AQA A Level Psychology

Knowledge Organiser: The Nervous System & Fight or Flight

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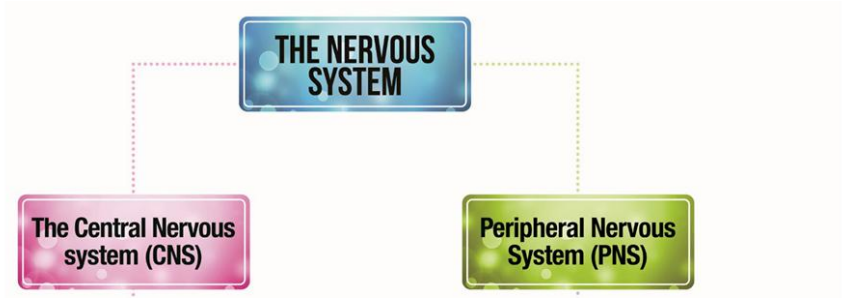
The nervous system is divided into two main components: CNS and PNS.



Central Nervous System

The brain: provides conscious awareness and consists of many regions, which are responsible for different functions.
The Spinal Cord: transfers messages to and from the brain and is responsible for simple reflex actions that do not involve the brain.

Peripheral Nervous System

Somatic Nervous System: facilitates communication between the CNS and the outside world.

Autonomic Nervous System: important for homeostasis and maintains internal processes like body temperature and heart rate.

Autonomic Nervous System Branches

Sympathetic Nervous System: involved in fight or flight and helps us prepare when faced with dangerous situations. E.g. HR and BP increase.

Parasympathetic Nervous System: slows down our heart rate and breathing rate, and reduces our blood pressure, after the danger has passed.

Fight or Flight

If a situation is deemed stressful, the amygdala sends a distress signal to the hypothalamus. If a short-term response is needed, the sympathomedullary pathway (SAM pathway) is activated, triggering the fight-or-flight response.

Adrenaline is released from the adrenal gland and leads to various changes, such as increased HR (to increase blood flow), increased breathing (to maximise oxygen) and sweat production (to regulate temperature).

Following the fight-or-flight response, the parasympathetic nervous system is activated to return the body back to its 'normal' resting state.

Evaluating Fight or Flight

- Our reaction is not limited to the fight-or-flight response; some psychologists suggest that humans engage in an initial 'freeze' response.
- Fight-or-flight is typically a male response to danger. Recent research suggests females adopt a 'tend and befriend' response instead.
- Fight-or-flight may be counterintuitive for women as running (flight) might put their offspring at risk of danger.
- While the fight-or-flight response may have been a useful survival mechanism for our ancestors, who faced genuinely life-threatening situations (e.g. from predators), modern-day life rarely requires such an intense biological response.

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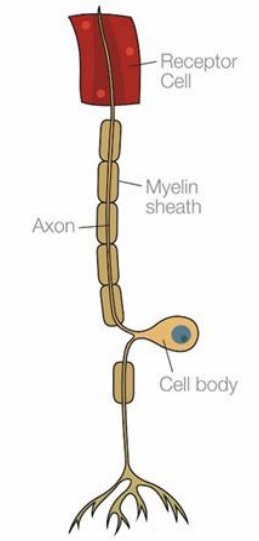
Knowledge Organiser: Neurons, Synapses, & Hormones

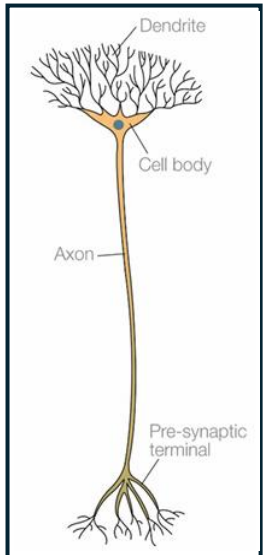


Sensory neurons

Found in receptors such as the eyes, ears, tongue and skin;

Carry nerve impulses to the spinal cord and brain.

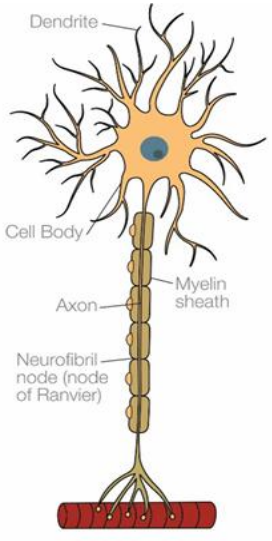
Translated into 'sensations'



Relay neurons

Found in the brain and spinal cord

Allow sensory and motor neurons to communicate.



Motor neurons

Found in the CNS and control muscle movements.

When motor neurons are stimulated, they release neurotransmitters that bind to receptors on muscles to trigger a response, which leads to movement.

Hormones and the Endocrine System

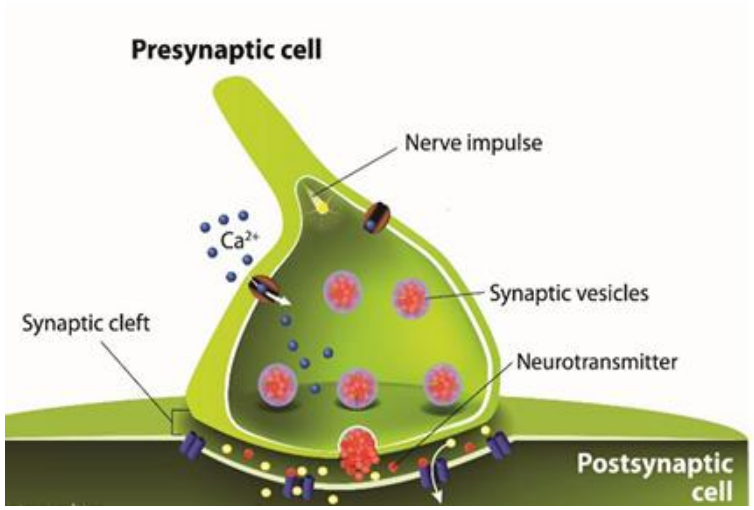
The endocrine system is a network of glands across the body that secrete chemical messages called hormones, using blood vessels. Different hormones produce different effects (behaviours). For example:

- The adrenal gland releases adrenaline which is key for the fight or flight response
- The pituitary gland is the master gland and releases ACTH, a stress hormone
- The testes release testosterone which affect puberty and aggression
- The pineal gland releases melatonin, which regulates our sleep-wake cycle.

Synaptic Transmissions in the Brain

Information is passed down the axon of the neuron as an electrical impulse **(an action potential)**. This causes **vesicles** to release **neurotransmitters.** They must cross over a gap **(synapse)** between the pre-synaptic neuron and post-synaptic neuron and bind to **receptor sites** on the post-synaptic neuron. This results in an excitatory or inhibitory effect.

Excitatory neurotransmitters (e.g. noradrenaline) make the post-synaptic cell more likely to fire, whereas inhibitory neurotransmitters (e.g. GABA) make them less likely to fire.



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Knowledge Organiser: Localisation and Lateralisation

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Localisation of the Brain

Localisation: the idea that certain functions (e.g. language, memory, etc.) have certain locations/areas within the brain. For example:

Motor area: located in the frontal lobe and is responsible for voluntary movements.
Visual area: located at the back of the brain, in the occipital lobe, is the visual area, which receives and processes visual information.

Language centres are also localised to specific areas of the brain. For example, the following are both located on the left of the frontal lobe.

Broca's Area: responsible for speech production
Wernicke's Area: responsible for speech comprehension

Hemispheric Lateralisation of Brain Function

Lateralisation: the idea that two halves of the brain (connected by the corpus callosum) each have functional specialisations, e.g. the left is dominant for language, and the right excels at visual-motor tasks.

Sperry and Gazzaniga (1967) investigated hemispheric lateralisation in their split-brain research to examine the extent to which the two hemispheres are specialised for certain functions. Amongst their results, they found that:

When a picture was presented to their right visual field, patients could describe what they saw, but when it was presented to their left visual field, they could not, demonstrating the superiority of the left hemisphere for language production.

Evaluating Localisation

- Equipotentiality theory suggests that basic motor/sensory functions are localised, but that higher mental functions are not.
- There is evidence for the localisation of language. E.g. Broca's Aphasia (impaired ability to speak) is caused by brain damage in Broca's area.
- Some suggest it is more important to investigate how the brain areas communicate with each other, rather than focusing on specific brain regions, and that localisation ideas are reductionist.
- Gender differences are ignored. E.g. Women have larger language areas.

Evaluating Lateralisation

- Research suggests the main advantage of lateralisation is an increase in neural processing capacity and the ability to perform multiple tasks simultaneously. (Rogers et al. 2004)
- There are issues with research into lateralisation because the split-brain procedure is rarely carried out, meaning very few participants to study.
- Research suggests lateralisation changes with age (Szaflarki et al. 2006) This raises questions about lateralisation, such as whether everyone has one hemisphere that is dominant over the other and whether this dominance changes with age.

Knowledge Organiser: Plasticity & Functional Recovery

Brain plasticity refers to the brain's ability to change and adapt because of experience.

The brain continues to create new neural pathways and alter existing ones in response to changing experiences.

Functional recovery: the transfer of functions from a damaged area of the brain after trauma to other undamaged areas.

It can do this through a process termed neuronal unmasking where 'dormant' synapses open connections to compensate for a nearby damaged area of the brain. This allows new connections in the brain to be activated, thus recovering any damage occurring in specific regions.

Research

Kuhn et al. found a significant increase in grey matter in regions of the brain after participants played video games for 30 minutes a day for 2 months.

Maguire et al. found the posterior hippocampal volume of London taxi drivers' brains positively correlated with their time as a taxi driver and that there were significant differences between the taxi drivers' brains and those of controls.

Davidson et al. demonstrated a permanent change in the brain after prolonged meditation. Buddhist monks who meditated frequently had much greater activation of gamma waves than those with no experience of meditation.

Evaluation

- Some psychologists suggest that research investigating the plasticity of the brain is limited. For example, Maguire's research is biologically reductionist and only examines a single biological factor (the size of the hippocampus) in relation to spatial memory.
- Many psychologists suggest that a holistic approach to understanding complex human behaviour may be more appropriate.
- There is research to support the claim for functional recovery. Tajiri et al. (2013) found that stem cells provided to rats after brain trauma showed a clear development of neuron-like cells in the area of injury.
- Functional recovery ability can deteriorate with age. Elbert et al. concluded that the capacity for neural reorganisation is much greater in children than in adults, meaning that neural regeneration is less effective in older brains.
- This area has led to positive applications for society and the general population, such as neurorehabilitation. This uses motor therapy and electrical stimulation of the brain to counter the negative effects and deficits in motor and cognitive functions following accidents, injuries and/or strokes.

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Knowledge Organiser: Ways to Study the Brain

Post-Mortems

Used to study the physical brain of a person who displayed a particular behaviour while they were alive that suggested possible brain damage.

They enable researchers to examine deeper regions of the brain, such as the hypothalamus and hippocampus, something that is not as easy with other methods of investigation.

Evaluating Post - Mortems

The deficit a patient displays during their lifetime may not be linked to the deficits found in the brain, creating issues with causation.

This method has contributed to our understanding of disorders. E.g. Iverson examined the brains of deceased schizophrenic patients and found that they all had a higher concentration of dopamine.

FMRI Scans

A brain-scanning technique that measures blood flow in the brain when a person performs a task. Deoxygenated haemoglobin has a different magnetic quality from oxygenated haemoglobin.

An fMRI detects these magnetic qualities and creates a 3D map of the brain, highlighting which areas are involved in different neural activities.

Evaluating FMRI Scans

They have good spatial resolution (1-2mm) which allows psychologists to discriminate between different brain regions with greater accuracy.

They have poor temporal resolution (1-4 secs) which means psychologists are unable to predict with a high degree of accuracy, the onset of brain activity.

ERP and EEG's

EEG: measures electrical activity in the brain through electrodes attached to the scalp. There are four types of EEG patterns (e.g. alpha waves) and they produce two states: synchronised (recognised waveform) and desynchronized patterns (no pattern detected).

ERP: Electrodes are attached to the scalp. Researchers look for activity related to a stimulus which is presented many times. An average response is graphed. This procedure, which is called 'averaging', reduces any extraneous neural activity, which makes the specific response to the stimulus stand out.

Evaluating ERP and EEG's

They have poor spatial resolution, only detecting activity in superficial regions of the brain. They cannot provide information on what is happening in the deeper regions of the brain.

They have good temporal resolution. Brain activity can be recorded in real time. This leads to an accurate measurement when undertaking a specific task. However, ERPs are more robust than EEG's, since EEG's only measure general brain activity, and ERP's eliminate extraneous neural activity.

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Knowledge Organiser: Biological Rhythms

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Circadian Rhythms

A 24-hour rhythm is reset by levels of light. E.g. The sleep-wake cycle. Light acts as an external cue, detected by the eye, which sends messages concerning brightness to the SCN. This affects melatonin production. Low light increases production, making us sleepy and high light decreases it, making us alert.

Evaluation of Circadian Rhythms

Siffre (1975) found that the absence of external cues altered his circadian rhythm, showing the sleep-wake cycle is affected by external influences.

Aschoff & Weber studied participants living in a bunker and found that the participants settled into a longer sleep/wake cycle of between 25-27 hours, supporting Siffre.

Duffy et al. (2001) highlight innate individual differences in circadian rhythms. Some people prefer mornings (larks) and others, evenings (owls).

Infradian Rhythms

Last longer than 24 hours E.g. Menstruation.
It is regulated by hormones that promote ovulation or stimulate the uterus for fertilisation. Ovulation occurs roughly halfway through the cycle when oestrogen levels are high. After, progesterone levels increase in preparation for the possible implantation of an embryo in the uterus.

Evaluation of Infradian Rhythms

Russell et al. (1980) found menstrual cycles became synchronised with other females through odour exposure. This highlights the influence of pheromones, which are an exogenous zeitgeber.

Terman (1988) found the rate of SAD is more common in Northern countries where the winter nights are longer. E.g it affects 10% of people living in New Hampshire (a northern part of the US) and only 2% of residents in Southern Florida. These results suggest that SAD is affected by light (exogenous zeitgeber) which results in increased levels of melatonin.

Ultradian Rhythms

Last fewer than 24 hours. E.g. the stages of sleep.
A complete sleep cycle (90 mins) goes through the four stages of NREM sleep before entering REM (Stage 5) and then repeating. EEG's highlight brain waves during the different stages of sleep. E.g. Stages 3 and 4 are 'deep sleep' or slow-wave sleep stages, where it is difficult to wake someone up. This stage is associated with slower delta waves.

Evaluation of Ultradian Rhythms

Randy Gardener remained awake for 264 hours and generally coped well. After, Randy slept for just 15 hours. He recovered 70% of Stage 4 sleep, 50% of his REM sleep, and very little of the other stages. These results highlight the variable nature of ultradian sleep stages.

Individual differences need considering. Tucker et al. (2007) found significant differences between participants in the duration of each stage, particularly stages 3 and 4 (just before REM sleep).

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Knowledge Organiser: Pacemakers and Zeitgebers

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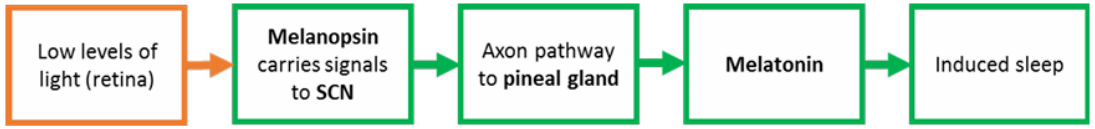
Endogenous Pacemakers

- Internal mechanisms which govern our biological rhythms
- Although endogenous pacemakers are internal biological clocks, they can be altered and affected by the environment.
- The most important endogenous pacemaker is the SCN which is closely linked to the pineal gland. If the SCN detects light, melatonin production is inhibited (and we feel alert) but if not, melatonin production is increased, making us sleepy.



Evaluating Endogenous Pacemakers

Morgan (1955) bred hamsters so that they had circadian rhythms of 20 hours and the SCN neurons from these abnormal hamsters were transplanted into normal hamsters, which subsequently displayed the same abnormal circadian rhythm of 20 hours.

Skene and Arendt (2007) claimed that most blind people who still have some light perception have normal circadian rhythms, whereas those without any light perception show abnormal circadian rhythms.

DeCoursey damaged the SCN areas in chipmunks and found that this greatly disrupted their sleep-wake cycle, and increased nighttime activity.

Exogenous Zeitgebers

- Environmental events that are responsible for resetting the biological clock of an organism.
- These can include social cues such as meal times and social activities
- The most important zeitgeber is light, which is responsible for resetting the body clock each day, keeping it on a 24-hour cycle.
- Social cues, such as mealtimes, can also act as zeitgebers and humans can compensate for the lack of natural light by using social cues instead.

Evaluating Exogenous Zeitgebers

Siffre returned from an underground stay with no clocks or light and believed the date to be a month earlier than it was. This suggests that his 24-hour sleep-wake cycle was increased by the lack of external cues.

Reinberg (1967) examined a woman who spent three months in a cave with only a small lamp. Her menstrual cycle shortened from 28 days to 25.7 days. This result suggests that the lack of light (an exogenous zeitgeber) affected her menstrual cycle/infradian rhythm.

Aschoff & Weber studied participants living in a bunker and found that the participants settled into a longer sleep/wake cycle of between 25-27 hours, supporting Siffre.

Some claim light is both an external and internal influence, so we should not be trying to separate the effects of pacemakers and zeitgebers.