
ymca
awards

YMCA Awards

Level 3 Applied anatomy and physiology

2018

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The nervous system

Learning outcomes

By the end of this session you will be able to:

- Describe the specific roles and functions of the central nervous system (CNS) and the peripheral nervous system (PNS) including somatic and autonomic nervous systems
- Describe the process of muscle contraction
- Describe the process of motor unit recruitment and muscle fibre innervation

Learning outcomes

By the end of this session you will be able to:

- Identify the structure and function of proprioceptors
- Describe how exercise can enhance neuromuscular connections and improve motor fitness
- Determine how plyometric exercise can utilise the stretch shortening cycle

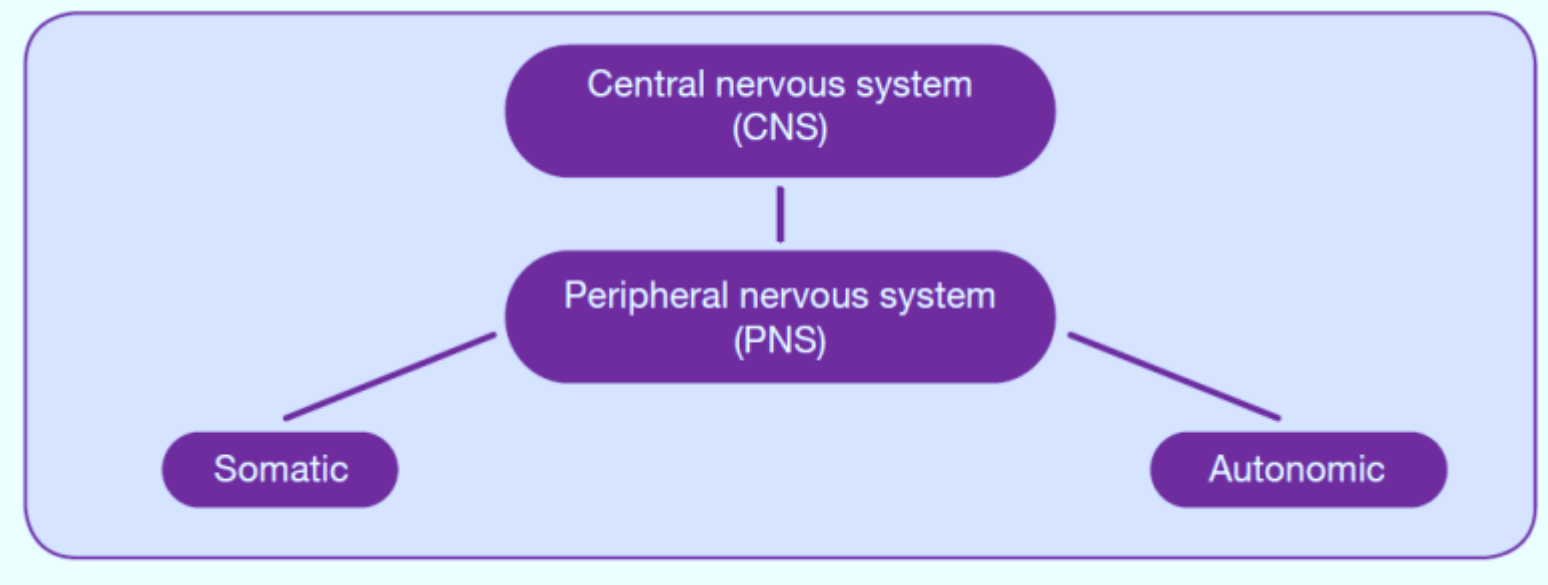
The nervous system functions

- Controls all the actions of all bodily systems
- Maintains ‘homeostasis’ - the body maintaining balance to operate effectively

Nervous system feedback loop

- Sensory input - To sense changes inside and outside the body
- Interpretation - To analyse and interpret incoming information
- Motor output - To respond to the information by activating the relevant bodily system

The nervous system structure



The central nervous system (CNS)

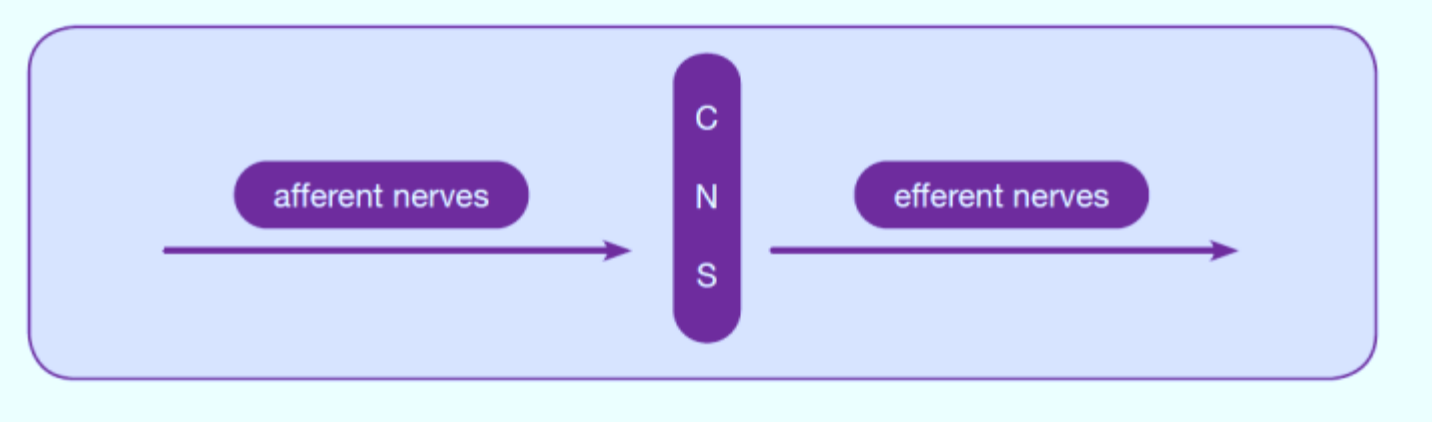
- The brain and the spinal cord
  - Receives messages from the peripheral nervous system (PNS)
  - Interpretation
  - Sending out the correct motor response
  - The brain is responsible for interpretation of messages and the spinal cord is responsible for the transfer of messages in and out of the CNS and spinal reflexes

The peripheral nervous system (PNS)

- The incoming and outgoing nerves to the spinal cord
  - Afferent nerves – sensory neurons carrying information about changes
  - Efferent nerves – carry information about the required response to a change

Afferent and efferent nerves

- **A**fferent Incoming information about changes
- **C**NS Interpretation and decision making
- **E**fferent Outgoing information about a response



The somatic nervous system

- This branch of the PNS is concerned with changes in the external environment
- It senses movement, touch, pain, skin temperature etc.
- It is under our conscious control and allows us to voluntarily control muscles

The autonomic nervous system

- This branch of the PNS is concerned with changes in the internal environment
- It senses hormonal status, functioning of internal organs, controls cardiac and smooth (involuntary) muscles and the endocrine glands that secrete hormones
- The autonomic nervous system is **not** under our conscious control

Efferent nerves that are under control of the autonomic nervous system are divided into two types:

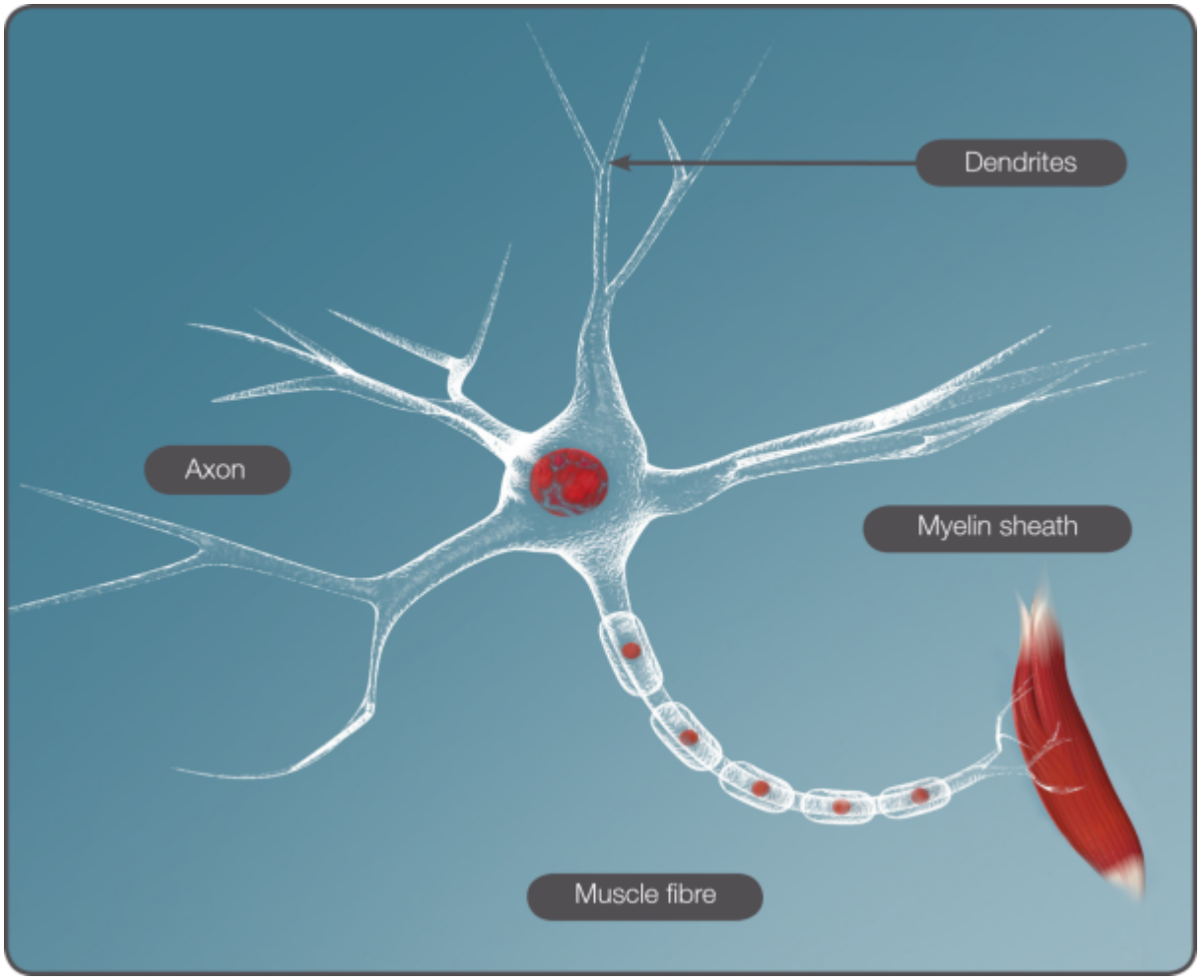
- Sympathetic nerves
  - Increased heart rate
  - Increased breathing rate
  - More forceful contraction of the heart leading to increased stroke volume
  - Vasoconstriction of the arteries and arterioles to increase blood pressure

Parasympathetic nerves

- Parasympathetic nerves are responsible for decreasing activity and are more active during times of relaxation and calm.

The sympathetic and parasympathetic nervous systems are constantly working together to help maintain homeostasis

The structure of a neuron



Structure of a neuron

- Dendrites – receive and carry incoming action potentials
- Axons – transmit action potentials
- Nucleus – cell's control centre and regulates cell activity
- Myelin sheath – insulates axons to speed up transmission of the action potentials
- Nucleus – regulates cell activity
- Axon terminals – interface between neuron and other cells
- Synaptic end bulbs – neurotransmitter is released

Sensory organs

Sensors for changes in the internal environment operate through the autonomic nervous system. These sensors include:

- **Chemoreceptors –** detect changes in dioxide for function.
- **Thermoreceptors –** temperature
- **Baroreceptors –** arteries to detect
- **Proprioceptors –** detect changes

Present throughout the body to levels of chemicals such as carbon respiration and calcium for muscle

Present in all tissues to detect changes

Found mainly in the walls of the changes in blood pressure

Found in muscles and tendons to in body position

Proprioceptors

Proprioceptors provide information about the position of the body and joints

They provide feedback on mechanical stimuli (position, pressure, tension, speed of muscle lengthening)

Muscle spindles

- Located in the muscle
- Detect changes in muscle length
- Bring about reflexive contraction of skeletal muscle to prevent injury (stretch reflex)

Muscle spindle structure

- Muscle spindles are small sensory organs with an elongated shape
- They consist of several modified muscle fibres enclosed in a sheath of connective tissue (intrafusal fibres)
- The central part of the muscle spindle is covered with a capsule of connective tissue

Golgi tendon organs

- Located in the muscle tendon
- Detects excessive tension in the muscle
- Brings about reflexive relaxation of skeletal muscle to prevent injury (inverse stretch reflex)

Golgi tendon organ structure

- The golgi tendon organ is composed of collagen strands that are connected with muscle fibres at one end and a tendon at the other end
- A fibrous capsule constituting several enlarged tendon fascicule (intrafusal fascicule) encloses the golgi tendon organ
- The sides of the capsules are perforated by several nerve fibres