to complete Horse Care 3.H.05-08 online assessments prior to attempting Horse Care 3.H.09-12 and to follow all recommended safety considerations.

Practical assessments for Horse Care 3.H.09-12 are as follows:

- A) Basic Reproduction
- B) Pregnancy & Foaling
- C) Skeletal System
- D) Muscular-Skeletal System

These assessments incorporate the following unit from the SIS30710 Sport Industry Training Package which include the listed elements

RGRPSH401A Relate anatomical and physiological features to the care and treatment of horses

- Identify basic anatomy and physiology of horses
- Relate anatomy and body systems to the performance of racehorses
- Follow illness and injury management plans

Further information about this assessment is available at www.training.gov.au

Musculo-Skeletal System Introduction

Following on from the previous workbook, in this week's learning resources you will find information presented on the basic structure and functioning of the muscles, tendons and ligaments. Kept short and to the point, this format should help you acquire this new information without becoming overloading or difficult to understand.

A section on the nervous system has been provided to inform you of the process of how messages transmitted from the brain work to direct muscles.

Musculo-Skeletal System

The muscular and skeletal systems are often referred to together as 'musculo-skeletal' as they both concerned with form and movement.

The skeleton provides the frame and protective shell for the vital organs and is also an essential component of locomotion. It is made up of bones and joints to allow movement. Whilst bones may differ in shape they all have the same basic structure. Bone is constantly being replaced especially in young horses and has the capacity to change shape and remodel according to the stress placed upon it. Tendons attach to bone by special fibres which penetrate into the bone.

Muscle produce force and cause motion of the horse and internal organs, it involves ligaments and tendons.



Muscles

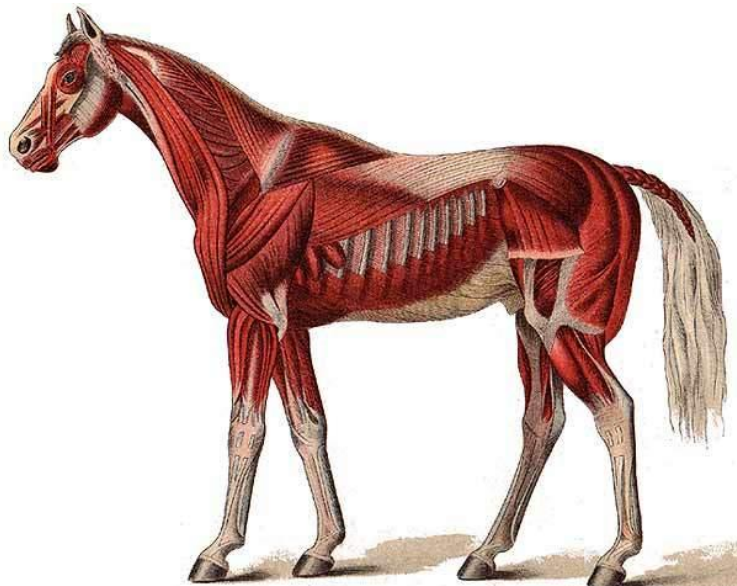
There are 3 types of muscles cardiac, visceral and skeletal. Cardiac and visceral types are smooth muscles which are involuntary muscles i.e. muscles which respond to reflexes that the horse has no control over. Cardiac muscles make up the heart, visceral or smooth muscles make up elements such as the digestive tract and bladder whilst skeletal muscles attach to bone to produce movement.

There are 2 types of muscle fibres 1) slow twitch which operate aerobically (with oxygen to produce energy over a period of time) and 2) fast twitch which operate anaerobically (energy provided in short bursts, produced without oxygen).

Motion is produced by the contraction and relaxation of opposing muscle groups which in turn, moves bones in the skeleton. Muscles are attached to bone by tendons and no muscle ever relaxes completely. Muscles are made up of many bundles of fibres, when in action a muscle or group of muscles will contract while the opposing muscles relax to the same extent as the contracted muscles. When contracted a muscle shortens which results in a 'pull' action, it cannot push. The action of an opposing muscle returns it to a relaxed state.

Movement is automatic once motion has started however it can be altered depending upon information received by the lower centre of the brain. The horse can make voluntary decisions based on this information.

In horses the propulsive muscles are in the hindquarters, thigh, shoulder and neck.



Superficial muscles

Tendons & Ligaments

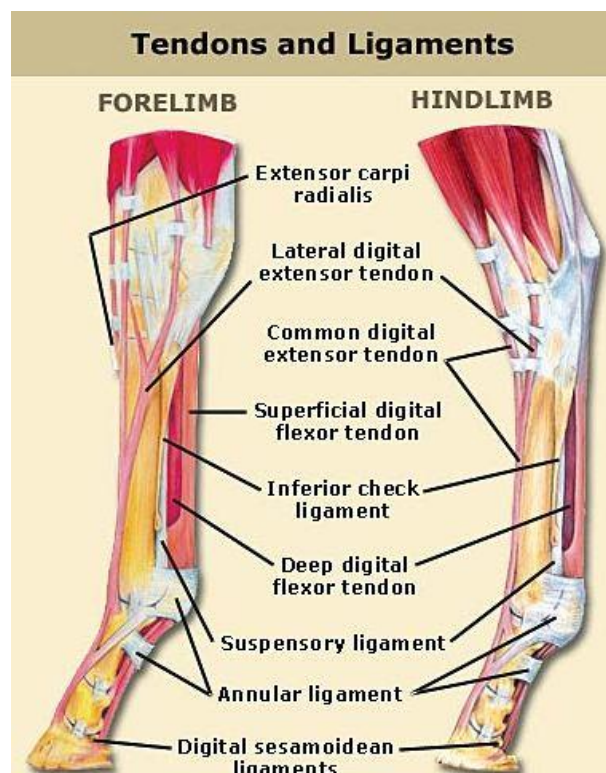
Tendons are fairly inelastic fibrous cords of connective tissue and attach muscle to bone, cartilage or other tendons. There are two types of tendons:- flexor tendons, which can be deep digital or superficial digital and extensor tendons.

The deep digital flexor tendon extends down the back of the cannon bone. The superficial digital flexor tendon runs behind the knee and down the back of the cannon and completely covers the deep digital flexor tendon. The location of these tendons on lateral parts of the leg means that they are covered only by skin, making them vulnerable to injury.

The extensor tendon attaches to all the bones in the foot with its function being to extend the bones of the foot to lift the toe.

Tendon structure is fairly complex. The tendon fibres are arranged in a zig-zag pattern within fascicles (organised bundles of tendon fibres), this zig-zag allows elasticity of the tendon. Surrounding these fascicles is the paratenon. The paratenon is a loose connective tissue sheath that provides the tendon with its blood supply. It is an intricate arrangement inside tendons and it is for this reason that damage can influence the functioning of the tendon.

Ligaments are very slow to heal after injury and help to limit the movement of joints depending on their function. They are more fibrous and less elastic than tendons and attach bone to bone or bone to tendon.



Nervous System

Every cell of every tissue (apart from blood cells) is connected to the nervous system. It is responsible for controlling body functions involving hormones the brain and the spinal cord. The nervous system is divided into 3 parts.

- 1) The central nervous system (CNS):- which incorporates the brain and vertebral cord.
- 2) The peripheral nervous system (PNS)(sometimes known as the somatic nervous system) which connects the CNS to the rest of the body.
- 3) The autonomic nervous system (ANS), this system is concerned with functions which are not under voluntary control (i.e. heart rate, respiration rate).

The Central Nervous System:-

The brain is the control centre for all voluntary striated muscle (which are muscles which are a form of fibres that are combined into parallel fibres) functions such as those required in the locomotor system and involuntary smooth muscle (i.e. found in the gastrointestinal tract, bladder etc) functions in connection with the ANS.

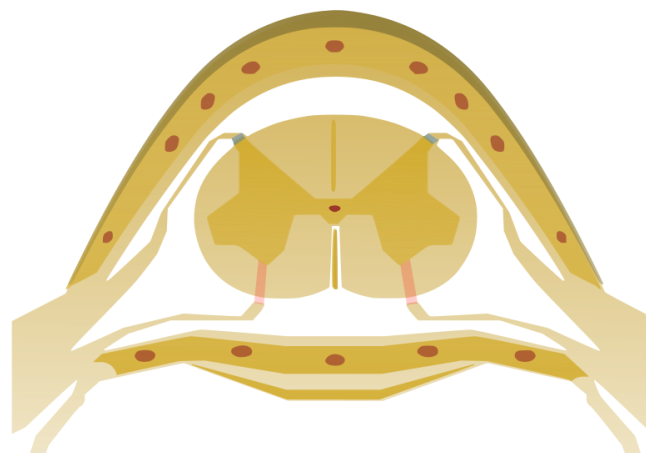
The difference between voluntary, involuntary and autonomic actions are:-

Voluntary:- There is awareness and control at a conscious level of an activity. Eventually the action can be maintained by the non-conscious brain (e.g. locomotion) but it can be altered at any stage if the conscious brain 'thinks' it.

Involuntary:- This is a reflex action triggered in response to nerves. Reflex activity is spontaneous however it can be overridden.

Autonomic:- These are involuntary actions of smooth muscles under the control of the ANS. Hormones can influence these actions.

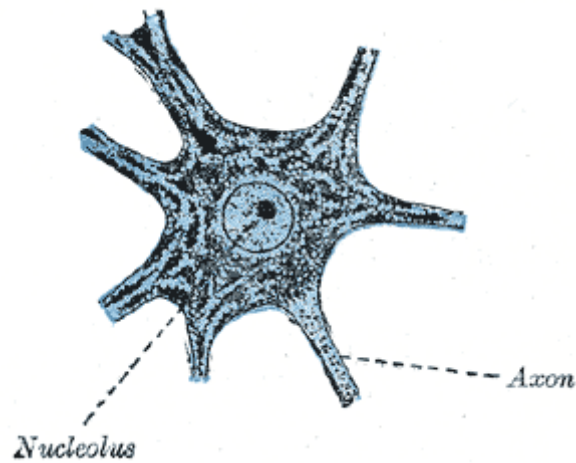
The spinal cord is a tubular bundle of nervous tissue and support cells which runs the entire length of the vertebral column. In the horse it is approximately 200cm long.



Cross section of a spinal cord

Nervous System (cont.)

Within the CNS are motor and sensory nerves or neurons. Sensory nerves receive stimuli such as how something feels. Motor nerves allow stimulation by the brain to produce muscle contraction.



Motor nerve

Extension Lesson

What do you think are some advantages and disadvantages of involuntary muscles being present in a horse's anatomy?

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Recommended Reading

Publication:-

Veterinary notes for horse owners

The BHS veterinary manual

Author:-

Captain M. Horace Hayes

P. Stewart Hastie

Websites:-

www.horse-diseases.com/horsemuscleanatomy.html

http://en.wikipedia.org/wiki/Aerobic_exercise

References

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P. Stewart Hastie

Websites & Images:-

<http://www.taranolanhorses.com>

<http://www.equi-therapy.net>

www.horse-diseases.com

<http://en.wikipedia.org>