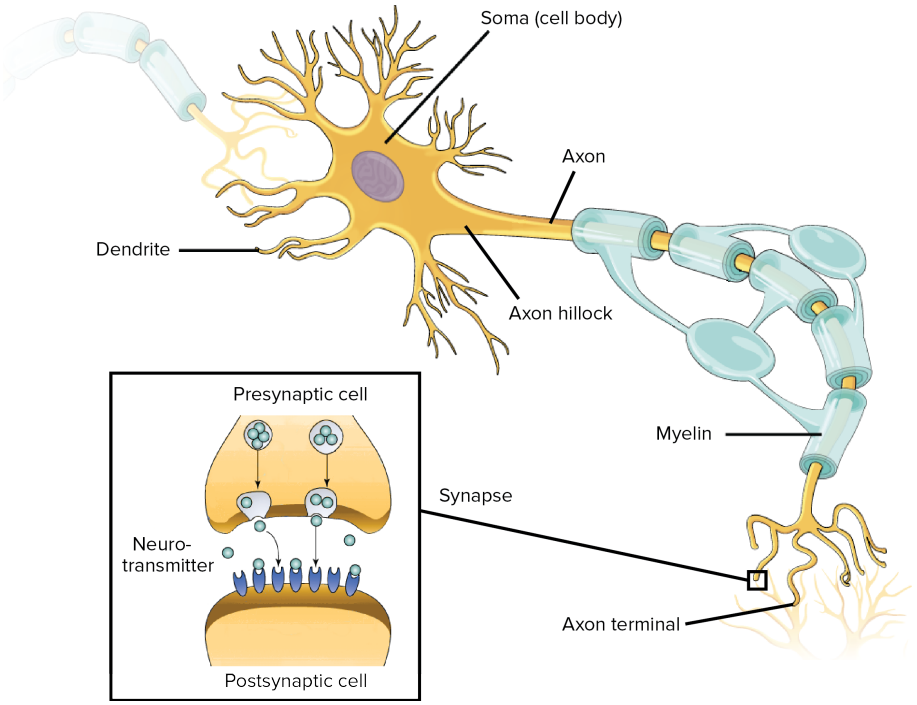
Edexcel Psychology A-level

Unit 2: Biological Psychology

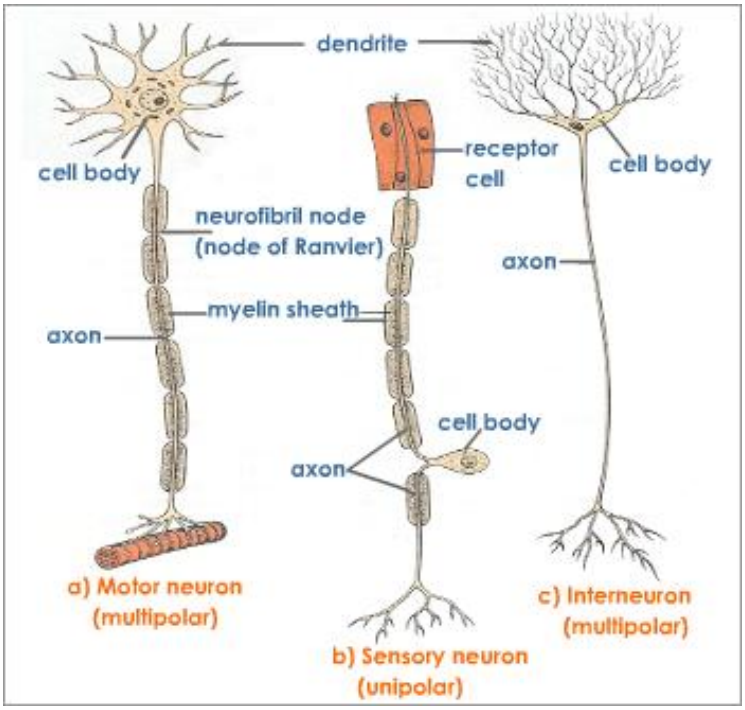
Notes

Part 1 — The Nervous System and the Endocrine System

- The nervous system is made up of the brain and the spinal cord, whilst the peripheral nervous system (PNS) relays messages from the environment to the CNS, via sensory neurones, and from the CNS to effectors, via motor neurones.
- The PNS is further subdivided into the autonomic nervous system (which controls involuntary, vital functions of the body, such as maintaining heart rates and breathing rates) and the somatic nervous system (which receives information from sensory receptors belonging to each of the 5 senses, and results in effectors being stimulated by the CNS, via motor neurones).
- The autonomic nervous system is also subdivided into the sympathetic and parasympathetic branches. These branches work as part of an antagonistic pair during the 'rest and digest' response, and are crucial in producing the physiological arousal needed to maintain the fight or flight response.
- For example, the sympathetic nervous system increases heart rates, breathing rate, causes vasoconstriction and pupil dilation, whilst the parasympathetic nervous system decreases heart rate, breathing rates, causes vasodilation and pupil constriction.
- The endocrine system is the main chemical messenger system of the body, where hormones are secreted into the bloodstream from glands, and then are transported towards target cells in the blood, with complementary receptors. The pituitary gland is considered to be the 'master' gland because it controls the release of hormones from all other glands in the body. For example, the thyroid releases the hormone thyroxine, which increases heart rate and therefore increases the rate of growth. The adrenal gland releases adrenaline which creates the physiological arousal preceding the fight or flight response, through increasing the activity within the sympathetic branch of the nervous system. The fight or flight response is described below:



1. The body senses and becomes aware of a stressor in the environment e.g. the sound of a speeding car.
2. Through sensory receptors and sensory neurones in the PNS, this information is sent to the hypothalamus in the brain which coordinates a response and triggers increased levels of activity in the sympathetic branch of the ANS.
3. Adrenaline is released from the adrenal medulla in the adrenal glands, and is transported to target effectors, via the blood and through the action of the endocrine system.
4. This results in the rectum contracting, saliva production being inhibited and a greater breathing rate. This creates the physiological response needed to sustain the fight or flight response, whose adaptive purpose is to enable us to escape the stressor and so increase the likelihood of our survival.
5. Once the stressor is no longer a threat, as part of an antagonistic pairing, the hypothalamus triggers less activity in the sympathetic branch and more activity in the parasympathetic branch of the ANS. This is also referred to as the rest and digest response, due to the parasympathetic branch decreasing the activity which was originally increased through the action of the sympathetic branch.



Part 2 — Neurons and Synaptic Transmission

- Synaptic transmission is a method of neurons communicating with each other, relaying information to the CNS across sensory neurons and carrying out responses dictated by the brain through sending information to effectors via motor neurons.
- The process of synaptic transmission is as follows:

1. An action potential arrives at the presynaptic membrane, causing depolarisation through the opening of voltage-dependent calcium ion channels, and the consequent influx of calcium ions.
2. The increased concentration of calcium ions within the membrane causes the vesicles, containing neurotransmitter, to fuse with the presynaptic membrane and release their contents into the synaptic cleft through exocytosis.
3. The neurotransmitter diffuses across the synaptic cleft, down a concentration gradient, and binds to complementary receptors on the post-synaptic membrane. This can result in an inhibitory or excitatory effect in the postsynaptic membrane.
4. The resultant action potential will then be transmitted along the axon of the following neuron, resulting in a 'cascade' of neurotransmission!

- Neurotransmitters can either have an inhibitory or excitatory effect. Inhibitory neurotransmitters (e.g. serotonin) reduce the potential difference across the postsynaptic membrane through the closure of the voltage-dependent sodium ion channels, reducing the likelihood that an action potential will be generated.
- Excitatory neurotransmitters (e.g. dopamine) increase the potential difference across the postsynaptic membrane through triggering the opening of more voltage-dependent sodium ion channels, increasing the likelihood that an action potential will be generated.

Part 3 — Localisation of Function in the Brain

- Localisation theory suggests that certain areas of the brain are responsible for certain processes, behaviours and activities.
- The motor area = Separated from the auditory area by the central suclus and found in the frontal lobe, this area is involved in regulating and coordinating movements. Lesions or damage in the motor area result in an inability to control voluntary fine motor movements.
- The auditory area = An area of the temporal lobe, located on the superior temporal gyrus, which is responsible for processing auditory information and speech. Lesions or damage in the auditory area causes hearing loss, whereas damage to specific parts of the auditory area (Wernicke's area) results in Wernicke's aphasia.
- The visual area = An area in the occipital lobe which is responsible for processing visual information.
- The somatosensory area = An area of the parietal lobe which processes information associated with the senses e.g. touch, heat, pressure etc. [1]"These regions receive neuronal input from specific nuclei of the thalamus that correspond with the handling of sensation along the lines of touch, pain, temperature and limb position". Lesions in this area result in a loss of ability to denote sensitivity to particular bodily areas.

[1] Noggle, C.A and Moreau, A.R., Somatosensory Area, Encyclopedia of Child Behaviour and Development, pp. 1416.

- Wernicke's Area = Responsible for speech comprehension and located in the temporal lobe (the left temporal lobe for most people). Lesions or damage (e.g. through stroke and trauma) results in Wernicke's aphasia, which is characterised by the use of nonsensical words (called syllogisms), no awareness of using incorrect words, but no issues with pronounciation and intonation.
- Broca's Area [Brodmann areas 44 and 45] = Responsible for speech production and located in the frontal lobe, usually in the left hemisphere. Lesions or damage results in Broca's aphasia, characterised by difficulty forming complete sentences and understanding sentences, as well as failing to understand the order of words in a sentence and who they are directed towards i.e. I, you, we, him, me etc.
- Overall, the left hemisphere of the brain is associated with language production and comprehension. Therefore, language is an example of a cognitive ability which is both localised and lateralised (to the left hemisphere).

+ Supporting evidence for localisation of brain function = Tulving et al demonstrated, using PET scans, that semantic memories were recalled from the left prefrontal cortex, whilst episodic memories were recalled from the right prefrontal cortex. This shows that different areas of the brain are responsible for different functions, as predicted by localisation theory. This idea was further supported by Petersen et al (1988) , who found that Wernicke's area activation is required for listening tasks, whereas Broca's area is required for reading tasks. This confirms the idea that Wernicke's area is involved in speech comprehension, whilst Wernicke's area is responsible for language production.

+ Supporting Case Studies = Phineas Gage was injured by a blasting rod which intersected the left side of his face, tearing through his prefrontal cortex. [2]"The damage involved both left and right prefrontal cortices in a pattern that, as confirmed by Gage's modern counterparts, causes a defect in rational decision making and the processing of emotion". Such case studies, particularly those showing marked differences after trauma, demonstrate the idea that some areas of the brain are responsible for specific functions. However, with the use of case studies, the subjectivity of the conclusions drawn and the unusual sample, alongside a lack of control over confounding and extraneous variables, must also be considered.

— Contradictory Theory = The opposite to localisation theory would be a holistic view of brain function, suggesting that each function requires several brain areas to be activated and that these functions are not restricted to these areas. For example, after removing 20-50% of the cortices belonging to rats, found that no specific brain area or lesion was associated with learning how to traverse through a maze. This suggests that intelligence, or even learning, is too complex and advanced a cognitive ability to be restricted to certain areas of the brain. Therefore, this suggests that localisation theory may provide a better explanation for 'simple', rather than complex, brain functions.

+ Evidence supporting the link between certain brain areas and symptoms of OCD = Dougherty et al (2002) studied 44 OCD sufferers who'd undergone lesioning of the cingulate gyrus (cingulotomy) in order to control their symptoms. After being assessed using the Structured Clinical Interview for DSM-III-R, the researchers found that [3]"At mean follow-up of 32 months after one or more cingulotomies, 32% met criteria for treatment response, and 14% were partial responders. 32-45% of patients previously unresponsive to medication and behavioural treatments for OCD were at least partly improved after cingulotomy". This suggests that not only are certain brain areas responsible for symptoms of OCD, but that an improved understanding of localisation of brain function has practical applications in the development of more advanced treatments for serious mental disorders.

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[2] Damasio, H., Grabowskki, T., Frank, R., Galaburda A.M. and Damasio A.R. (1994), The Return of Phineas Gage: Clues About the Brain from The Skull of a Famous Patient,

[3] Prospective Long-Term Follow-Up of 44 Patients Who Received Cingulotomy for Treatment-Refractory Obsessive-Compulsive Disorder Darin D. Dougherty, Lee Baer, G. Rees Cosgrove, Edwin H. Cassem, Bruce H. Price, Andrew A. Nierenberg, Michael A. Jenike, and Scott L. Rauch, American Journal of Psychiatry 2002 159:2, 269-275

Part 4 — Plasticity and Functional Recovery of the Brain after Trauma

- Plasticity = Refers to the brain's ability to physically and functionally adapt and change in response trauma, new experiences and learning. Neuroplasticity was demonstrated by Maguire et al (2006).
- The idea of plasticity opposes the previous theory that there is a 'critical window' for synaptic and neuronal connection formation, which occured during the first 3 years of life, after which no new neuronal connections would be formed (Gopnik et al).
- We control the strength and number of neuronal connections in our brains through the process of synaptic pruning i.e. [4]"the process by which extra neurons and synaptic connections are eliminated in order to increase the efficiency of neuronal transmissions".
- After studying the brains of London taxi drivers, Maguire et al. found a larger grey matter volume in the mid-posterior hippocampi (and a lower volume in the anterior hippocampi) of their brains, alongside a positive correlation between an increasing grey matter volume and the longer the individuals had been taxi drivers. The researchers concluded that [5]"a complex spatial representation, which facilitates expert navigation and is associated with greater posterior hippocampal gray matter volume, might come at a cost to new spatial memories and gray matter volume in the anterior hippocampus". This may be because the hippocampus is associated with spatial awareness; an ability which taxi drivers must have when they complete The Knowledge test.
- Functional recovery is the ability of the brain to transfer the functions of areas damaged through trauma, to other healthy parts of the brain, thus allowing for normal functioning to carry on. This is enabled through the law of equipotentiality (where secondary neural circuits surrounding the damaged area become activated), axonal sprouting (formation of new synapses and strengthening of axonal connections between damaged and healthy areas), reformation of blood vessels (as part of the haemodynamic response, where activated areas experience a higher blood deoxygenation level) and recruiting homologous areas on the opposite side of the brain.
- This means that function is not always lateralised to specific hemispheres!
- One example of functional recovery would be Ramachandran's research into phantom limb syndrome, which he explained as being [6]"caused by the sensory input from the face skin 'invading' and activating deafferented hand zones in the cortex and thalamus… there appears to be tremendous latent plasticity even in the adult brain". This demonstrates negative plasticity, because the neuroplasticity results in painful or negative consequences.
- A second example of functional recovery would be the case of Jodi Miller, whose entire left hemisphere was removed in an attempt to control her epileptic seizures. However, through the mechanisms of neuroplasticity, she was still able to control the right side of her body through the use of cerebral spinal fluid. This demonstrates positive plasticity, because the neuroplasticity results in desirable or positive consequences.

+ Evidence supporting the positive and negative effects of neuroplasticity = Much research has been carried out into the phenomenon of plasticity. For example, Ramachandran et al. has demonstrated negative plasticity through providing an explanation for phantom limb syndrome in terms of cortical reorganization in the cortex and thalamus (particularly, the somatosensory area). Positive plasticity has been demonstrated by the case study of Jodi Miller, who has shown the power of recruiting homologous areas on the opposite side of the brain, axonal sprouting and the reformation of blood vessels. Therefore, there is evidence supporting not only the existence of, but also the uses of plasticity.

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[4] Santos, E. and Noggle, C.A. (2011), Synaptic Pruning, Encyclopedia of Child Behaviour and Development, pp.1464-1465.

[5] Maguire, E. A., Woollett, K. and Spiers, H. J. (2006), London taxi drivers and bus drivers: A structural MRI and neuropsychological analysis. Hippocampus, 16: 1091–1101. doi:10.1002/hipo.20233

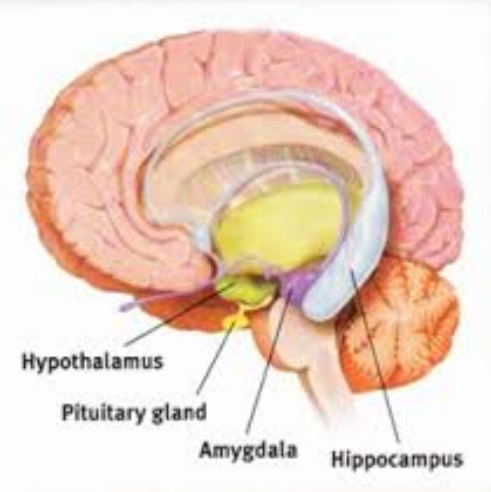
[6] Ramachandran V.S., Plasticity and functional recovery in neurology, Clin Med July/August 2005 5:368-373; doi:10.7861/clinmedicine.5-4-368

+ Neuroplasticity occurs in animals too = Hubel and Weisel (1970) sutured the right eye of kittens, who are blind from birth, for a period of 6 months, opening the eyes and several points and monitoring brain activity in the visual cortex. The researchers found that, although the right eye was closed, there was still activity in the left visual cortex, corresponding to the development of occular dominance columns. This was demonstrated by how [7]"during the period of high susceptibility in the fourth and fifth weeks eye closure for as little as 3-4 days leads to a sharp decline in the number of cells that can be driven from both eyes". This therefore supports the idea that areas of the brain receiving no input can take over the function of highly stimulated areas, despite originally having different functions.

+ Cognitive reserve may increase the rate of functional recovery = Cognitive reserve is the level of education a person has attained and how long they have been in education. Research suggests that an increased cognitive reserve increases the likelihood of making a disability-free recovery (DFR) after trauma, due to increased rates of neuroplasticity. For example, Schneider et al (2014) found that of the [8]769 patients studied, 214 achieved DFR after 1 year. Of those, 50.7% had between 12 and 15 years of previous education and 25.2% had more than 16 years. This suggests that individuals who have been in education for a longer time may have developed the ability to form neuronal connections at a high rate, and therefore experience high levels of functional recovery, demonstrating positive plasticity.

— There are limits to spontaneous and functional recovery = Although after trauma the brain activates secondary neural circuits which contribute towards reinstating normal function (law of equipotentiality), the brain can only 'repair' itself up to a specific point, after which motor therapy or electrical stimulation is needed to increase recovery rates. For example, Lieperta et al (1998) found that after constraint-induced movement therapy, the motor performance of stroke patients improved significantly. Therefore, this suggests that functional recovery cannot be relied upon to reinstate normal function.

Part 5 — Neural and Hormonal Mechanisms in Aggression



- The limbic system is associated with the regulation of emotions and emotional behaviour. It is comprised of the formix, cingulate gyrus, thalamus, hippocampus, hypothalamus and amygdala (Maclean, 1952).
- The amygdala is thought to be particularly important in regulating emotional behaviour, as demonstrated by Gospic et al (2011) in her study of the Ultimatum game. The researchers found that when participants rejected an unfair monetary reward (which can be seen as a social provocation), there was a sudden increase in amygdala activity, as measured using an fMRI. These 'spikes' were less drastic when benzodiazepines were used, suggesting there is a strong link between the action of the autonomic nervous system (amygdala activity) and aggression.
- Serotonin is an inhibitory neurotransmitter (reduces the action potential in the postsynaptic membrane) and is associated with the regulation of impulsive behaviour when present at normal concentrations in the orbitofrontal cortex (Denson et al, 2012).

[7] Hubel, D. H., Wiesel, T. N., (1970), The period of susceptibility to the physiological effects of unilateral eye closure in kittens. The Journal of Physiology, 206 doi: 10.1113/jphysiol.1970.sp009022.

[8] Schneider et al (2014), Function recovery after moderate/severe traumatic brain injury, Neurology, 82(18), pp.1636-1642.

- Due to the link between serotonin and the regulation of emotional/impulsive behaviour, it has also been proposed (by Virkkunen et al, 1994) that serotonin is involved in controlling sleeping patterns, due to being found in lower levels in non-violent offenders.

— There may be an over-reliance on the limbic system as an explanation for aggressive behaviour. For example, the orbitofrontal cortex (OFC) may also play a significant role, due to its link with the action of serotonin, as shown above. Therefore, as suggested by Gospic et al, it may be more effective to focus on the neural connections between the OFC and the limbic system, as opposed to looking at the two in isolation.

+ However, there is evidence supporting the negative correlation between increasing serotonin levels and decreasing levels of aggression. For example, Berman et al found that participants who were given the serotonin agonist 'paroxetine', they behaved less aggressively compared to a control group whilst playing a video game, delivering fewer and less intense shocks!

- Testosterone is an androgen (male sex hormone) present in significantly larger concentrations in men, compared to women, and is responsible for the production of male facial characteristics and reproductive organs, being secreted from the pineal gland. There may be a link between decreased testosterone levels and decreased levels of aggressive behaviour, a positive correlation demonstrated by castration studies.
- Dolan et al (2001) provided further support for this link by showing that violent prisoners in maximum security prisons displayed higher levels of testosterone than their non-violent counterparts.

— Carre and Mehta (2011) suggest that, through their dual-hormone hypothesis, testosterone does not work alone in determining aggression, but rather has an antagonistic relationship with the stress hormone cortisol, where increased levels of aggression are associated with increased testosterone levels but only when cortisol is low. Therefore, this implies that different hormones have different predictive values for aggression and are part of a system when developing aggressive behaviour.

Part 6 — Ways of Investigating the Brain

1. PET Scans = These use radioactive isotopes with a long half-life e.g. Nitrogen-13. As the isotope decays, such as through the emission of positrons, these particles interact and are combined with glucose or water molecules, forming radiotracers. An increased number of radiotracers will accumulate in areas of the brain with high levels of activity, due to the haemodynamic response where such areas have a larger requirement for oxygenated blood. Therefore, such highly active areas will appear brightly coloured on the PET scans, as the emitted positron collides with an electron, resulting in the emission of gamma rays which are detected by the scan.

— PET scans are very expensive and so are not extensively used in public healthcare systems - only for diagnosis purposes.

— Some people may object to the use of radioactive tracers in their blood, due to exposure to ionising radiation which may lead to cancer. Therefore, only one or two PET scans can be carried out on an annual basis.

+ Very useful for the diagnosis and monitoring of progressive, neurodegenerative diseases, such as Alzheimer's (characterised by a reduction in glucose metabolism rates in the brain).

2. fMRI scans = These rely on the haemodynamic response. Areas of the brain with high levels of activity have a larger requirement for oxygenated blood, leading to a higher rate of blood deoxygenation. As measured through the bold response, the deoxyhaemoglobin in the blood in these highly active areas absorbs the signal produced by the scan, so such areas appear brightly coloured on the scan.

+ High temporal resolution as up to 4 images can be produced per second.

+ Can be used whilst a patient is carrying out a task, and so data from fMRI scans can help us to make inferences about brain function and localisation.

+ Does not use ionising radiation, unlike PET scans, and so is safer.

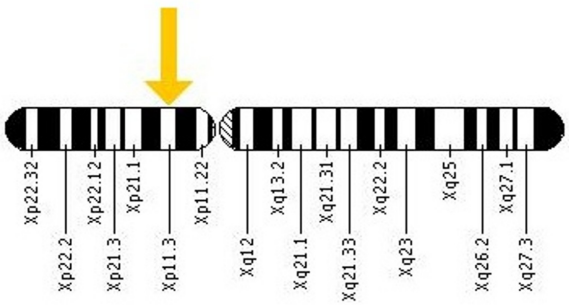
— Poor temporal resolution because there is approximately a 5 second difference between neuronal activity and the produced image.

3. EEG scans = Through the use of electrodes attached to the scalp, EEG scans measures and amplifies the electric activity across the whole brain i.e. action potentials being transmitted across the axons of neurons.
+ Particularly useful in investigating the characteristics of the different stages of sleep, as demonstrated by Dement and Kleitman.
+ Much higher temporal resolution than fMRI scans, and so more appropriate for the monitoring of ongoing cerebral states and activity.
— Lower temporal resolution compared to fMRI scans, with particular difficulty in differentiating activity between adjacent areas.
+ Useful in the diagnosis of epilepsy, which is characterised by random bursts of activity.
4. Post-mortem examinations = These involve a comparison of the patient's brain with that of a healthy, neurotypical brain. Any differences (e.g. lesions, damage, abnormally large or small areas) are assumed to have caused the neruological problem the patient faced in their lifetime.
— Incorrectly makes the assumption that differences compared with the neurotypical brain must be the explanation for neurological or cognitive deficits. Prolonged drug use, stress and genetic factors may be other plausible explanations.
— Ethical issues arise because informed consent cannot always be obtained before the patient dies or from the family. The patient may be unable to give informed consent e.g. HM suffered from deficits in his short-term memory, and so would not remember having signed the document.
+ Particularly useful for advancing medical knowledge, and being the basis of further research into certain areas of the brain e.g. Broca used a post-mortem examination on his patient Tan, which led to the identification of Broca's area and was the foundation of further research into the theory of the localisation of brain function.

Part 7 — Genetic Factors in Aggression

- Twin studies are particularly important in determining the genetic/biological basis of a behaviour, due to the fact that MZ twins are genetically identical, whilst DZ twins share 50% of genes with each other. Evidence from this comes from Coccaro et al (1997), who found concordance rates of 50% for MZ twins and 19% for DZ twins in terms of physical acts of aggression. This strongly suggests a genetic basis for aggression.
- The differences between MZ and DZ twins in terms of rates of aggression was further supported by Rhee and Waldman (2002) who came to the conclusion that, based on their meta-analysis of adoptees suffering from aggressive behaviour and APD (antisocial personality disorder) that a further 41% variance in rates of aggressive behaviour can be accounted for by candidate genes.
- An example of a key candidate gene would be the MAOA gene, which codes for the MAOA enzyme that breaks down serotonin within the synaptic cleft after neurotransmission e.g. leading to increased levels of the metabolite 5-HIAA. Brunner et al provided evidence for the link between decreased MAOA levels and aggression through studying a large Dutch family who were all actively engaged in aggressive behaviour (e.g. rape) and who all had unusually low MAOA levels. This would mean that as less serotonin is broken down within the synaptic cleft, there is a higher rate of serotonin binding to complementary receptors on the postsynaptic membrane, leading to an increased rate of stimulation of the postsynaptic membrane.
- However, Frazzetto et al (2007) suggests that it may be more beneficial to take an interactionist approach. The researchers found that low MAOA levels only resulted in increased aggression when accompanied by traumatic childhood events which had occurred within the first 15 years of life. This supports the interactionist, diathesis-stress model where the diathesis (biological vulnerability) is the genetic mutation of the MAOA gene and the stressor (environmental stressor) is childhood abuse, showing how genes and the environment interact with each other.

— However, a major problem with the use of the diathesis-stress model is the difficulty in distinguishing between the effects of nature (MAOA genetic mutations) and nurture (childhood trauma), as well as determining which has a larger influence. For example, McDermott et al (2009) found that provocation



in a money-lending game was key to triggering aggressive behaviour in individuals with low MAOA activity levels, whereas previously they displayed the same levels of aggression as the healthy, neurotypical control group. This suggests that although the interactionist approach may be a better explanation for aggression compared to biological determinism, there is still a lack of clarity over the role of the stressor.

+ There is evidence supporting a positive correlation between increasing MAOA activity levels and increasing levels of prosocial behaviour, as demonstrated by Mertins et al (2011) who found that participants with high MAOA activity levels behaved more compassionately in a money-lending game, often with fewer provocations or refusals of offers. Therefore, this suggests that the link between MAOA and aggression is valid because correlations in both directions (increasing and decreasing MAOA levels) are supported by research evidence.

+ There is also evidence supporting the strong link between MAOA activity levels and concentrations of serotonin, which has been based upon animal studies where researchers are able to 'switch off' or prevent the expression of the gene coding for the MAOA enzyme, thus allowing the researchers to study its effects in isolation. For example, Godar et al (2014) found that when the MAOA gene was switched off in mice, these mice were 'hyperaggressive', potentially due to the increased stimulation of postsynaptic neurons due to an increased concentration of serotonin in the synaptic cleft. Therefore, alongside additional evidence that the serotonin agonist 'fluoxetine' reverses this effect, increases the validity of the MAOA-aggression link.

Part 8 — The Ethological Explanation of Aggression

- Ethological explanations draw links between animal and human behaviour, on the basis of studying animals in their natural habitats. From the ethological perspective, aggression is adaptive because of two reasons. Firstly, aggression increases the chance of survival of a species - through appeasement following an aggressive confrontation, the 'loser' will seek out new territory, increasing the scope of the resources of the species and so increasing their chances of survival. Secondly, aggression acts as a method of increasing one's social status within a hierarchy, as demonstrated by Pettit et al (1988) who found that young children use aggressive tactics in playgrounds to assert their authority, lead the others and have their way.
- Since not all acts of aggression leads to death, ritualistic behaviours (a series of behaviours conducted in the same, set order) are important. After an aggressive confrontation, the 'loser' (through an act of appeasement) will make themselves vulnerable to the victor (e.g. wolves displaying their neck) as a sign of accepting defeat. This is adaptive in the sense that it ensures no further aggressive behaviour between the two, thus increasing the likelihood of survival of the species.
- The physiological process of an innate-releasing mechanism (IRM) is activated by a release signal, causing a cascade of the same series of behaviours, described as a fixed action pattern (FAP). These can be characterised as being, according to Lea: being responsive to a releaser, ballistic, single-purpose, unaffected by learning, universal and stereotyped.
- It is important to note that a releaser which activates the IRM will always lead to the FAP, with no further signals needed. This is an innate response and cannot be unlearnt, as demonstrated by Tinbergen (1951) who found that male sticklebacks will respond aggressively to model red spots (a releaser which triggers the IRM), regardless of whether the model resembles a stickleback or not.

+ There is evidence to suggest that ritualistic aggression may not be displayed by all species and in all situations. For example, Goodall's (2010) observation of chimpanzees in the Gombe Stream National Park found that rival communities slaughtered each other in a systematic fashion, despite appeasament and ritualistic signals being displayed by the victims. This supports the idea that once a releaser has triggered the IRM, this will always lead to a FAP, and so the releaser is a stronger predictor of aggressive behaviour than appeasement.

— However, a more accurate description of FAPs may be 'modal' rather than 'fixed', as suggested by Hunt (1973). The researcher provided evidence that the duration of each behaviour within each FAP may vary between individuals as well as the specific other animal towards which it is targeted. Hence,

environmental and social factors may have significant influences on the course of the FAP, resulting in lower validity of the universal nature of FAPs as part of an explanation for aggression.

+ There is also evidence supporting the biological, innate basis of IRM and FAP systems. For example, researchers have pointed to Bremner's work (1993) on the link between the MAOA activity and levels of aggression, as evidence for the heritability of IRM and FAP systems. This is due to aggressive behaviour being triggered by increased levels of testosterone which must have been preceded by exposure to a releaser or signal, which had triggered the IRM. Therefore, the role of the limbic system and the IRM can be considered as valid explanations of aggression.

Part 9 — Evolutionary Explanations of Human Aggression

- Sexual jealousy is stronger in males (compared to females) due paternity uncertainty, which may lead to cuckoldry i.e. a male raising a son which is not his own. This is an evolutionary disadvantage, due to the male wasting his resources which he could have otherwise used on raising his own children. Therefore, anti-cuckoldry behaviours, in the form of male retentive strategies, are adaptive because they reduce the risk of cuckoldry.
- Wilson and Daly (1996) suggested that there are two types of male retention strategies - direct guarding (e.g. insisting on knowing where your partner is and who she is with) and negative inducements (e.g. threats of suicide to avoid infidelity).
- Therefore, there is a clear link between male retention strategies and aggression, the latter of which is usually used to implement such strategies. This idea is supported by Shackleford et al (2005) who found that when 107 couples, who'd been married for less than a year, individually completed the Male Retention Inventory (husbands) and the Spouse Influence Report (wives), there was a positive correlation between increasing scores on these two measures, which translated to being an important predictor of the use of aggression in such married relationships. This was further supported by Wilson et al (1995), who found that male retention strategies left 53% of respondents fearing for their lives.
- Bullying may not be the product of poor social skills or dysfunctional upbringing as previously thought, but may have an evolutionary advantage. For example, in evolutionary terms, men who bullied other men through reinforcing a power imbalance, were more likely to have their pick of resources and to mate with more females (due to the influence of fewer competing males), and increasing the likelihood of their genes being passed onto as many offspring as possible. Female bullying is more likely to occur within relationships to ensure fidelity (e.g. through threats or monitoring), as opposed to aiming to acquire new relationships (which is the male perspective). Therefore, the aggressive act of bullying may be considered as adaptive, as suggested by Volk et al (2012).

+ Evolutionary theories are useful because they can provide an explanation for gender differences in aggression. For example, Campbell (1999) suggested that females are more likely to engage in acts of verbal, as opposed to physical, aggression as this ensures that their own survival, as well as the survival of their offspring, is not endangered. Such tactics also prevents females from being involved in life-threatening physical confrontations with their partners, and so further increases their chance of survival through the use of non-aggressive methods of resolving conflicts (Bess and Shackleford). This utility increases the validity of the evolutionary explanation of aggression.

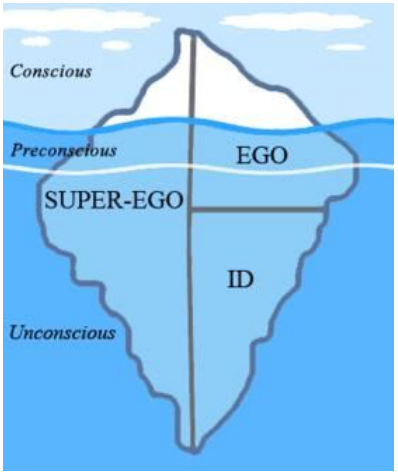
— There are methodological issues associated with the use of evolutionary theories to explain current examples of aggression. For example, predominantly such studies are correlational, meaning that there is only a correlation between aggression and the use of male retention strategies. This means that the research may suffer from the 'third factor problem', where there may be a third contributory factor which has not been studied. These studies may also jump to make causal conclusions, when really correlations can never demonstrate a 'cause and effect' relationship.

+ However, there is research supporting the link between sexual jealousy and aggression. The main example of this would be Shackleford's 2005 study which found that male retention strategies are a method of expressing sexual jealousy, which leads to aggressive behaviour both towards females

and other partners. This increases the reliability of evolutionary theories as a method of explaining aggression, due to this supporting evidence.

Part 10 — The Psychodynamic Approach

A01 Introduction and Assumptions:



- Freud adopted the use of psychic determinism = This is the idea that all behaviour is caused by unconscious internal conflicts, over which we have no control.
- There are 3 levels of consciousness: The conscious, preconscious and unconscious.
- We are only aware of our conscious. Contents of the preconscious are revealed through parapraxes, slips of the tongue and dreaming. Therefore, since we are completely unaware of our unconscious, inferences of its workings can be made through the psychoanalysis (analysing symbols in dreams) and psychotherapy.
- The unconscious stores our biological drives and instincts (e.g. hunger, thirst and sex) as well as upsetting and disturbing thoughts repressed from the conscious.

Freud's Tripartite Personality:

- Freud viewed the personality as made up of three components i.e. 'tripartite'. These are the Id, ego and superego.

2. Id = This is the innate part of the personality, and operates on the pleasure principle. Therefore, the Id constantly demands instant gratification (e.g. to fulfill innate, biological instincts, such as hunger and thirst) and so is in conflict with the superego.

Stage	Ages	Focus of Libido	Major Development	Adult Fixation Example
Oral	0 to 1	Mouth, Tongue, Lips	Weaning off of breast feeding or formula	Smoking, Overeating
Anal	1 to 3	Anus	Toilet Training	Orderliness, Messiness
Phallic	3 to 6	Genitals	Resolving Oedipus/ Electra Complex	Deviancy, Sexual Dysfunction
Latency	6 to 12	None	Developing Defense Mechanisms	None
Genital	12+	Genitals	Reaching Full Sexual Maturity	If all stages were successfully completed then the person should be sexually matured and mentally healthy.

3. Ego = Formed during the first 3 years of life, and operates on the reality principle. The ego helps to resolve the conflict between the id and the superego through the use of defence mechanisms (repression, denial and displacement). The strength of the unconscious depends upon how efficiently the ego resolves this conflict.
4. Superego = Formed at the end of the phallic stage, and operates on the morality principle. This contains the child's internalised sense of right and wrong, based upon their same-sex parent. The superego is in constant conflict with the Id.

The Psychosexual Stages:

- Freud adopted a nomothetic approach by suggesting that there a series of developmental stages through which all children progress, and in the same order.
- Each stage is characterised by a conflict, which must be resolved to pass to the next stage, apart from latency.
- Failure to do so results in 'fixation' at that stage, where dysfunctional behaviours associated with that stage are carried forwards to adulthood.

- The ideas of the Oedipus and Electra Complexes were developed on the basis of case studies conducted on Little Hans, where Freud suggested that Little Hans' phobia of horses stemmed from a fear towards his father, due to having sexual desires for his mother.
- This is an example of the idiographic approach to research (i.e. the use of case studied), but with a nomothetic application (i.e. all boys experience the Oedipus Complex, whilst all girls experience the Electra Complex).

A02 Potential Application Questions:

1. Comparisons between the psychodynamic approach and humanism.
2. Explanation of the case of Little Hans, using the psychosexual stages.
3. Links between the psychodynamic approach and the current scientific status of Psychology (synoptic with Research Methods).
4. Psychodynamic explanations of mental disorders, making links with the tripartite personality and the role of the unconscious.

A03 Evaluation:

— Unconscious Concepts = Since we are unaware of the unconscious, then it is not possible to objectively and systematically measure it. Therefore, this means that, according to Karl Popper, that the psychodynamic approach does not meet the scientific criterion of falsification, leaving it unfalsifiable and a pseudoscience. This does little to improve the scientific credibility of psychology, and indeed has left many with an inaccurate view of psychology as a scientific discipline.

— The use of an idiographic approach / Case studies = Many of Freud's theories, most notably the Oedipus and Electra Complexes, were based on data from individual case studies and interviews. There are several problems with this. The first, is that participants selected to be subjects of case studies are often of some kind of special psychological interest, and so cannot represent the experiences of the general population, so the findings lack ecological validity. Secondly, mainly qualitative data is collected, which means that the researcher draws their own subjective conclusions. This is particularly the case if the researcher knows what they are looking for and/or the aims of the investigation, so the results will be affected by researcher bias. Therefore, Freud's data and theories suffer from limited applications and generalisability.

— Psychic Determinism = Freud suggested that all behaviour is the product of unconscious, internal conflicts (between the Id and the superego, whilst being mediated by the ego) over which we have no control. This means that every action, even 'accidental' slips of the tongue, has some kind of meaning and can give us insight into our unconscious. However, this adds to the subjectivity of interpretations of these meanings, and therefore is not in line with scientific methods of investigating behaviour. This is all in contrast to the hard determinism approach used by behaviourism, reciprocal determinism used by social learning theory, soft determinism used by the cognitive approach and biological determinism used by the biological approach.

+ Practical Applications = Psychotherapy and psychoanalysis are both rooted in the psychodynamic approach and still have modern uses. For example, Kohlenberg et al (2002) found that [9]"FECT / Functional Analytic Cognitive Therapy produced a greater focus on the client-therapist relationship and is a promising approach for improving outcomes and interpersonal functioning. It also appears that a focus during sessions on clients' problematic cognitions about the therapist adds to the efficacy". Therefore, Freud's psychodynamic approach has made a long-lasting contribution towards treatment of various mental disorders, such as depression.

Part 11: Introduction to Key Study:

[9] Robert J. Kohlenberg, Jonathan W. Kanter, Madelon Y. Bolling, Chauncey R. Parker, Mavis Tsai, Enhancing cognitive therapy for depression with functional analytic psychotherapy: Treatment guidelines and empirical findings, Cognitive and Behavioral Practice, Volume 9, Issue 3, 2002, Pages 213-229,

- Genetic explanations of offending mainly focus on the heritability and role of candidate genes in the development of criminal behaviour.
- For example, Christiansen et al (1977) found concordance rates of 33% for identical (87 MZ) twins but only 12% concordance for non-identical (147 DZ) twins. Since MZ twins share 100% of their genetic information with each other, whereas DZ twins share only 50%, then this suggests that there is a moderate genetic or heritable basis of criminal behaviour.
- However, the concordance rates for MZ twins is not 100%, and so this suggests that an interaction between the environment and genetics together produces the outcome of criminality, as suggested by Mednick et al (1984), and so the traditional diathesis-stress model can be used to account for this.
- Candidate genes each represent slight genetic variations which increase the risk of developing criminal behaviour, in this case, as suggested by Tiihonen et al (2014). Abnormalities in the MAOA and CDH-13 genes, which both code for neurotransmitters such as serotonin and dopamine and so are also implicated in the development of ADHD, increases the likelihood of becoming criminal by 13-fold. This gives further support to the role of a genetic diathesis in the development of criminality.
- Neural explanations mainly focus on individuals with antisocial personality disorder (APD), a disorder which is very common amongst criminals. For example, Raine et al (2000) found that criminals have a lower volume and activity level (11% reduction) in the prefrontal cortex, which is responsible for logical thinking and decision making. Therefore, this supports the idea that criminals may have difficulties in regulating their emotions and so make irrational decisions.
- Neural abnormalities associated with criminality were further supported by Keysers et al (2011), who found that criminals appear to have a 'neural switch' which they can use to turn their capacities for empathy on or off. This may explain why and how criminals lack empathy towards their victims.

— A key methodological issue with the use of twin studies as a means of investigating the genetic basis of behaviour is that such studies assume that the only difference between twins is the amount of genetic information they share. This is an incorrect assumption and would be better addressed through the use of an interactionist approach. For example, the fact that MZ twins are likely to share the same environment as opposed to normal siblings may explain why MZ concordance rates are higher than for normal siblings, despite both sharing 50% of their genes. This suggests that causal conclusions about the genetic basis of criminality have incorrectly been reached.

+ Strong support for the use of a diathesis-stress model in explaining criminality comes from Mednick et al (1984). After analysing the court convictions of 14,427 adoptees with adoptive and biological parents, the researchers concluded that [10]"siblings adopted separately into different homes tended to be concordant for convictions, especially if the shared biological father also had a record of criminal behaviour". This supports the idea that criminality is only likely to be an outcome if a genetic susceptibility is paired with environmental (criminal) stressors, as predicted by the diathesis-stress model.

— The focus on the role of genetics and neural activities as a means of explaining criminal behaviour suffers from the problem of biological reductionism, as suggested by Katz et al (2007). Although it does appear that criminality runs in families, so do other risk factors associated with criminality e.g. a high frequency and intensity of exposure to pro-criminal attitudes (similar to Sutherland's Differential Association Theory), a lack of educational opportunities, economic deprivation etc. Therefore, it is important not to stereotype children from criminal families as 'criminal' as this may lead to the realisation of self-fulfilling prophecies.

Part 12: An Introduction to Van den Oever et al (2008)

- Prefrontal cortex AMPA receptor plasticity is crucial for cue-induced relapse for heroin-seeking.
- Associative learning processes are essentially based upon the classical conditioning principles of associations being formed between the unconditioned stimulus and the neutral stimulus (through

[10] Genetic influences in criminal convictions: evidence from an adoption cohort. S. A. Mednick, W. F. Gabrielli, Jr, B. Hutchings, Science. 1984 May 25; 224(4651): 891–894.

repeated pairings), leading to the neutral stimulus being the conditioned stimulus, which then produces a conditioned response.

- The aim of the research was to establish the role of neural plasticity in response to drugs, and specifically focus on the synaptic functioning of the brain. There were three conditions, with different periods of abstinence: the home cage (21 days of abstinence in home cage), extinction (21 days of abstinence with daily 1-hour abstinence sessions) and the control condition (no abstinence).
- The researchers found that repeated exposure of heroin to rats meant that there was the downregulation of the AMPA receptor subunit GluR2, and this is associated with a smaller AMPA/NMDA ratio.
- The researchers concluded that [11]"GluR2 receptor endocytosis and the resulting synaptic depression in ventral mPFC are crucial for cue-induced relapse to heroin-seeking. As reexposure to conditioned stimuli is a major cause for heroin relapse, inhibition of Glur2 endocytosis may provide a new target for the treatment of heroin addiction". The cues are more important than the drug, in terms of changing brain structure (through neural plasticity) and functioning.
- A particularly important real-life application of an increased understanding of the role of associative learning in re-exposure to drugs is an improved effectiveness of such treatment programmes, with a focus on either removing cues which trigger relapse, or learning how to cope with and ignore such cues.

[11] Prefrontal cortex AMPA receptor plasticity is crucial for cue-induced relapse to heroin-seeking Michel C Van den Oever, Natalia A Goriounova, Ka Wan Li, Roel C Van der Schors, Rob Binnekade, Anton N M Schoffelmeer, Huibert D Mansvelder, August B Smit, Sabine Spijker & Taco J De Vries *Nature Neuroscience* **11**, 1053 - 1058 (2008) Published online: 1 August 2008