Psychology – cognitive level of analysis

Science, Biology

Biological level of analysis Bidirectional – cognition can affect biology and biology can affect cognition Nature versus nurture debate – debate whether human behaviour is the result of biological or environmental factors Interactionist approach – both nature and enlivenment Principles of biological level of analysis: 1. Behaviour can be innate because it is genetically based. 2. Animal research can provide insight into human result. 3. There are biological correlates of behaviour. Reductionist approach – micro-level of research, which breaks down complex human behaviour into its smallest parts.

Neurons Neurotransmission Neurotransmitters are stored in neuron's terminal buttons Synapse – gap between neurons Reuptake – neurotransmitters after sending the message are either broken down or reabsorbed by terminal buttons Neurotransmitters: 1. Acetylcholine – effect: muscle contraction, and a role in the development of memory in the hippocampus. 2. Dopamine – effect: voluntary movement, learning, and feelings of pleasure. 3. Norepinephrine (noradrenaline) – effect: arousal, alertness, and stimulation of the sympathetic nervous system. 4. Serotonin – sleep, arousal levels, and emotion.

Kasamatsu and Hirai – monks after 48h of not eating, drinking, sleeping started to have hallucinations and the level of serotonin was increased. These higher levels of serotonin activated the parts of the brain called the hypothalamus and the frontal cortex, resulting in hallucinations. Drugs given to people are not neurotransmitters, but they stimulate or block specific neurotransmitter. Mertinez and Kesner –role of acetylcholine on memory. Rats going through the maze, at the end= food. 1st group= injected scopolamine, which blocks acetylcholine receptor sites, so decreasing available acetylcholine.

Effect: slower than the control group. 2nd group= injected physostigmine, which blocks the production of cholinesterase(cleans up the rests of acetylcholine). Effect: quicker than the control group. 3rd group= control group, no injections. Longitudinally – over a long period of time Localization of brain function Phineas Gage - the man with an iron stick going through his brain Paul Broca – discovered that people with damage in the left frontal lobe were unable to understand and make grammatically complex sentences.

Broca's Aphasia- being unable to speak but able to understand speech (Tan studied by Broca) Carl Warnicke – the left posterior superior temporal gyrus= language comprehension. Warnicke's patients could produce speech, but could not understand it. Wernicke's Aphasia - able to produce speech, but could not understand it. Karl Kim and Joy Hirsch – used fMRI to research how the brain processes language in bilingual individuals. 1st group= those who had learned a second language as children. 2 nd group= had learned a second language later in life.

People were asked to think about something they had done a day before, first in one language, then in the other. Both groups used the same part of Wernicke's area, regardless of which language they were thinking in. But their use of Broca's area differed. 1 st group used the same Broca's area for both languages. 2 nd group used a larger area of the brain, with the second language activating an area adjacent (sasiedni, sasiadujacy) to the area activated by the first language. Nucleus accumbens – pleasure centre Robert

Heath – by electrically stimulating specific parts of the brain of depressed patients, they would experience pleasure.

He let the patients press the buttons themselves to receive pleasure. James Olds – stimulated pleasure centres of rats. Rat was pressing a button to receive pleasure, but to get to the button the rat had to walk across electrified grids. It appears that the electrical activation of the pleasure centre is based mostly on dopamine (a neurotransmitter that promotes desire) and serotonin (a neurotransmitter that promotes satiety and inhibition). Ablation – removing Scarring – lesioning Hetherington and Ranson – they lesioned a part of a brain called the ventromedial hypothalamus in rats.

The rats increased their food intake dramatically, and often doubled their weight. Hypothalamus plays role in the regulation of hunger. EEG – when neurons transport information, they have an electrical charge, so EEG register patterns of voltage change in the brain. PET – scan monitors glucose metabolism in the brain. The patient is injected with a harmless dose of radioactive glucose, and the radioactive particles emitted by the glucose are detected by the PET scanner. The scans produce coloured maps of brain activity. fMRI - provide three-dimensional pictures of the brain structures, using magnetic fields and radio waves.

It shows actual brain activity and indicates which areas of the brain are active when engaged in a behaviour. Brain plasticity Brain can be changed by the behaviour, environment (and the other way around). Hubel and Weisel – brain can change as a response to environmental input. Brain is constantly changing as a result of experience throughout the lifespan. Brain plasticity – brain’s ability to rearrange the connections between its neurons, that is the changes being a result of learning and experience. Dendritic branching – dendrites grow in numbers and connect with other neurons.

Rosenzweig and Bennett - they placed rats into one of two environments to measure the effect of either enrichment or deprivation on the development of neurons in the cerebral cortex. The enriched, stimulating environment had interesting toys. The deprived environment had no toys. The rats spent 30 or 60 days in there and they were sacrificed. Post-mortem studies of their brains showed that those from the stimulating environment had an increased thickness in the cortex. The frontal lobe, which is associated with thinking, planning and decision making, was heavier in the rats that had been in the stimulating environment.

Similar results we have when we place rats with other rats, toys and having a company create the best conditions for developing cerebra thickness. Richard Davidson - could meditation change brain activity? He involved 8 Buddhist monks who were highly experienced in meditation and 10 volunteers who had been trained in meditation for one week. All the participants were told to meditate on love and compassion. Using a PET scan, Davidson observed that two of the controls and all of the monks experienced an increase in the number of gamma waves in their brain during meditation.

Gamma waves have been linked to higher reasoning faculties as soon as they stopped meditation, the volunteers’ gamma waves reduced to normal, while the monks, who had meditated on compassion for more than 10 000h in order to attain the rank of adept, did not experience a decrease to normal in their gamma-wave production after they stopped meditating. The synchronized gamma-wave area of the monks' brains during meditation on compassion was found to be larger than the corresponding activation of the volunteers' brains.

This led Davidson to argue that meditation could have significant long-term effects on the brain and the way it processes emotions. These findings indicate that the brain adapts to stimulation (from environment or our own thinking). Mirror Neurons Thy play vital role in the ability to learn from another person. A mirror neuron is a neuron that fires when an animal or a person performs an action or when the animal observes somebody else perform the same action. The mirror neuron is so called because it " mirrors" the behaviour of another. Marco Iacoboni - asked participants to look at human faces while undergoing on fMRI.

He wanted to see if by looking at the emotion on someone's face would cause the brain of the observer to be stimulated. First, the participants had to imitate the faces they were shown, then they had to simply watch as they were shown the faces again. Not only were the same areas of the brain activated in both cases, but it became clear that the limbic system was also stimulated-observing a happy face activate pleasure centres in the brain. Functions of hormones in human behaviour Hormones – produced by the glands that make up the endocrine system Hormones: 1. Adrenaline – gland: adrenals; function: flight or fight response, arousal 2.

Cortisol – gland: adrenals; function: arousal, stress hormone, memory 3. Melatonin – gland: pineal; function: regulation of sleep 4. Oxytocin – gland: pituitary and hypothalamus; function: mother-child attachment 5.

Testosterone and oestrogen – gland: gonads; function: development, emotion Hormones enter directly into the bloodstream, so they are slower than neurotransmitters. Some chemicals serve as both hormones and neurochemicals. Oxytocin is a hormone that is produced by the hypothalamus after being stimulated by the pituitary gland. As a hormone it plays a role in inducing labour contractions and lactation.

It is released with hugs, it is associated with creating bond between people. Melatonin production by the pineal gland is stimulated by darkness and inhibited by light. Melatonin levels peak in the middle of the night, and gradually decreases towards morning. Circadian rhythm- biological clock based on a 24h day/night cycle. Melatonin release correlates with the circadian rhythm. Taking melatonin helps to fall asleep. Rosenthal – high levels of melatonin contribute to seasonal affective disorder (SAD), a subcategory of depression that is characterized by sleepiness and lethargy, as well as cravings (glod) for carbohydrates.