6.1 Influence of biological structures on behaviour: Divisions of the nervous system

- Divided into central nervous system and peripheral nervous system.
- CNS – brain and spinal cord.
- PNS – nerves outside brain and spinal cord.

CNS

- Brain involved in psychological processes – main job is to ensure life maintained.
- Some parts of brain more primitive and concerned with vital functioning – others involved in higher thinking, planning and problem solving.
- Spinal cord helps transfer messages to and from brain to PNS.
- Involved in reflex actions.

PNS

- Extends beyond CNS – transmits messages to whole body from brain.

Two divisions:

- Somatic system – transmits and receives messages from senses (e.g. visual info form eyes). Directs muscles to react and move.
- Autonomic system – transmits and receives info from organs. Further divided.
  - Sympathetic system – increases activity.
  - Parasympathetic system – conserves the body's natural activity levels by decreasing or maintaining it.

6.2 Structure and function of sensory, relay and motor neurons

- Neurons receive and transmit info to other cells.
- 100 billion in brain, 1 billion in spinal cord.

Sensory Neuron

- Tell rest off brain about external and internal environment, processes info from senses.

Relay Neuron

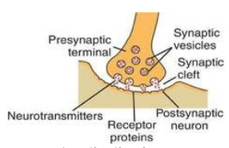
- Carry messages from one part of CNS to another, connect motor and sensory neurons.

Motor Neurons

- Carry signals from CNS which helps organs and muscles function.
- Sensory neuron only transmit messages (unipolar).
- Motor and relay send and receive messages (multipolar).
- Dendrite/receptor cell receive the signal and it travels through neuron to pre-synaptic terminal.

Synaptic Transmission:

- Process of transmitting messages from neuron to neuron.
- Synapse – specialised gap between neurons through which electrical impulse from neuron is transmitted chemically.
- Electrical nerve impulse travels down the neuron and prompts release of neurotransmitters at pre-synaptic terminal.
- Neurotransmitters then released into synapse.
- Other neuron then must quickly take up neurotransmitters and convert them into electrical impulse to travel down neuron to next pre-synaptic terminal.



Excitation and Inhibition:

- Not all messages prompt activation in same way – depends on action potential of post-synaptic neuron and message type received.
- Only certain neurotransmitters can unlock a message channel in certain receptors in post-synaptic neuron.
- Lock and key system.
- Right key (neurotransmitter_ meets right lock (receptor) – specific ion channel in membrane is opened up.
- Ion then flows through membrane into neuron along specific pathways.
- Flooding of ions can cause potential in the dendrites.
  - Excitatory potential: more likely for neuron to fire. If synapse is more likely to cause post-synaptic neuron to fire – excitatory synapse.
  - Inhibitory potential: less like to fire. If message likely to be stopped at post-synaptic neuron – inhibitory synapse.

6.3 Influence of neurochemistry on behaviour: Function of the endocrine system

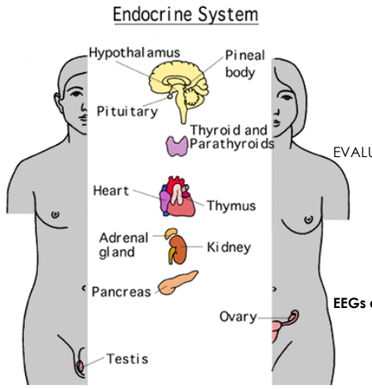
- Series of glands which release chemicals throughout body via blood and other bodily fluids.
- Communicates messages to organs of the body.
- Specialist glands in body .
- Pituitary Gland: some of hormones released are important for regulating endocrine system,
- Adrenal: important part of fight-or-flight response as it facilitates the release of adrenaline.
- Testes: facilitate release of testosterone.
- Ovaries: facilitates release of oestrogen and progesterone.
- Behaviour thought to be influenced by hormones – each hormone is thought to affect behaviour in different way.

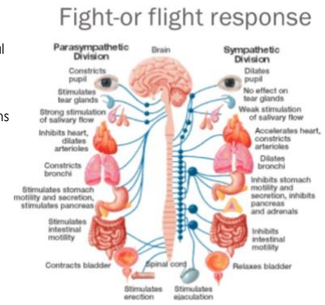
6.4 Fight-or-flight response, including role of adrenaline

- Generated from autonomic nervous system – specifically sympathetic.
- Reflex response – designed to help individual manage physically under threat.
- Also activated in times of stress – body perceives stress and threat.
- Helps individuals react quicker than normal and facilitates optimal functioning so they can fight threat or run from it.
- Hypothalamus recognises threat – sends message to adrenal gland (specifically adrenal medulla) – triggers release of adrenaline to endocrine system and noradrenaline in brain.
- Prompts physical changes:
  - Increased hr – speed up blood flow to vital organs and improve speed of adrenaline around body.
  - Faster breathing rate – increase oxygen intake.
  - Muscle tension – improve reaction time and speed.
  - Production of sweat – temperature regulation.
- Physical changes help individual to fight or run away from potentially threatening situation.

EVALUATION:

- Assessing extent to which biological structures affect behaviour is very difficult. Argued that they are just tools to make behaviour happen rather than being cause. Cause and effect cannot be established – only the relationship between biological influence and behaviour can be investigated.
- Biological structures that underpin behaviour can be seen as reductionist. Attempts to reduce behaviour and cognitive processes down to biological processes e.g. levels of hormones. Too simplistic.
- Scientific research – measures to aid objective – opinion or judgement do not play part increases reliability.





6.5 Localisation of the brain

Hemispheric Lateralisation

- Brain is contralateral – left hemisphere deal with right side etc.
- What you see in right visual field is processed in left hemisphere.
- Same with auditory info, taste and smell.
- LEFT – most people language processing is done in left.
- RIGHT – dominant for recognising emotions in others and at spatial relationships.
- Left focuses on detail – right processes overall patterns.

MOTOR CORTEX

- Movement centred on primary motor cortex of brain – sends messages to muscles via brain stem and spinal cord.
- Particularly important for complex movement.
- Within motor cortex there are areas which control specific parts of body.
- No relationship between size of area of body and number of neurons involved – complexity of movement dictates how many neurons.
- When motor cortex instructs an outcome – spinal cord and other areas co-ordinate areas of body into a movement.

SOMATOSENSORY CENTRES

- Referring to sensation of the body.
- Lies next to motor cortex in brain.
- Perceives touch – amount of neuronal connections needed dictates amount of somatosensory cortex needed for that area.

PRIMARY VISUAL CORTEX

- Two visual cortices – one in each hemisphere.
- Primary visual cortex is in occipital lobe – back of brain.
- Main visual centre –area V1. Patients with damage to that area report no vision of any kind, when awake or in dreams.
- Visual information transmitted along two pathways – one containing components of visual field and other being involve in location within visual field.

PRIMARY AUDITORY CORTEX

- Two primary auditory cortices – one in each hemisphere.
- Receives auditory info from both ears via two pathways that transmit info about what sound is and its location.
- Info from right eye goes primarily to left hemisphere etc.
- If damaged it does not lead to total deafness – sound can still be heard but no longer able to process complex info such as music.

Split brain research

- Corpus callosum – link between the hemisphere.
- People who suffered from epilepsy that was not helped by drug treatment had brain surgery.
- Cut corpus callosum so epilepsy contained in one hemisphere – reduce number of fits.
- Affects on behaviour and perception.
- Patients can tell us about roles of each hemisphere.

Sperry 1968:

- Presented with visual stimuli to far side of each visual field – to one hemisphere at a time. Flashed image for 1/10 second.
- Tactile stimuli –screen so subject could not see what he was holding – info from one hand received by contralateral hemisphere alone.
- Image/object only recognised when presented to same eye/hand again.
- Can only say what they saw or felt when presented to right eye/hand – left hemisphere.
- Objects/images presented to left eye/hand can be identified by pointing to pictures, feeling for it in array of objects or drawing it with left hand.
- Each hemisphere has its own memory that's not accessible to the other.
- Only the left hemisphere able to produce language (speech and writing).
- Right recall and identify stimuli even though it cant verbalise it.
- Two hemispheres have independent perception, awareness and memory.

EVALUATION:

- Useful in understanding role of each hemisphere and extent to which their lateralised.
- Possible that there were other effects during surgery in addition to procedure itself – evidence may be flawed.

LANGUAGE CENTRES

- In left hemisphere for most people.

Broca's Area

- Area of brain responsible for speech production.
- Not all words affected equality. Nouns and verbs seem relatively unaffected in some patients with damage to Broca area – conjunctions and predispositions cannot be spoken.

Wernicke's Area

- Wernicke found patients with damage to area close to auditory cortex had specific language impairment
- Inability to comprehend language and struggle to find right word.
- Still had fluent speech when they could access words quickly
- Wernicke's area important for understanding language and assessing words.

EVALUATION:

- Holistic theory argues localisation of function is incorrect – work on rats did not show specific brain area for memory stored all over brain. Not generalisable.
- Case studies of brain damage indicates localisation and lateralisation of function
- Fact rehabilitation works following brain injury suggests there is no localisation or lateralisation.

6.6 Ways of studying the brain

Functional magnetic resonance imaging (fMRI)

- Operates same as MRI scan – also shows activity as it occurs.
- MRIs record energy produced by molecules of water, after magnetic field removed.
- fMRI uses same principle - measure the energy released by haemoglobin .
- When haemoglobin has oxygen it reacts differently – when are of brain is active and therefore using more oxygen.
- Amount of energy released by haemoglobin is detected by scanner and change measured.
- Gives moving picture.

EVALUATION:

- Provides moving picture of brain activity – patterns of activity can be compared rather than just the physiology of the brain.
- Complexity of brain activity means interpreting an fMRI is problematic.
- Machines expensive to buy and maintain and require trained operators. Research expensive and difficult to organise.
- Sample size in studies often small due to availability and funding – results different to generalise.

EEGs and ERP

- EEG – electrodes placed on scalp and they record the electrical activity of the brain. Measure activity of cells immediately under electrode – using more gives fuller picture.
- ERP – use same apparatus, but record when there is activity in response to a stimulus introduced by researcher. Greater accuracy than self-report.

EVALUATION:

- Both only reasonably accurate for activity measure close to electrodes – finer detail is missed.
- Cheaper methods of scanning – widely available to researchers.
- Output from equipment needs to be interpreted so there is a level of expertise required.
- Useful method to test reliability of self-report answers.

Post-mortem examinations

- Persons body, including brain, is examined after they have died.
- Used to see where damage had occurred in brain and how that might explain behaviour exhibited by individual.

EVALUATION:

- No brain activity measured – dead person.
- Issues with comparison of functioning prior to death. May have been little info about person.
- Some brains may have been effected by the reason for death.
- No discomfort experience by person.

6.7 Biological Rhythms

CIRCADIAN RHYTHM

- Biological rhythm lasting a day.
- E.g. sleep/wake cycle – measured by reading the time and regular events like when we eat and go to sleep.
- Body clocks regulated by internal system including factors such as release of hormones like melatonin, metabolic rate and body temperature.
- **Siffre 1975 -** Spent six months in cave with natural light or cues to day or time. Internal body clock allowed to free-run, settled into a sleep/wake cycle of 25-30 hours. Lost track of how many days in there – believed they was in there one month less than he actually was. Natural light sources in the environment are vital for keeping individuals 24 hour cycle.

Endogenous pacemakers:

- Rhythms from internal bodily systems.
- Can be affected by the environment.
- Still function without cues form the environment- although circadian rhythms can vary as a consequence.
- Suprachiasmatic nucleus seems to be most influential endogenous pacemaker in the body – in centre of brain, regulated by light from the environment.
- Animals also have SCN so can be examined, argued it can be generalised to humans.

Exogenous zeitgebers:

- Cues from environment that play an important role in regulating time and circadian rhythm in humans.
- Cue for endogenous pacemaker help regulate body clock so individual synchronised with environment.
- Sunlight, noise, seasons and the moon are all zeitgebers.
- Entrainment is where there is an adjustment of the body clock l line with the environment.
- Happens when a traveller crosses time zones – pacemakers not synchronised with environment anymore.
- Zeitgebers act as cues allowing person to adjust.

Evaluation:

- Most research criticised for external validity – often carried out in artificial conditions – resulting behaviour could be argued to be false.
- Monitoring sleep can also have affect on sleep patterns – recorded sleep patterns could be by-product of being monitored rather than the effect of zeitgeber/pacemakers.
- Using animals in research raises concerns about extrapolation – physiological differences – make generalising to humans problematic.
- Research used to develop interventions to help clinical population.

INFRADIAN RHYTHMS

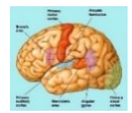
- Lasts more than 24 hours.
- E.g. menstrual cycle – dictated by endocrine system.
- Rhythm not imposed purely by release of hormones – zeitgebers such as light and odours involved.
- **Reinberg 1967 –** women spent three months in cave, days lengthened to 24.9 hours, menstrual cycle shortened to 25.7 days. Level of light in cave could of affect cycle. Infradian rhythms influenced by external zeitgebers such as light.

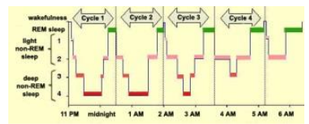
Evaluation:

- Effects of pheromones can help explain menstrual synchronicity – groups of women who live together have menstrual cycles synchronised with each other – something in shared environment that acts as zeitgeber.
- Evolutionary advantage – potential for synchronised pregnancy – shared childcare.

ULTRADIAN RHYTHMS

- Lasts less than 24 hours. E.g. Sleep cycle - 5 stages that occur within the night over 90 minutes – sleeper goes through stages 1-4 then returns to 3 then 2 then REM.





Dement et al. 1957:

- Participants connected to EEGs whilst they slept.
- Took measurements throughout time asleep.
- Everyone had periods of REM every night.
- High incidents of dream recall when participants were awakened during REM – if awakened in other stages very fewer reported dreaming.
- REM during REM sleep varied according to dream type and mirrored REM whilst awake and completing similar task.
- Stages of sleep follow typical pattern throughout the night, dreams mostly occur in REM sleep.
- Many replications of findings.
- Way data collected could of caused atypical reaction from participants and the frequency of occurrence of REM sleep might be different in non-experimental setting.
- Dreaming difficult to measure.
- EEG – objective measure, scientific, increased reliability.

PLASTICTY

- Ability to replace function lost by anatomical damage.
- Cell body can never be replaced but sometimes axons can.

Ways body can increase axon functioning:

- Increased brain stimulation – even if damage is only on one side, other hemisphere functions at lower level too – has reduced input. If undamaged hemisphere stimulated, recovery can be improved.
- Axon sprouting – when axon damaged connection with neighbouring neuro lost. Other axons already connect with that neuron will sprout extra connections, replacing ones destroyed – compensating for loss.
- Denervation super sensitivity – axons that do similar job become aroused to higher level compensate for ones lost.

FUNCTIONAL RECOVERY OF BRAIN AFTER TRAUMA

- Much recover after trauma is due to anatomical compensation – intensive rehabilitation.
- Brain learns to compensate for function.
- Taught how to use working faculties and function to compensate for the ones that are lost.

Factors affecting recovery:

- Perseverance – dependent on assessment and perseverance. Function may appear to be lost but may be that individual not trying and takes view that it is unrecoverable.
- Physical exhaustion, stress and alcohol – when function recovered, function us used with considerable effort and although person can do task, often fatigued by it. Stress and alcohol consumption can affect ability to use function that has been regained.
- Age – deterioration of brain in old age, affects extent and speed of recovery. Following brain trauma 40+ regained less function in treatment than younger patients. More likely to decline in terms of function 5 years after recovery.
- Gender – women recover better from brain injury as their function not as lateralised. Research assessing cognitive skills shows women performed significantly better than men on tests of attention/working memory and language, whereas men outperformed females in visual analytical skills.