

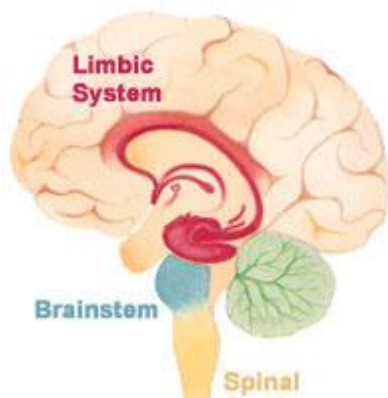
The Limbic System combines higher mental functions and primitive emotion into one system.

KEY POINTS

- The limbic system, located just beneath the cerebrum on both sides of the thalamus, is not only responsible for our emotional lives but also our higher mental functions, such as learning and formation of memories.
- The primary structures within the limbic system include the amygdala, hippocampus, thalamus, hypothalamus, basal ganglia, and cingulate gyrus.
- The amygdala is the emotion center of the brain, while the hippocampus plays an essential role in the formation of new memories about past experiences.
- The thalamus and hypothalamus are associated with changes in emotional reactivity.
- The cingulate gyrus coordinates smells and sights with pleasant memories, induces an emotional reaction to pain, and helps regulate aggressive behavior.
- The basal ganglia is a group of nuclei lying deep in the subcortical white matter of the frontal lobes; its functions include organizing motor behavior and coordinating rule-based, habit learning.

In humans it is the largest part of the brain and is the seat of motor and sensory functions, and the higher mental functions such as consciousness, thought, reason, emotion, and memory

The limbic system is a complex set of structures found just beneath the cerebrum on both sides of the thalamus. It combines higher mental functions and primitive emotion into a single system, often referred to as the emotional nervous system. It is not only responsible for our emotional lives but also our higher mental functions, such as learning and formation of memories. The limbic system is the reason that some things seem so pleasurable to us, such as eating, and why some medical conditions are caused by mental stress, such as high blood pressure. There are several significant structures within the limbic system: the amygdala, hippocampus, thalamus, hypothalamus, basal ganglia, and cingulate gyrus.



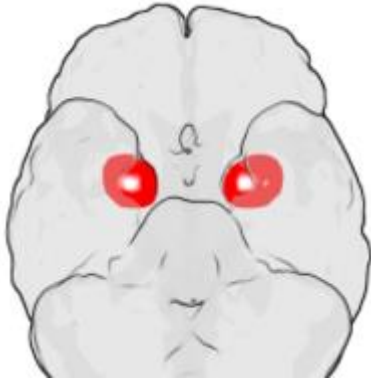
The Limbic System

The limbic system is a complex set of structures found just beneath the cerebrum on both sides of the thalamus. This diagram illustrates the limbic system's location in relation to the brainstem and spinal cord.

The Amygdala

The amygdala is a small almond-shaped structure located in the left and right temporal lobe. Known as the emotion center of the brain, it is involved in evaluating the emotional valence of situations (e.g., happy, sad, scary). It helps the brain recognize potential threats and helps prepare the body for *fight or flight* reactions by increasing heart and breathing rate. The amygdala is also responsible for learning on the basis of reward or punishment. Due to its

close proximity to the hippocampus, the amygdala is involved in the modulation of memory consolidation, particularly emotionally-laden memories. Emotional arousal following a learning event influences the strength of the subsequent memory of that event, so that greater emotional arousal following a learning event enhances a person's retention of that memory. In fact, experiments have shown that administering stress hormones to individuals immediately after they learn something enhances their retention when they are tested two weeks later.

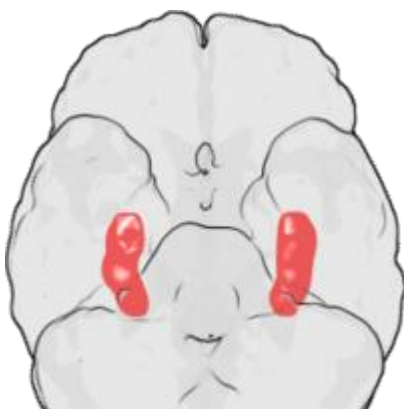


The Amygdala

The figure shows the location of the amygdala from the underside (ventral view) of the human brain, with the front of the brain at the top.

The Hippocampus

The hippocampus is found deep in the temporal lobe, and is shaped like a seahorse . It consists of two horns that curve back from the amygdala. Psychologists and neuroscientists dispute over the precise role of the hippocampus, but generally agree that it plays an essential role in the formation of new memories about past experiences. Some researchers consider the hippocampus to be responsible for general declarative memory (memories that can be explicitly verbalized, such as memory of facts and episodic memory). Damage to the hippocampus usually results in profound difficulties in forming new memories (*anterograde amnesia*), and may also affect access to memories prior to the damage (*retrograde amnesia*). Although the retrograde effect normally extends some years prior to the brain damage, in some cases older memories remain intact; this leads to the idea that over time the hippocampus becomes less important in the storage of memory.



The Hippocampus

This figure shows the location of the hippocampus in the temporal lobe from the ventral (underside) of the human brain.

The Thalamus and Hypothalamus

Both the thalamus and hypothalamus are associated with changes in emotional reactivity. The thalamus is primarily important due to its connections with other limbic system structures. The hypothalamus is a small part of the brain located just below the thalamus on both sides of the third ventricle. Lesions of the hypothalamus interfere with several unconscious functions (such as respiration and metabolism) and some so-called motivated behaviors like sexuality, combativeness, and hunger. The lateral parts of the hypothalamus seem to be involved with pleasure and rage, while the medial part is linked to aversion, displeasure, and a tendency for uncontrollable and loud laughter.

The Cingulate Gyrus

The cingulate gyrus is located in the medial side of the brain next to the corpus callosum. There is still much to be learned about this gyrus, but it is known that its frontal part links smells and sights with pleasant memories of previous emotions. This region also participates in our emotional reaction to pain and in the regulation of aggressive behavior.

The Basal Ganglia

The basal ganglia is a group of nuclei lying deep in the subcortical white matter of the frontal lobes that organizes motor behavior. The *caudate*, *putamen*, and *globus pallidus* are major components of the basal ganglia. The basal ganglia appears to serve as gating mechanism for physical movements, inhibiting potential movements until they are fully appropriate for the circumstances in which they are to be executed. Functions of the basal ganglia include rule-based, habit learning system (e.g., initiating, stopping, monitoring, temporal sequencing, and maintaining the appropriate movement); inhibiting undesired movements and permitting desired ones; choosing from potential actions; and motor planning, sequencing, learning, maintenance, predictive control, working memory, and attention.

Source: <https://www.boundless.com/psychology/the-brain-and-behavior/the-brain/the-limbic-system/>