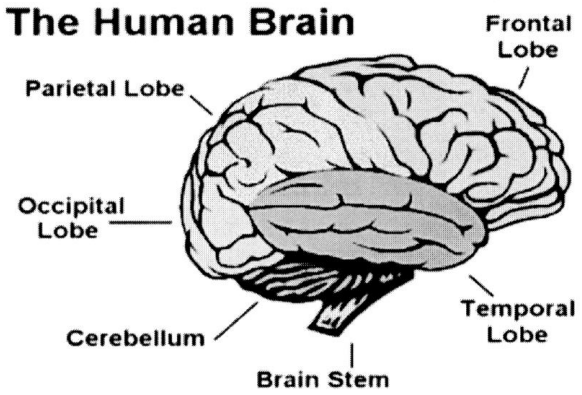
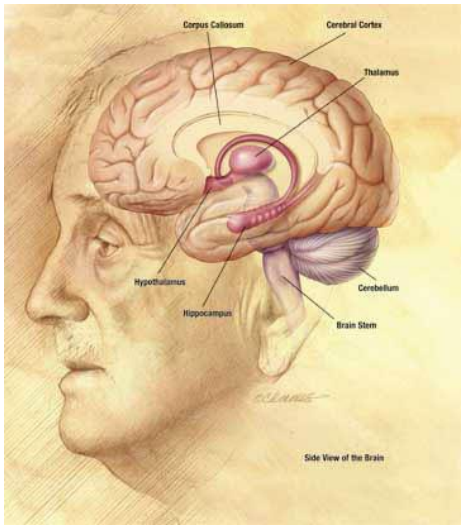
THE BRAIN – BEHAVIOUR LINK

The following section describes areas of the brain, what they control and what symptoms develop after an in injury to that area. Assessment of behaviour and symptomatology may provide clues as to the area of the brain involved.





Frontal Lobe: behind the forehead & above the eyes

Parts

- Lateral –area on the side of each lobe
- Medial –area between lobes
- Orbito-basal –area above eyes

Functions:

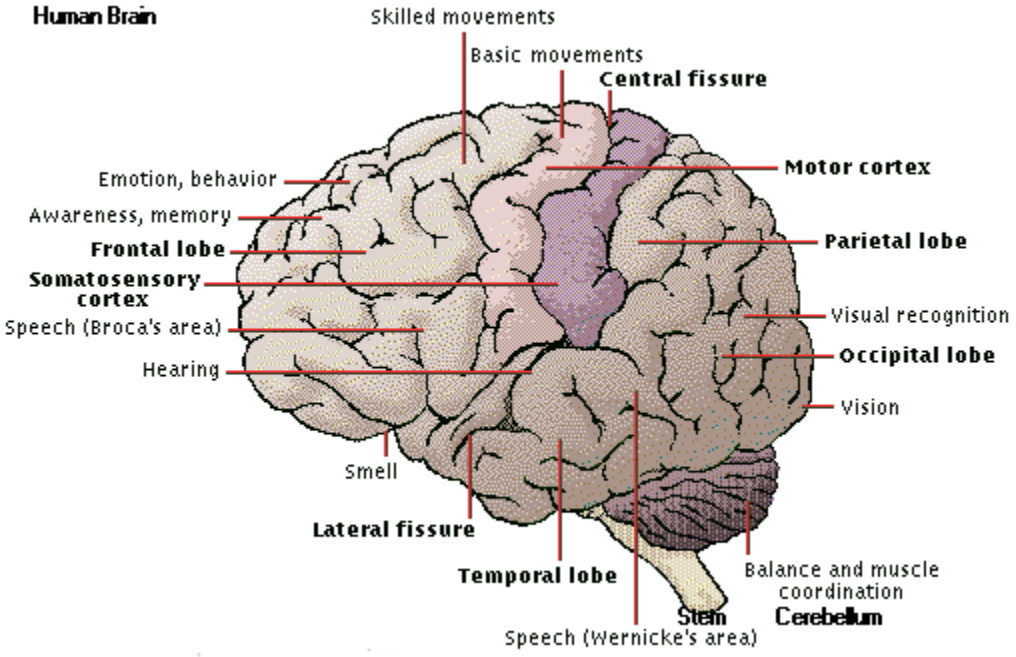
- Executive function –lateral parts
- "Adult" centre
- new learning –lateral part
- Motivation
- Controls attention
- Judgement
- Problem solving
- Decision making
- Guide/regulation/control of social behaviour

THE BRAIN – BEHAVIOUR LINK

- Attention to task
- Emotional responses/control
- Expressive language
- Motor integration
- Initiation of behaviour –medial part
- Receive and process feedback on performance
- Voluntary movements
- Controls many other areas of the brain
- All three areas communicate to provide Insight

Problems if Frontal-Lobe impaired:

- Loss of simple movement of body parts (paralysis)
- Inability to plan a sequence of movements needed to complete multi-step tasks such as making coffee (Sequencing)
- Inability to focus on a task (Attending)
- Perseveration (can't get off topic or stop carrying out a behaviour)
- Difficulty with problem solving
- Loss of spontaneity in interactions with others
- Loss of flexibility in thinking
- Persistence of a single thought (Perservation)
- Inability to express language
- Mood changes
- Changes in social behaviour
- Changes in personality



THE BRAIN – BEHAVIOUR LINK

Parietal Lobe: near the back and top of the head

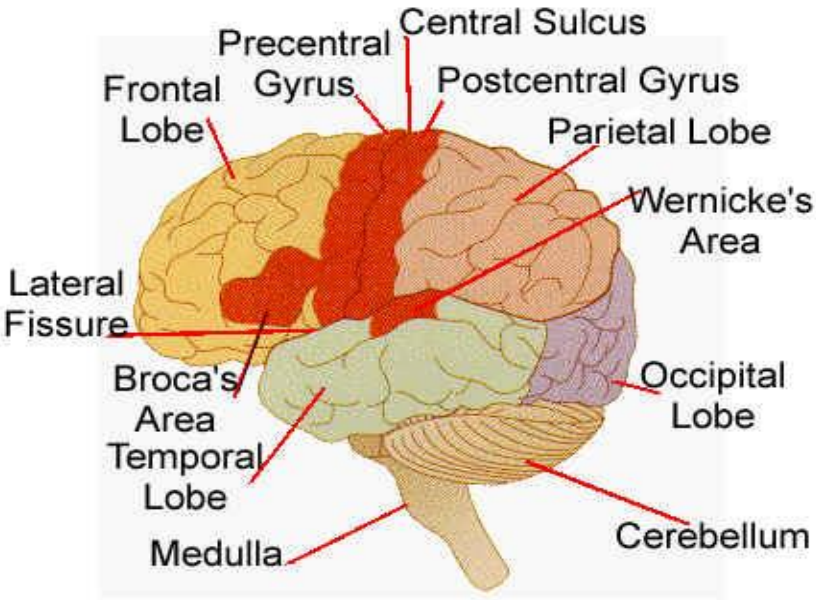
Functions:

- Visual attention
- Touch perception
- Manipulation of objects
- Awareness of spatial relationships
- Academic skills (reading)
- Knowing and recognising

Problems if Parietal Lobes impaired:

- Inability to attend to more than one object at a time
- Inability to name an object (Anomia)
- Inability to carry out purposeful movements or behavioural patterns (Apraxia)
- Inability to locate the words for writing (Agraphia)
- Problems with reading
- Difficulty drawing objects
- Difficulty distinguishing left from right
- Problems with mathematics
- Lack of awareness of certain body parts and/or surrounding space that leads to difficulties in self-care
- Inability to focus visual attention
- Difficulties with hand to eye coordination
- Difficulty in recognising people, things, places (agnosia)

THE BRAIN – BEHAVIOUR LINK



Occipital Lobe: back of the head

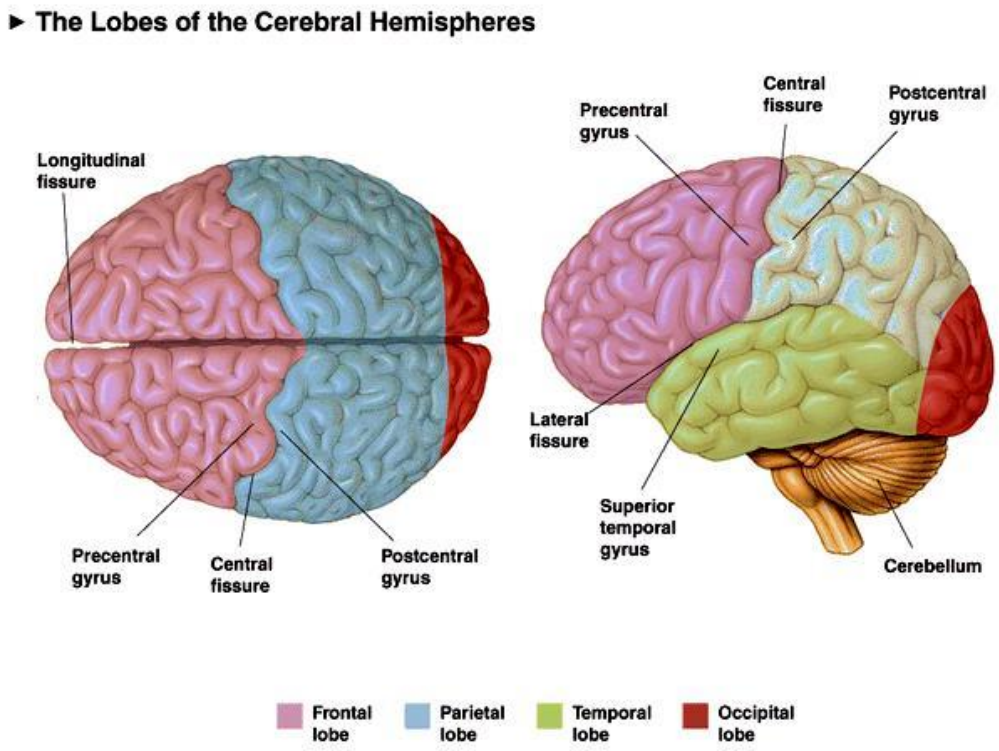
Functions:

- Visual perception
- Visual input
- Reading (recognition of printed words)

Problems:

- Defects in vision
- Difficulty locating objects in current environment
- Difficulty identifying colours
- Hallucinations
- Visual illusions – inaccurately seeing objects
- Inability to recognize words
- Difficulty recognizing drawn objects
- Inability to recognize the movement of an object
- Difficulty reading and writing

THE BRAIN – BEHAVIOUR LINK



Temporal Lobe: side of head above the ears

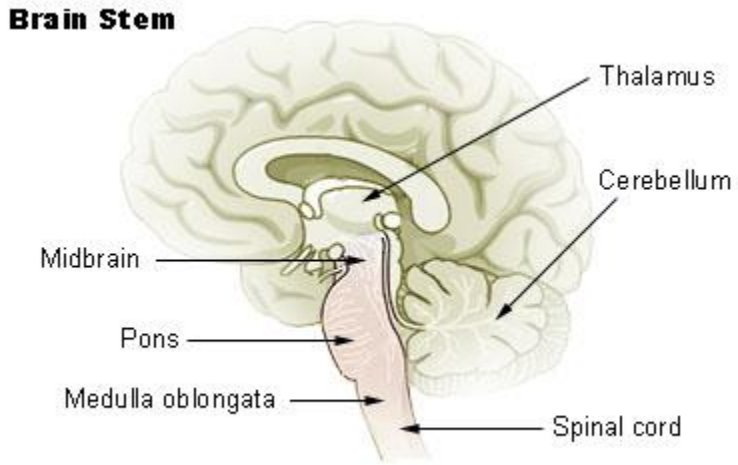
Functions:

- Hearing (musical awareness)
- Learning
- Memory acquisition
- Emotions

Problems:

- Difficulty recognizing faces
- Difficulty understanding spoken words
- Disturbance of selective attention – visual and hearing
- Difficulty identifying and verbalizing about objects
- Short-tem memory loss
- Interference with long-term memory
- Changes in sexual behaviour
- Inability to categorize objects
- Right lobe damage can cause persistent talking
- Increased aggressive behaviour

THE BRAIN – BEHAVIOUR LINK



Brain Stem: deep in the brain – leads to spinal cord

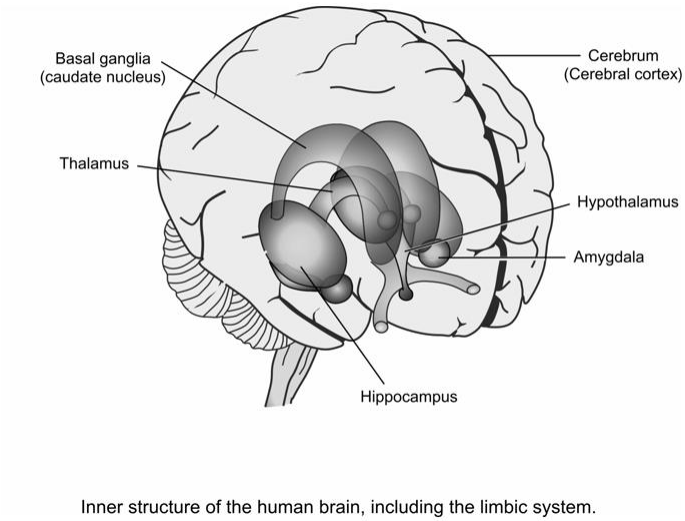
Functions:

- Breathing
- Heart rate
- Swallowing
- Reflexes for seeing and hearing
- Controls sweating, blood pressure, digestion, temperature (Autonomic Nervous System)
- Affects level of alertness
- Affects ability to sleep
- Sense of balance

Problems:

- Decreased vital capacity for breathing – important for speech
- Difficulty swallowing food and water
- Difficulty with organization and perception of environment
- Problems with balance and movement
- Dizziness and nausea (Vertigo)
- Sleeping difficulties

THE BRAIN – BEHAVIOUR LINK



Inner structure of the human brain, including the limbic system.

The Limbic System

Parts:

- Hippocampus
- Amygdala
- Hypothalamus
- Cerebral cortex
- Thalamus
- Caudate Nucleus (basal ganglia)

Function

The limbic system (or the limbic areas) is a group of structures that are important for controlling the emotional response to a given situation. The hippocampus is also important for memory.

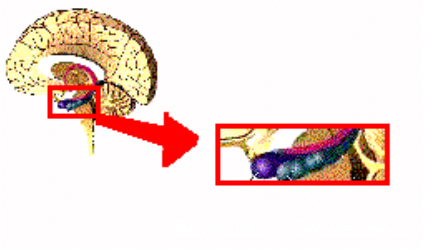
Changes in any of the integral parts will impact on the specific function of the part as well as that of the system as a whole.

The Main Areas Involved with Emotions

It is important to stress that all these structures interconnect intensively and none of them is the sole responsible for any specific emotional state. However, some contribute more than others to this or that kind of emotion. We shall review now, one by one, the best known structures of the limbic system.

THE BRAIN – BEHAVIOUR LINK

Amygdala and Hippocampus-



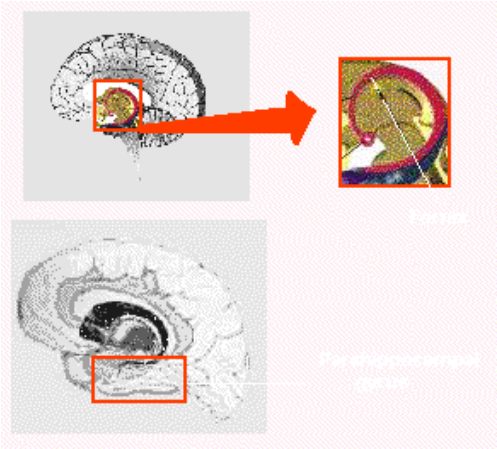
Amygdala

A little almond shaped structure, deep inside the temporal lobe, connects with the hippocampus, the septal nuclei, the prefrontal area and parts of the thalamus. These connections make it possible for the amygdala to play its important role on the mediation and control of major activities like friendship, love and affection, on the expression of mood and, mainly, on fear, rage and aggression The amygdala, being the centre for identification of danger, is fundamental for self preservation. When triggered, it gives rise to fear and anxiety which lead us into a stage of alertness, getting ready to flight or fight. *Experimental destruction of both amygdalae, tames the animal, which becomes sexually non-discriminative, deprived of affection and indifferent to danger*. Stimulation of these structures elicits a crises of violent aggressivity. Humans with marked lesions of the amygdala, lose the affective meaning of the perception of any outside information, like the sight of a well known person. The subject knows, exactly, who the person is, but is not capable to decide whether he likes or dislikes him (or her).

Hippocampus

Is particularly involved with aspects of memory, especially with the formation of long-term memory (the one that, sometimes, lasts forever). When both hippocampi (right and left) are destroyed, nothing can be retained in the memory. The subject quickly forgets any recently received message. The intact hippocampus allows the animal to compare the conditions of a present threat with similar past experiences, thus enabling it to choose the best option, in order to guarantee its own survival.

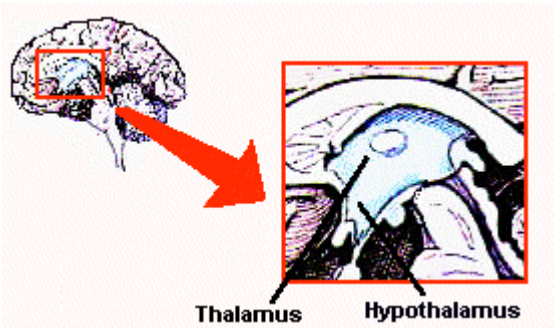
Fornix and Parahippocampal gyrus



Both are important connecting pathways of the limbic system.

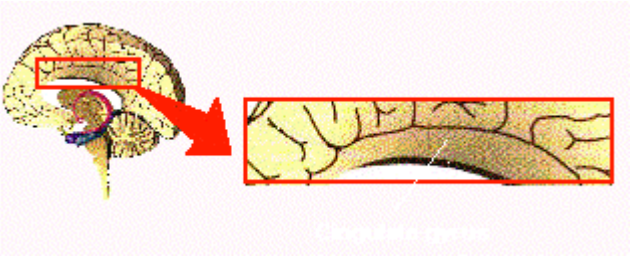
THE BRAIN – BEHAVIOUR LINK

Thalamus and Hypothalamus



Thalamus
Lesion or stimulation of the thalamus is associated with changes in emotional reactivity. However, its importance in the regulation of emotional behaviour is not due to the thalamus itself, but to its connection with other limbic system structures.
Hypothalamus
Dysfunction of the hypothalamus interferes with several vegetative functions and some of the so-called motivated behaviours, like thermal regulation, sexuality, combativeness, hunger and thirst. The hypothalamus is also believed to play a role in emotion. Specifically, it seems to be involved with pleasure and rage and aversion, displeasure and a tendency to uncontrollable and loud laughing. However, in general terms, the hypothalamus has more to do with the expression of emotions than with the generation of the affective states. When the physical symptoms of emotion appear, the threat they pose returns resulting in increased anxiety and may even lead to a situation of panic.

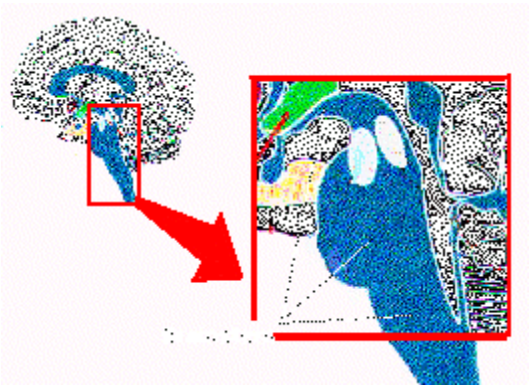
Cingulate gyrus



It is located in the medial side of the brain. There is still much to be learned about this gyrus, but it is already known that its frontal part coordinates smells and sights with pleasant memories of previous emotions. This region also participates in the emotional reaction to pain and in the regulation of aggressive behaviour. Wild animals, submitted to the ablation of the cingulate gyrus (cingulectomy), become totally tamed. The cutting of a single bundle of this gyrus (cingulotomy) reduces pre-existent depression and anxiety.

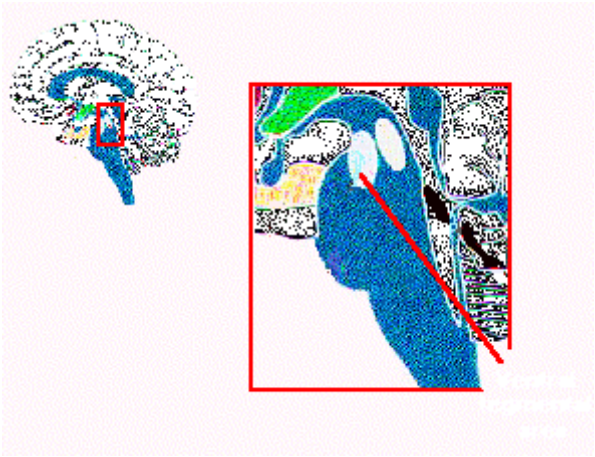
THE BRAIN – BEHAVIOUR LINK

Brainstem



The brainstem is the region responsible for the "emotional reactions". It is important to stress that, even in humans, these primitive structures remain active, not only as alerting mechanisms, vital for survival, but in the maintenance of the sleep-awake cycle.

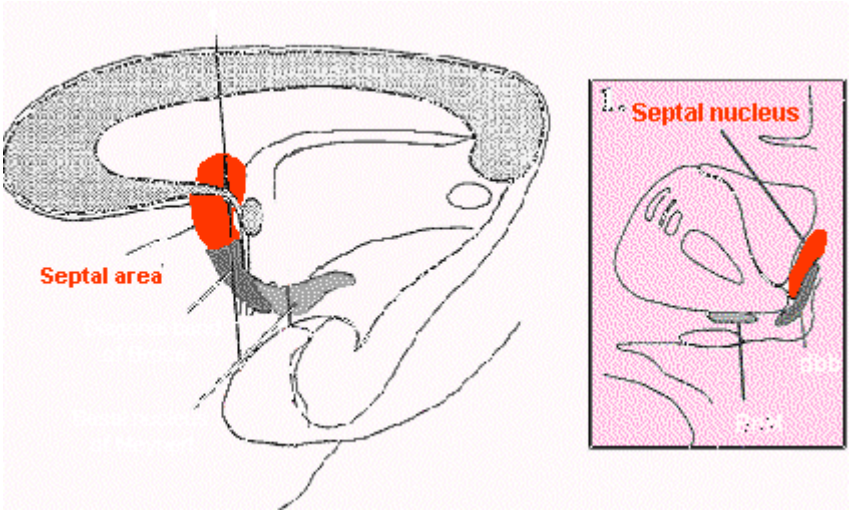
Ventral Tegmental Area



In the ventral tegmental area, stimulation of neurons produces pleasurable sensations, some of them similar to orgasm. Many people who, for a genetic error, have a reduction of D2 become, sooner or later, incapable to obtain gratification from the common pleasures of life. Thus, they seek atypical and noxious "pleasurable" alternatives, like alcoholism, cocaine addiction, impulsive gambling and compulsion for sweet foods. Certain brainstem structures are responsible for the expressions of anger, joy, sadness, tenderness, etc.

THE BRAIN – BEHAVIOUR LINK

Septum

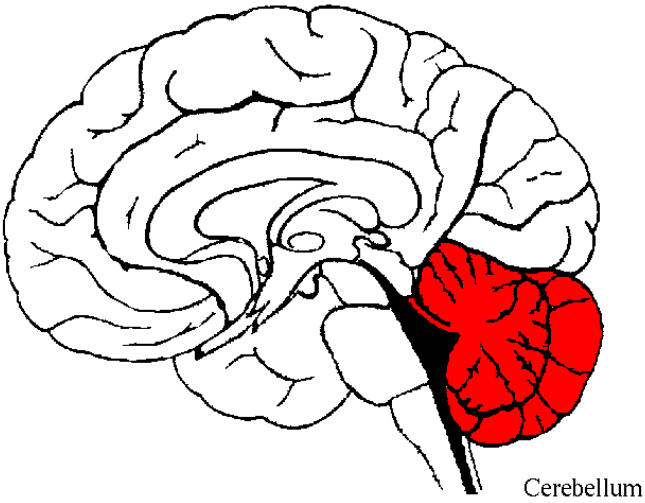


The septal region lies in front of the thalamus. Inside it, one finds the centres of orgasm (four for women and one for men). This area has been associated with different kinds of pleasant sensations, mainly those related to sexual experiences.

Prefrontal area

This area is especially large in man and in some species of dolphins. When the pre-frontal cortex suffers a lesion, the subject loses his sense of social responsibility as well as the capacity for concentration and abstraction. In some cases, although consciousness and some cognitive functions, like speech, remain intact, the subject can no longer solve problems, even the most elementary ones. When pre-frontal lobotomy was used for treatment of certain psychiatric disturbances, the patients entered into a stage of "affective buffer", no longer showing any sign of joy, sadness, hope or despair. In their words or attitudes, no traces of affection could be detected.

THE BRAIN – BEHAVIOUR LINK



Cerebellum: base of the back of the skull

Functions:

- Coordination of voluntary movements
- Balance and equilibrium
- Memory for reflex motor acts

Problems:

- Loss of ability to coordinate fine movements
- Loss of ability to walk
- Inability to reach out and grab objects
- Tremors
- Dizziness
- Slurred speech
- Inability to make rapid movements

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