Biopsychology

For this part of your exam you need to cover the following areas:

1) The central nervous system
2) The peripheral nervous system
3) Fight or flight process
4) Synaptic transmission including excitation and inhibition
5) Motor, relay and sensory neurons
6) Role of pacemakers and zeitgebers in biorhythms
7) Circadian, Infradian, Ultradian biological rhythms
8) Localisation, lateralisation, plasticity and recovery of the brain
9) Ways to study the brain

This booklet will break up each approach into the minimum details that you need to know, remember and understand.

The central nervous system: This consists of your spine and brain, and together they work to ensure complex functions including movement

The peripheral nervous system: This consists of the ANS (autonomic) and the SNS (somatic). The SNS is responsible for the use of effectors such as muscles. The ANS is made up of 2 branches. Parasympathetic branch (for resting state) and sympathetic branch (stress state). During the sympathetic branch, the adrenal gland is stimulated to release adrenaline, which causes us to enter fight or flight mode (HR and BP increase…)

Neurons: Neurons are ways in which the brain and body communicate. We have sensory neurons that detect information from our environment and this gets sent to the relay neuron, then to the motor neurons, which pass the sensory information to the brain. The motor neurons then send messages back to the sensory neurons (PNS) and cause an effector in the SNS to respond. For example, jolting away from a hot iron.
These neurons are covered by myelin sheath and nodes of ranvier, and pass messages through axon potentials and dendrites.

Synaptic transmissions: Synapses in the brain are what pass chemicals like serotonin around the brain. Axon potentials (Electrical impulse) force chemicals out of their vesicles and into the synapse, where they wait to be bound to receptor sites on other neurons. Excess in synapses is recycled

For future use. The electrical impulse can be positively charged (excitation) and result in a lot of synapse activity, or negatively charged (inhibition).

Ways the brain is investigated

The brain is investigated using a range of methods including:
1) Postmortems of dead people: these are used to investigate the intricate structure of the brain and find causes of disorders. For example, researchers discovered the SDN in gender, using postmortems. However, the sample is low in population validity, there can be no cause and effect established due to bidirectional trends.
2) EEG: Electrodes are placed on the brain and the scan is able to see what parts of the brain are active. For example, Raine found low activity in the area of the brain for emotion, in murderers. However, they only give you a general view of the brain and do not allow you to have precision.
3) ERP: Event related potentials include electrodes to the brain, giving people tasks, and then precisely see what parts of the brain are involved. This is much more accurate than EEG's, yet they both share similar resolutions.
4) FMRI scans: scans that can detect the blood flow in areas of the brain. Used in schizophrenia research and are the only ones that measure blood flow rather than precise findings. However, they are very expensive and there is some risk of radiation.

Endogenous pacemakers and exogenous zeitgebers

Pacemakers are external things that help us to regulate or biological rhythms, such our sleep cycle. These can include melatonin, the pineal gland, hormones—anything within the body that helps us have an internal clock. Zeitgebers are external timekeepers: clocks, social cues, meals. The great debate is which is the most important in our biorhythms—internal or external?

Circadian rhythms

24 hour rhythms such as our sleep wake cycle. It is influenced by light (pacemaker) since our pupils are able to detect light/darkness and pass messages to the brain (the scn) to release melatonin or stop producing it. It is also affected by time too (zeitgeber). In the artic circle where there is constant

Darkness at times, they should have a disturbed sleep cycle, yet they are able to use clocks and social cues to maintain a good cycle. Siffre contrasts this when he found his internal clock to work fine, even in the absence of clocks and cues.

Infradian rhythms

Monthly/yearly rhythms such as menstruation, hibernation and seasonal changes. Menstruation is affected by hormones (pacemakers) such as FSH and oestrogen. However they are also affected by pheromones (zeitgebers). Russel found that 4 out of 5 women synchronised menstrual cycles after being exposed to 1 menstruating womens sweat, proving the role of zeitgbers. However, female basketballers did not synch—meaning it cant just be the role of pheromones and sweat that regulate menstruation.

Ultradian rhythms

Short, 90 minute cycles, such as urination, eating and the stage we go through when we are asleep. .Each cycle of sleep takes approx. 90 mins (45 in nrem and 45 in rem sleep). Measured using EEG's, alpha waves are dominant in the brain when we are alert, delta waves start in stage 3 when are HR and BP decrease, delta waves are dominant in stage 4 meaning that we are deeply asleep and in this stage, we also release growth hormone. REM sleep is next and where we spend half of our cycle, alpha waves show that the brain is active in rem sleep which is paradoxical since it should be the deepest sleep. Several cycles happen before we wake up, however some things affect these cycles: age (babies have more rem than adults), work (shift workers at night, sleep in the day and don't get good sleep). Implications from this research include helping shift workers or employers to create shift rotations that cause minimal damage to sleep. Peter Tripp skipped 200 hours of sleep and hallucinated, proving that sleep is crucial. Cats deprived of sleep died on flowerpots, all proving that this rhythm is crucial to survival.

Localisation of the brain

This is the idea that the functions of the brain are different (localised) in each part. For example, Brocas area (speech production) and Wernickes area (speech analysis) are the language centres and each plays a different role in speech. The brain is made of lobes and cortex areas, each with their own

Purpose. Frontal lobe (motor cortex) parietal lobe (somatosensory cortex) occipital lobe (visual cortex) and temporal lobe (auditory cortex). Research into rats proved that the functions of the brain are not localised since when they tried to run a maze with damaged lobes, no one area was more problematic than they other—meaning that the brain worked as a whole, not as separate parts. However, OCD patients who have parts of the brain removed, improve symptoms, showing that some areas are localised! Perhaps it is better to assume that simple brain functions ARE localised but the more complex functions of the brain ARE NOT and require the whole brain.

Lateralisation of the brain

Sperry investigated split brain patients who had their corpus callosum damaged, in order to see if functions of the brain were lateralised to the left hemisphere or the right hemisphere. He found that patients drew better with their left hand (right brain) than with their right hand (left brain) proving that the right hemisphere is dominant in these visual tasks. However he found they could describe what they looked at in their left visual field (right brain) much worse than if they described what they looked at in their right visual field (left brain) showing that speech and descriptive skills are lateralised to the left hemisphere of the brain. Despite his findings, the sample is small and suffered epilepsy, rendering them an invalid sample. The implications may be significant for being who have damage to the brain. If we know the left area is for description, then this is useful for doctors who may be trying to rehabilitate your brain after injury.

Plasticity and functional recovery of the brain

If someone does damage their brain, good news! The brain is able to regenerate and repair itself after injury, or transfer the functions of the damaged area to other parts of the brain! However, after a while, this will stop and manual rehabilitation is needed from medical teams. The brain can go through axonal sprouting and recovery spontaneously, but thanks to the brains plasticity, there is a lot of hope for recovery. Plasticity refers to the brains ability to grow and adapt to our experiences. For example, synaptic pruning means that we lose unneeded synapses, and we make stronger connections in the brain in other areas. For example, London taxi drivers had an increase in their cerebral cortex thickness after studying hard for their taxi test. Bilingual students and medical students have superior hippocampi in contrast to others—meaning that if we practice, we can improve our brain! Great for growth mindset!