

Memory functions of the hippocampus psychology essay



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The hippocampus, named after its resemblance to a sea horse, has many different important functions in the brain including memory functions. It is a structure included in many different brain systems such as the limbic system and medial temporal lobe. While it does play a major role in memory retention it is also involved with spatial navigation and long term potentiation. Many neurotransmitters affect the hippocampus and its functions. Memory disorders are also related to damage to the hippocampus including Alzheimer's and types of amnesia. One of the most famous cases involving amnesia is H. M. whose memory was severely impaired after an operation took out most of his hippocampus and medial temporal lobe. False memories are also formed in the hippocampus which makes people think they remember events or parts of events that never occurred.

One of the systems that the hippocampus is a part of is the limbic system which also consists of the cingulate cortex, olfactory cortex and amygdala. The hippocampus also receives input from the olfactory bulb which involves the sense of smell. This system is mainly responsible for emotion. Activation of the amygdala, which is mainly responsible for encoding and retaining emotional memories, can strengthen the memory formation in the hippocampus. The medial temporal lobe which contains the hippocampus, entorhinal cortex, perirhinal cortex and parahippocampal cortex is the main brain area for aspects of memory.

The hippocampus is responsible for new episodic and semantic memory encoding, retaining and storage. Spatial navigation has been found to originate in the hippocampus which is another important function. This can be demonstrated by impairing the hippocampus in a rat and then doing the <https://assignbuster.com/memory-functions-of-the-hippocampus-psychology-essay/>

Morris water maze or radial arm maze. Place cells are neurons that are activated when in a certain area or place to remember the location. These cells are also very dependent on visual input. Long term potentiation, which is when synaptic transmission becomes more effective with repeated and recent activity, also aids memory because it occurs in the hippocampus. This is best studied in the hippocampus because of the defined layers of cells and abundance of glutamate and NMDA receptors, which respond to glutamate.

Many different neurotransmitters are involved with the hippocampus. It receives input from serotonin, norepinephrine and dopamine systems. GABA and dopamine are highly concentrated in the hippocampus and GABA can impair learning and memory because of its inhibitory effects. Epinephrine plays a role in regulation of memory formation by emotions and arousal. Glutamate increases release of GABA and glycine. Glutamate and glutamate receptors, NMDA receptor, play a part in facilitating synaptic plasticity and long term potentiation which involves learning and memory functions.

Diseases associated with the hippocampus all involve problems or dysfunctions of memory. Alzheimer's is one of the most common diseases associated with the atrophy of the hippocampus and the medial temporal lobe. A famous example of the importance of the hippocampus in memory is the case of H. M with anterograde amnesia after he had surgery on his medial temporal lobe. H. M.'s specific type of amnesia was anterograde amnesia or profound amnesia which means that he has problems forming new explicit memories. During the extensive memory testing he received <https://assignbuster.com/memory-functions-of-the-hippocampus-psychology-essay/>

when he was alive H. M. proved that he could form new implicit memories. This was demonstrated through a task where he had to trace a line between two outlines of a 5 point star in a mirror. This task is difficult for anyone trying this for the first time. He did not remember the task explicitly but he recognized that during later trials it seemed easier than he thought it should be. The only problem was that he would not believe that he could do this new activity or task because he was not consciously aware that he had already learned this.

The implications from H. M.'s surgeries and his memory problems led neuroscientists to believe that there are two systems for forming new memories. One system is called declarative memory which is composed of semantic and episodic memory. Semantic memory is factual memories such as, who was the first president. Episodic memory is part of your life that you remember such as, your prom night. This system depends on the medial temporal lobes specifically the hippocampus. Declarative memory is explicit and can be consciously recalled. The other memory system is motor learning which is implicit and depends on other systems other than the medial temporal lobes. This is why amnesiacs can remember motor skills that they developed before their brain lesions such as playing the piano.

Two sources of amnesia are damage to either the medial temporal lobes or the hippocampus or a combination of the two. This damage could be caused by a disease such as a virus, surgery to stop seizures or other problems or damage to these brain areas caused by acute trauma to the head in an accident. Retrograde amnesia is when you cannot remember past experiences such as before an accident but can make new memories.

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Transient global amnesia is a temporary disruption of memory that only lasts for several hours and has not been studied extensively because of the length of time that it affects people. Functional amnesia seems to occur from psychological causes rather than physical causes. Cases of this are rare and the numbers are skewed because some patients admit to faking amnesia to avoid consequences of their actions such as a crime. Infantile amnesia which everyone experiences to a certain degree happens when you can't remember events from birth to around 4 years old. Source amnesia is when you can remember a fact or event but attribute it to the wrong source.

The creation of false memories originates in the hippocampus which is also where "real" memories are stored. Creating false memories is not as hard as it seems. In a well known experiment by simply photo shopping a photo from a participant's childhood into a picture showing them riding a hot air balloon and asking participants to describe the event and other details about what happened that day half would "remember" details about this day (Wade, Garry, Read & Lindsay, 2002). Even though older adults are more prone to false memories compared to young people they have increased activation in other brain areas such as the frontal lobes (Dennis, Kim & Cabeza, 2008).

To designate a memory as false more encoding steps are taken to "tag" this memory and if these steps become disordered can lead to delusions. Bias for accepting a memory is "true" after encoding is the default bias. An example of the misinformation effect when preschoolers were told to recall events that they had not experienced, two out of the four were false, and they "remembered" the false events. Source memory is a component of episodic

memory which is the memory for the situation or context in which the
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memory was received or experienced (Ladowsky-Brooks & Alcock, 2007).

False memories are characterized by remember experiences which is basically a general feeling that the event did happen in the past, feels like it has “pastness” (Heaps & Nash, 2001).

Can emotional content distinguish a true memory from a false memory?

Emotional content is not a reliable predictor of whether a memory is true or false. Different types of emotions can improve memory, such as happiness, while others, stress or sadness, make it more likely to become manipulated and therefore false (Laney, 2008). Childhood amnesia or infantile amnesia increases susceptibility to false suggestion. Lack of true memories and no fool proof ways to check for veracity from early childhood increases susceptibility to false suggestion. These results have implications for court cases that used early memories to try and influence the jury (Strange, Wade & Hayne, 2008).

The hippocampus is mainly known for its important functions for memory. But the hippocampus is involved in much more than memory. As research has shown and will show in the future, the hippocampus has connections with other brain areas that are important and will continue to be a brain area that sparks continued curiosity.