Summary of Brain Structures

Referenced from:

Hart, S. (2008). Brain, attachment, personality: An introduction to neuro-affective development. London: Karnac.

Pinel, J. (2010). *Biopsychology*. Prentice Hall.

BODY BRAIN STRUCTURES:

The following structures register changes in the body's internal environment, such as heart rate, blood pressure, etc.; the foundation of basic motivations and drives. Proprioceptive systems provide a sense of the body's position in space. The sensations involve various modalities such as pressure/touch, warmth/cold, pain/and the kinesthetic sense which is based partly on ones sense of the static position of the limbs and partly on the sense of the limbs in motion. The proprioceptive sense is crucial for the affective sense of self.

Reticular Activating System-manages arousal and alertness, controls the focus of attention, co-ordinates stimuli. Main "circuit breaker" for the brain. Springs from the base of the brainstem and travels all the way up through the brainstem. Includes the nuclei that produce a range of neurotransmitters.

PAG (periaqueductal grey matter) is located at the top of the brainstem. If is activated in fear reactions in immobilization states, in grief reactions, and in pleasure.

Tectum- provides a primitive representation of the entire body, ie a combination of internal and external body sensations. This sensory integration provides a sensorimotor map of the body that activates basic action- generating mechanisms, such as approach or avoidance behaviors that are closely related to pleasure and displeasure.

Colliculus areas process simple orientation responses and provide a sense of the body in the world. These areas provide a basic motor image of the body. In this area visual auditory, tactile, and other sensory stimuli come together through polymodal areas. The sensorimotor self - representation develops from the interaction of the tectum colliculus areas, and circuits in the PAG. The colliculus areas are closely connected to the premotor cortex, where motor plans and intentions arise.

Cranial Nerves -12 Cranial nerves regulate somatic and self regulating functions, ie breathing, blood flow, digestion, etc. Regulate communication and emotional attunement, regulate facial motor functions, and facial expressions, connect sensory body input with brain processes, are the physiological basis for sensory impressions. The vagus nerve is a self calming system that is capable of quickly regulating the parasympathetic nervous system, including the heart rate and the digestive system and supports a balance of stimulation and relaxation.

Cerebellum- 10 cm wide, with two hemispheres, and densely packed neurons with many interconnections. Registers body movements in relation the environment, and regulates the control of fine motor functions , helping to co-ordinate the rhythmic movements in the face, diaphragm, etc. The cerebellum adjusts motor movements to match the appropriate sequence in relation to sensory information, and damage to the cortex of the cerebellum is associated with timing issues –e.g. difficulty in learning to play a piano, plan action sequences etc. Many connections with the prefrontal cortex have been discovered recently, so the cerebellum coordinates the body with emotional and cognitive processing.

LIMBIC SYSTEM

Thalamus
Relay station that receives sensory impulses and distributes information to the appropriate parts of the brain. Integrates motor functions. Co-ordinates systems that are important in relation to orientation and behavior. Enables the simultaneous use and integration of the different senses. Co-ordinates and regulates interactions with the outside environment.

Basal Ganglia
Organize instinctive motor functions, represent a basic source of willpower, contain the pleasure and reward system, adjust arbitrary movements refine motor sequences and store them in an organized motor plan. Filter potential movement alternatives and thoughts.

Putamen-controls automatic movement

Cingulate gyrus- determines what we pay attention to , and supports the coordination of sensation and action

Nucleus accumbens- receives input from the limbic system and releases dopamine

Fornix- connects the hippocampus to other regions of the brain including the hypothalamus, linking memory and glandular function.

Hypothalamus- Controls the autonomic nervous system. Controls the bodies balance for sex hormones, releases stress hormones. Receives information about the bodies state. Triggers dispassionate aggression, and playing dead behaviour. Regulates the arousal and inhibitory (calming) system . Organizes a rhythm and time structure in relation to light and dark. Regulates sleep wake rhythm, temperature, hunger, and thirst. The basis for instincts and drives.

Hippocampus- makes it possible to remember sequences of events. Vital to short term memory and relates memories to time and place. Commits special and temporal dimensions of experience to memory. Categorizes and stores incoming stimuli. Shapes special representation of the world. Makes it possible to remember one's life story in a time context. Integrates information from many sensory modalities. Converts unconscious (implicit) memory tracks to conscious (explicit) mental images. Makes it possible to maintain information for short periods of time. Influences the regulation of information take up all over the brain. Structures conscious, logical and social functions, in charge of discriminating experienced stimuli.

Rhinal Cortex -object recognition memory

Amygdala -monitoring, scanning for sensory stimuli. Prepares organism for action on the basis of signs of potential danger, relates to environment with primary punishment and reward systems. Activates fight or flight behavior. In charge of emotional and somatic organization of experience. In charge of generalizing responses to experienced stimuli.

THE FRONTAL LOBE SYSTEM AND PARALIMBIC STRUCTURES

Dorsolateral Prefrontal Cortex- The large area of cortex on the dorsolateral surface of each frontal lobe, it is involved in the cognitive organization of behavior. Coordinates information and reactions, combines and directs mental impressions, and plans actions.
Part of a superconvergenge zone that is highly connected with other parts of the brain.
Essential for emotional stability.

Premotor Cortex- coordinates impulses into motor patterns and enables volitional movement

Orbitofrontal Cortex- The large area of the cortex at the anterior pole of each prefrontal love, plays a role in emotion and social behavior, as in anticipating the impact of ones actions on others.

Anterior Cingulate Gyrus- The front part of the cingulated gyrus which is necessary for the ability to act counter to innate or early acquired impulses. Emotionally related movement is controlled from here, and the area is involved in selective attention and volitional movements.

Posterior Cingulate Gyrus- the back part of the cingulated gyrus, which relates to social behavior, attachment and caring behavior, and the ability to play.

Corpus Callosum- links the right and left brain, both inhibiting and facilitation activity between the two hemishperes.

Ventromedial Cortex- where emotions are consciously experienced and meaning is bestowed upon perceptions.

Visual, auditory, and somatosensory cortices- each area is devoted to processing the perception of specific sensory information traveling from the sensory organ (eyes, ears, body), through the thalamus, and to the processing area.

Vocabulary Key

Anterior	Toward the Front
Posterior-	Toward the Rear
Inferior	Below
Superior	Above
Lateral	Away from the midline
Medial	Toward the midline
Dorsal	the back
Ventral	The front
Cephalad	Toward the head
Caudad	Toward the Coccyx

A. Neurotransmitters

1) Amino Acids

a. Glutamate activating neurotransmitter with receptors throughout the brain. Helps a synapse react more quickly the next time it is activated, which is the basis of learning, long-term memory, and cognitive processes. Probably involved in controlling every single through, perception, and emotion in the brain, and is also distributed throughout the body.

b. Gaba is the most important inhibitory neurotransmitter. Unlike glutamate, GABA reduces the tendency of a given neuron to activate. If Gaba lost it's ability to inhibit, meaningless stimuli would constantly irritate the amygdala, and neurons would "fire themselves to death". Gaba is only released in the brain, and acts as a calming system, reducing dopamine and stress hormones.

2) Acetylcholine- an excitatory substance involved in the control of muscle movements, supports maintenance of attention, promotes arousal in the sensory systems, and affect activities related to cognition, learning and memory. Helps control the quantity and quality of our level of consciousness. Throughout the brain and the body.

3) Monoamines- produced in the brain stem, especially in the reticular activation system, and they exert great influence over large areas of the central nervous system. Determine coordination and arousal levels- important for motivational and emotional processes.

a. Serotonin- stabilizes perceptual and cognitive information. Serotonin producing clusters are in the brainstem and distributed throughout the basal ganglia, the limbic system, and the neocortex. Receptors are especially concentrated in the amygdala and the orbitofrontal cortex. It increases GABA and diminishes the intensity of the startle response. Associated with social trust and a sense of relatedness. Modulates impulsive behavior on a neocortical level. Animals exposed to repeated shocking experiences have reduced serotonin levels. Closely related to melatonin.

b. Noradrenalin- makes the organism respond to danger. Maintains high alertness, attention and efficient information processing. A raised level results in anxiety, irritability, alertness, quick temper, and defensiveness. Enhances memory in connection with traumatic events, although highly raised levels have the opposite effect.

c. Dopamine- coordinates many different functions in the cortex. Plays a key role in relation to reward behavior, inquisitiveness, and positive emotions. Dopamine levels rise in response to natural rewards such as water, food, and sexual stimulations, and play an important role in pleasant feelings. Regulates the growth of nerve fibers, including the prefrontal regions. Children who do not receive enough of an experience of pleasant caring adults develop

deficiencies in the balancing of the nervous system, partly due to insufficient dopamine activation.

B. Peptides- Opiods (betaendorphins and encephalines, CRF (acts as a hormone in connection with stress activation), there are over 100 kinds in the brain, shifting from neurotransmitters to hormones throughout the brain and the body.

C. Hormones- Oxytocin, Vasopressin, Oestrogen, Testosterone, ACTH CRF, Cortisol, Adrenalin