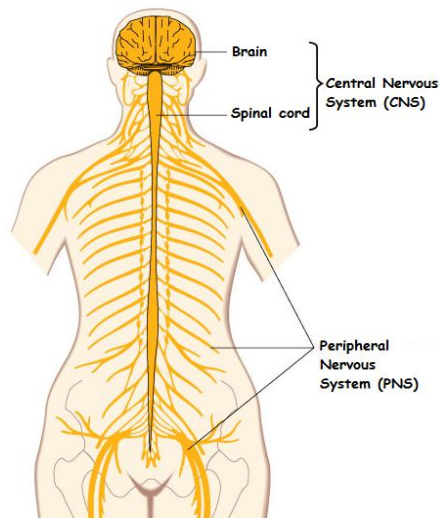


Higher Human Biology
Unit 3 Notes
Divisions of the Nervous System

The Nervous System

- The nervous system of the human body is responsible for numerous functions, such as:
 - analysing sensory information from the body and external environment
 - storing some information
 - making decisions regarding appropriate responses and behaviours.
- It produces motor responses by causing muscular contractions or secretion from glands.
- The nervous system can be divided into the Central Nervous System (CNS) and the Peripheral Nervous System (PNS).
- The CNS is made of the brain and spinal cord.
- The PNS is made up of neurons throughout the rest of the body.



The Peripheral Nervous System (PNS)

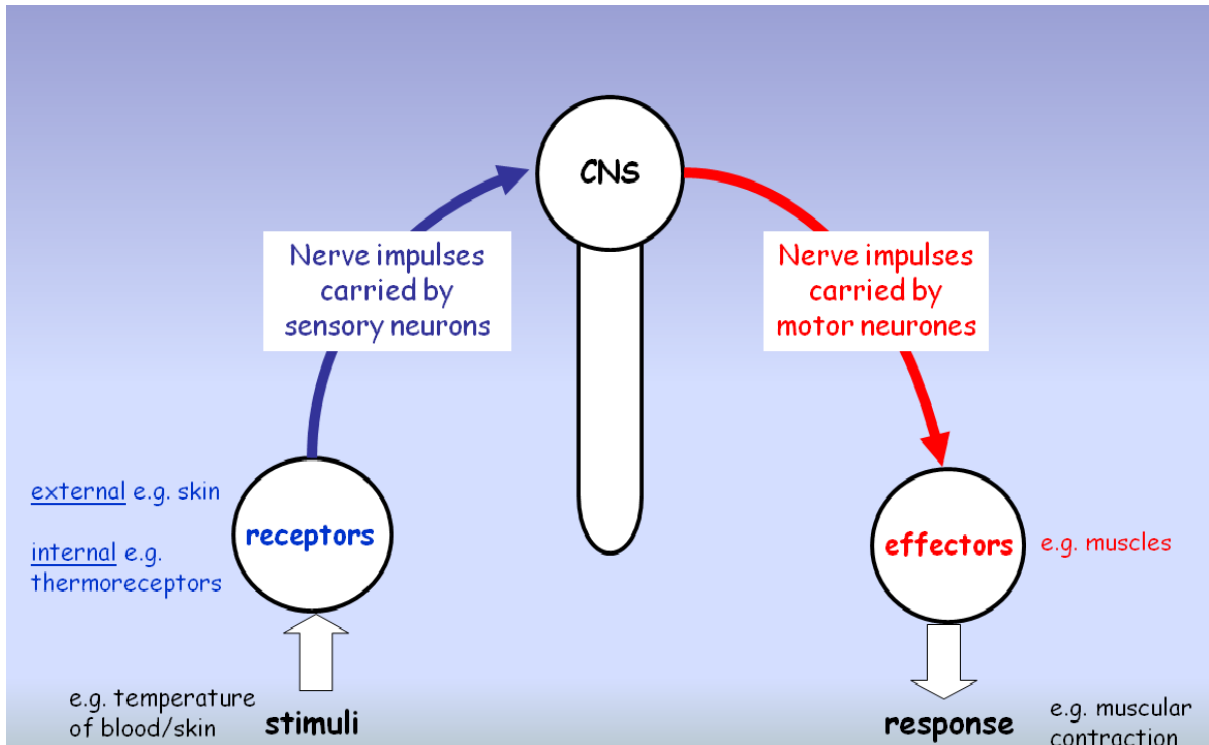
- The PNS is comprised of sensory and motor neuron pathways which pass information to and from the CNS via electrical impulses.

Higher Human Biology

Unit 3 Notes

Divisions of the Nervous System

- When a stimulus is detected by receptors in external sensory organs (e.g. eyes, ears etc) or internally (e.g. thermoreceptors in the hypothalamus), an impulse is carried along sensory neurons to the CNS.
- The CNS processes the information and impulses are transmitted along motor neurons to effectors, such as muscles and endocrine glands, which bring about a response, such as muscle contraction or hormone secretion.



- The PNS can be divided into the Somatic Nervous System (SNS) and the Autonomic Nervous System (ANS).

The Somatic Nervous System (SNS)

- The somatic nervous system controls the skeletal muscles through the action of sensory and motor neurons and is involved in mostly voluntary actions, such as walking and speaking.
- The SNS is also responsible for involuntary reflex actions.

Higher Human Biology
Unit 3 Notes
Divisions of the Nervous System

The Autonomic Nervous System (ANS)

- The autonomic nervous system (ANS) is responsible for regulating internal structures such as the heart, blood vessels etc.
- This regulation occurs through automatic, involuntary actions which involve sensory and motor neurones.
- The autonomic nervous system is involved in homeostatic control (e.g. regulation of body temperature or osmoregulation).
- The nerves of the ANS arise in the medulla region of the brain and emerge from the spinal cord at numerous points to reach the organs that they stimulate.
- The ANS is made up of two parts, the sympathetic and the parasympathetic systems.

The parasympathetic system

- in control in times of rest and relaxation; slows functions and conserves resources
- acts on heart to lower heart rate
- slows breathing rate
- decreases blood flow to muscles
- increases blood flow to digestive system (increases digestion) causing an increase in the rate of peristalsis and increasing intestinal secretions

The sympathetic system

- in control when the body is active or excited; raises activity levels
- acts on heart to increase heart rate
- affects the SAN (pacemaker)- see Unit 2
- increases breathing rate
- increases blood flow to muscles
- decreases blood flow to digestive system (slows digestion) causing a decrease in the rate of peristalsis and decreasing intestinal secretions

Higher Human Biology
Unit 3 Notes
Divisions of the Nervous System

- increases perspiration (i.e. sweating)

The sympathetic and parasympathetic systems act on many areas of the body.

- The sympathetic system is involved in the 'fight or flight' response, whilst the parasympathetic system is involved in the 'rest and digest' response.
- As these systems work on the same structures but have opposite effects, they are said to have an antagonistic relationship.

Parts of the Brain

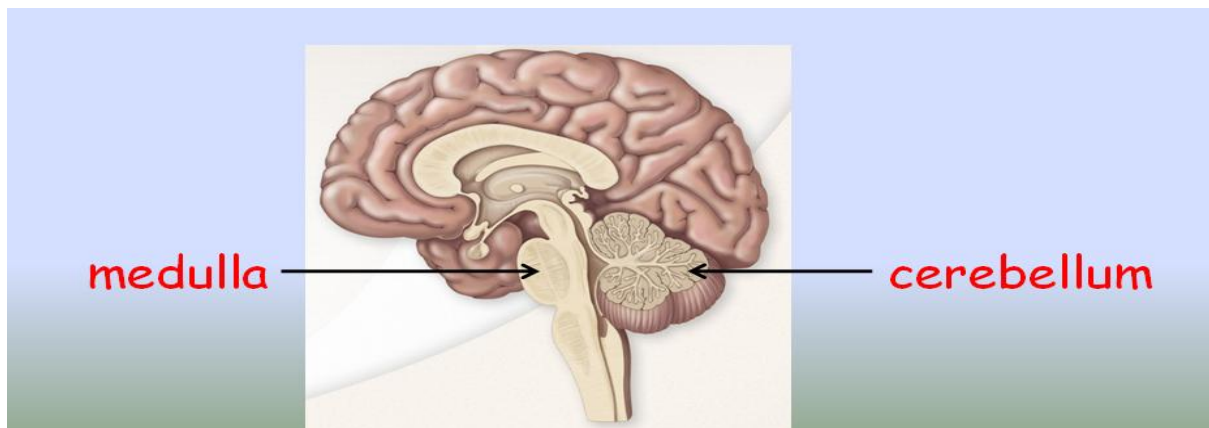
The Brain

- The brain is composed of three interconnected layers:
 - the central core
 - the limbic system
 - the cerebral cortex

The Central Core

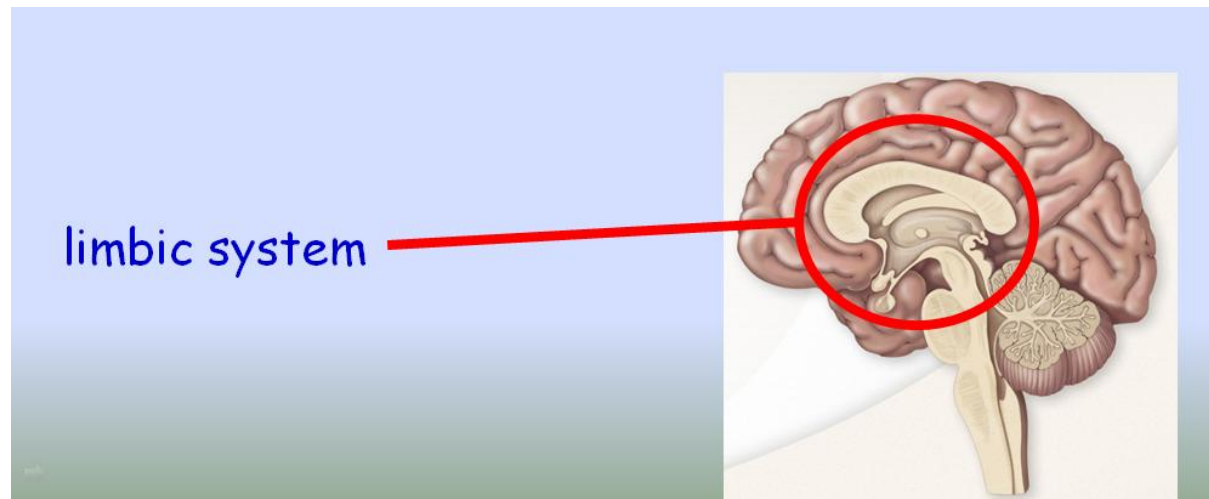
- The central core contains:
 - The medulla – which regulates basic life processes such as breathing, heart rate, sleeping and arousal (being awake and aware of the environment). Impulses controlling the autonomic nervous system originate in the medulla.
 - the cerebellum – which is responsible for controlling balance, posture and movement

Higher Human Biology
Unit 3 Notes
Divisions of the Nervous System



The Limbic System

- The limbic system is responsible for:
 - processing information for memories
 - regulating emotional states, e.g. fear, aggression and anxiety
 - Regulating biological motivation, e.g. hunger, thirst and sex drive.



The Cerebral Cortex

- The cerebral cortex is the outer part of the cerebrum and is the centre of conscious thought and memories.
- The cerebral cortex has three key functions
 - receives sensory information
 - co-ordinates voluntary movement

Higher Human Biology

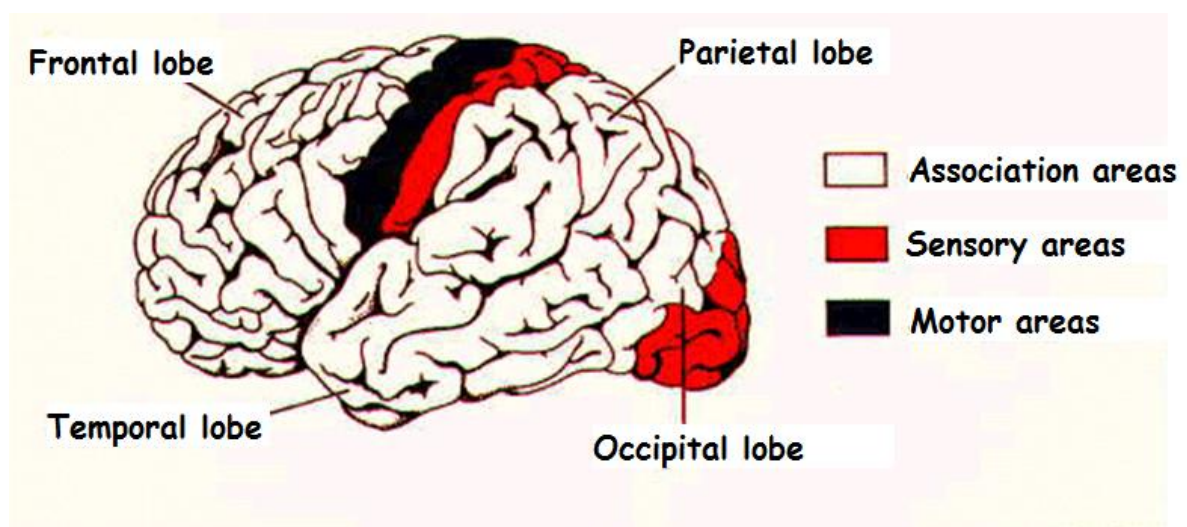
Unit 3 Notes

Divisions of the Nervous System

- making decisions based on experience.
- The cerebral cortex is highly folded (convoluted) which greatly increases its surface area, this
 - provides greater space for more neurons
 - allows for more interconnections between neurons

The Cerebral Cortex – Localisation of function

- Within the cerebral cortex, there are three main areas each of which deals with a particular function.
 - the sensory areas – receives information as sensory impulses from receptors (e.g. sense organs)
 - the association areas - analyse and interpret impulses received from the sensory areas and deals with thought processes, language, personality, imagination and intelligence.
 - the motor areas – act on information from association areas by sending motor impulses to effectors.
- By this means, coordination of voluntary movement is achieved.



Higher Human Biology

Unit 3 Notes

Divisions of the Nervous System

Electroencephalograms – EEG's

- EEG's record the electrical activity of the cerebrum.
- EEG's can indicate different levels of brain activity but are not precise enough to locate the areas of the brain which are active.

Brain Scans

- Brain scans, such as CAT, MRI or PET scans, provide a more detailed images of the brain.
- They can detect activity through changes in blood flow or uptake of glucose and can allow localisation of function to be identified by showing which areas are most active whilst carrying out a particular function.

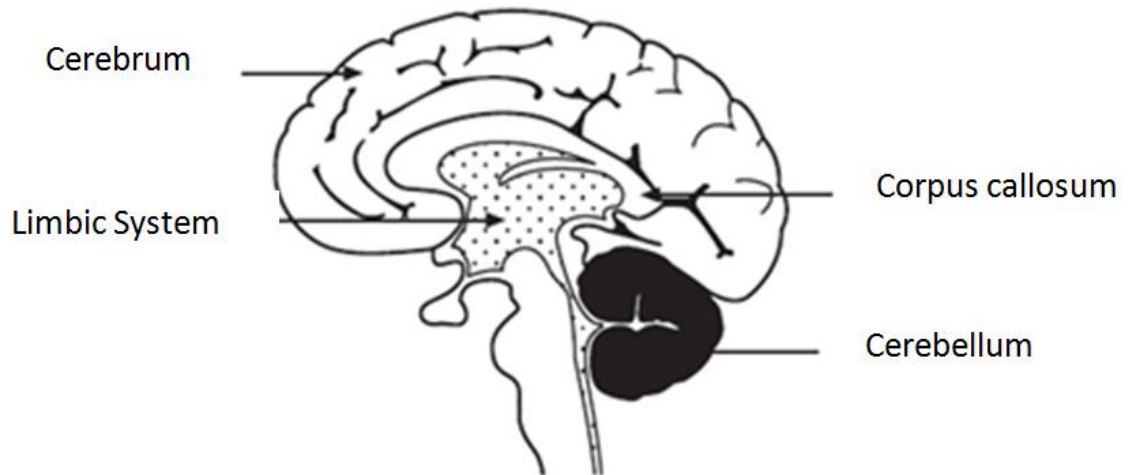
The Cerebrum

- The cerebrum is divided into two halves, the left and right cerebral hemispheres.
- The left cerebral hemisphere receives information from the right visual field and controls movement in the right side of the body.
- The right cerebral hemisphere receives information from the left visual field and controls movement in the left side of the body.

The Corpus Callosum

- The cerebral hemispheres are not entirely separate, they are connected by a bundle of nerve fibres known as the corpus callosum.
- The corpus callosum allows the transfer of information between the cerebral hemispheres and so allows the coordination of brain function, thus enabling the brain to act as an integrated whole.

Higher Human Biology
Unit 3 Notes
Divisions of the Nervous System

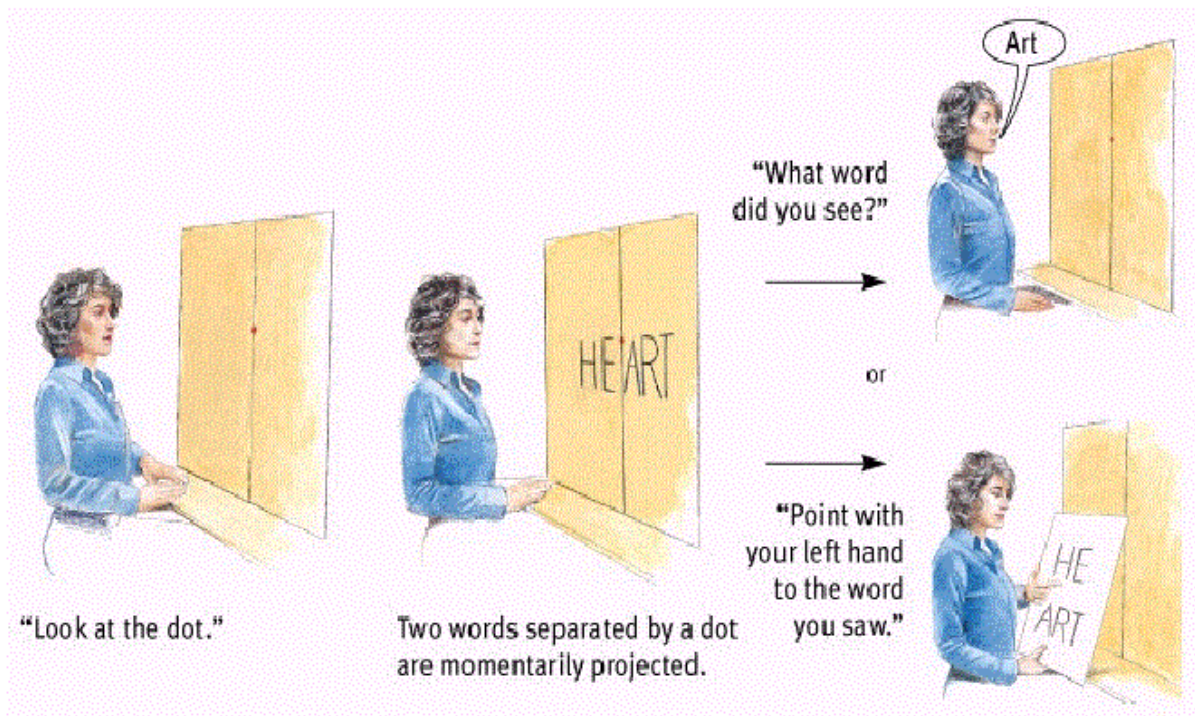


Split Brain Syndrome

- In rare cases, a person can be born without a corpus callosum or may have it cut due to serious epilepsy, this results in split brain syndrome.
- The cerebral hemispheres do not share information and each processes information separately.

Higher Human Biology
Unit 3 Notes
Divisions of the Nervous System

Example



<i>Left cerebral hemisphere</i>	<i>Right cerebral hemisphere</i>
processes information from right eye	processes information from left eye
controls language production	controls movements of left hand

NB – This table does not need to be learned

Higher Human Biology
Unit 3 Notes
Divisions of the Nervous System

1. The information from left eye went to the right (cerebral) hemisphere.
2. The right hemisphere controls / moves the left hand (so the patient points to "HE").
3. The information from right eye went to the left hemisphere.
4. Information cannot be transferred to the right hemisphere / from left hemisphere. (so patient does NOT point to anything.)

However, if the patient was then asked to say what she saw written on the screen, she would say ART.

Reason –Information from the right eye goes to the left (cerebral) hemisphere which controls language production