

# Limbic System

by Sophia Tutorial



## WHAT'S COVERED

Welcome to today's lesson on the limbic system. Just below the cerebral cortex (the outer layer of wrinkled material) are several other important structures that make up the forebrain. This tutorial will focus specifically on the:

1. Thalamus and Hypothalamus
2. Amygdala
3. Hippocampus

## 1. Thalamus and Hypothalamus

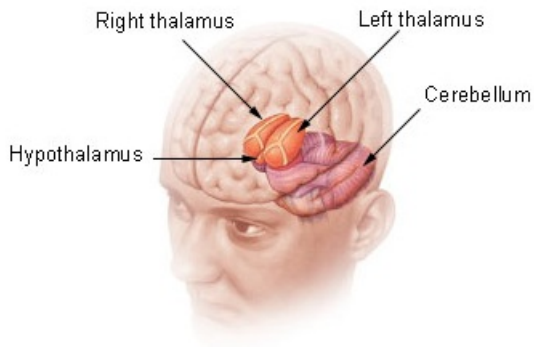
The internal structures in the forebrain comprise what is called the **limbic system**, which is an area of the brain involved in aspects such as emotions, motivation, and memory formation. This area acts as an intermediary system to the cerebral cortex, as it passes on a lot of the information and processes it in different ways.

The **thalamus** is a small, football-shaped structure that is located at the center of the brain. It is a type of conduit or switching center for all the sensory information that is being sent up to the cerebral cortex.

Injury to the thalamus can lead to a loss of senses in general, like deafness or blindness. The thalamus is also related to control of movement and sleep as well.

The **hypothalamus**, which is the even smaller and more circular-shaped gland located right in front of the thalamus, is involved in things like motivation and emotion within people. One of the major duties of the hypothalamus is to regulate food, water, and sleep motivations. Damage to specific areas of the hypothalamus can result in different aspects of overeating or under-eating, drinking, or sleeping. This has been shown in rats as well as in humans.

The hypothalamus regulates the autonomic nervous system and controls all of those regular bodily functions that keep us alive. Those things that we don't necessarily consciously deal with, like heartbeat and digestion, are regulated by the hypothalamus.



#### TERMS TO KNOW

### Limbic System

Areas of the forebrain involved in emotions, motivation, and memory formation

### Thalamus

A small, football-shaped structure central to brain; acts as conduction and switching center for sensory information being sent to the cerebral cortex

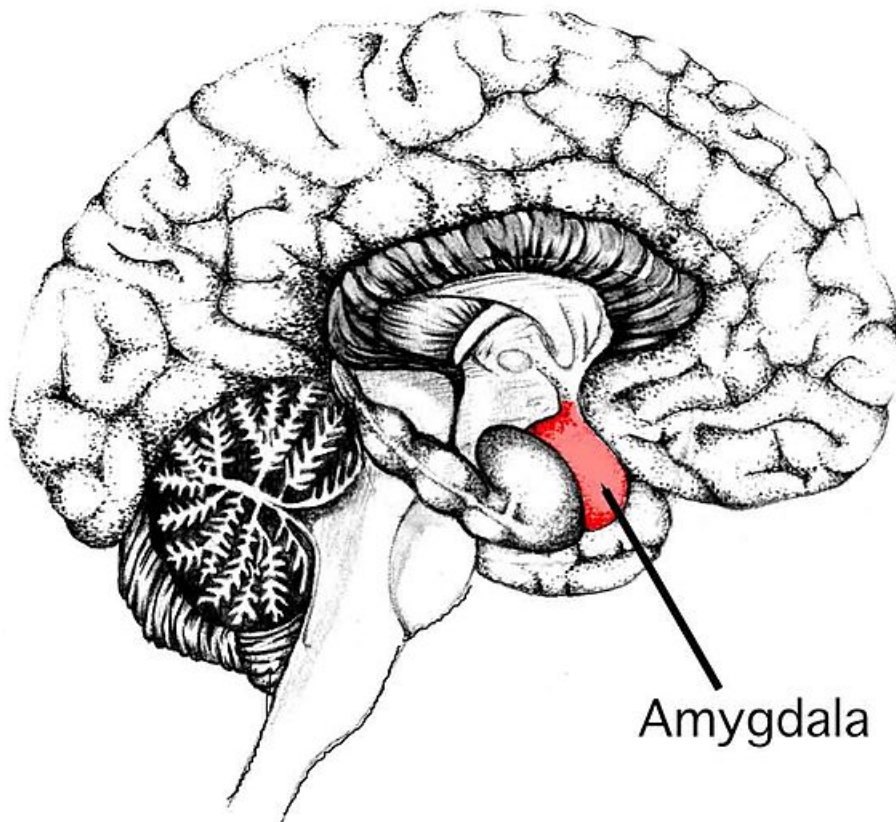
### Hypothalamus

A smaller, circular center in front of the thalamus, involved in motivation and emotions in people

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## 2. Amygdala

The **amygdala** is a small almond-shaped structure down towards the bottom of the brain. Remember, the brain has two different hemispheres, so there are two of these located inside of the brain. It is related to emotional responses within people, especially those emotions that have to do with survival--the fight or flight response--where it motivates us to survive in some way. Other emotional responses affected by the amygdala would include fear, anger, or pleasure-seeking emotions.



While it is a basic structure that develops in animals as well people, it serves a powerful function. The amygdala can lead to the creation of a lot of irrational fears or phobias. If you have any phobia, you likely know that these kinds of things are very difficult to shake. It's hard to get rid of a phobia. Therefore, you can see how intrinsic and powerful this organ can be to the formation of different kinds of thoughts and ideas.



#### TERM TO KNOW

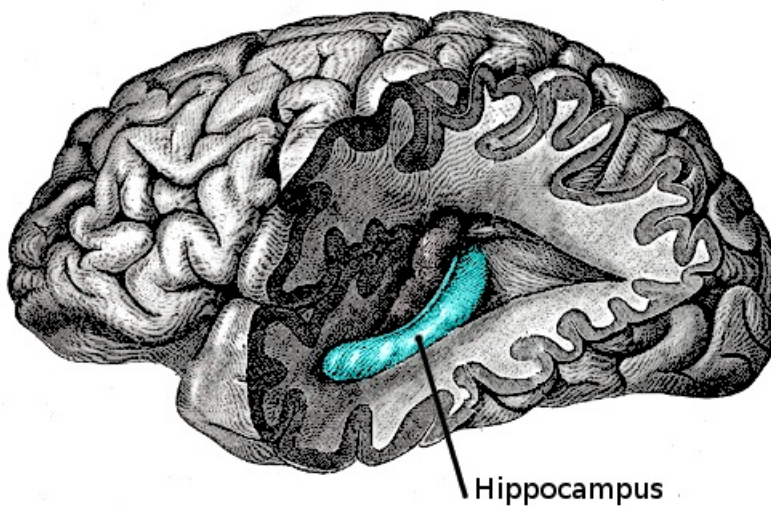
##### **Amygdala**

A small, almond-shaped structure related to emotional responses in people, especially fear

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## 3. Hippocampus

The **hippocampus** is a crescent-shaped structure that appears on both sides of the brain. Again, there are two of these crescent shapes inside of the brain. The hippocampus is related to the formation of memories.



Now, remember that as with all parts of the brain, the parts of the limbic system also work together in many ways. The thalamus and the hypothalamus help to bring all of that sensory information to the higher levels of the brain. The amygdala attaches emotions and helps to create those quick-thinking types of responses. In addition, they all act as conduits to relay that information up to the cerebral cortex.

Similarly, with all of those parts working in conjunction, the hippocampus takes all the sensory information and the emotions that these three other organs are processing, and then attaches it to different kinds of events and helps to create strong long-lasting memories in our minds. This is why a lot of sensory information can trigger memories in people.

➦ **EXAMPLE** For instance, the smell of smoke can automatically trigger a memory of camping trips when you were a child.

This explains why memories have very strong emotions attached to them. If you remember, for example, a traumatic event from your childhood, you can still feel those same kinds of emotions because the hippocampus plays that central role in attaching those memories and creating meaning out of them, so that they can last longer within the brain.



#### TERM TO KNOW

### Hippocampus

Crescent-shaped structures on both sides of the brain, related to the formation of memories



#### SUMMARY

Today we learned about the different parts of the limbic system. The **thalamus** is a type of conduit for all the sensory information that is being sent up to the cerebral cortex. The **hypothalamus** regulates the autonomic nervous system and controls regular bodily functions that keep us alive. The **amygdala** is related to emotional responses, especially the fight or flight response, and can lead to the creation of many irrational fears or phobias. The **hippocampus** plays a central role in attaching memories to meaning.

Good luck!

Source: This work is adapted from Sophia author Erick Taggart.



## TERMS TO KNOW

### **Amygdala**

A small, almond-shaped structure related to emotional responses in people, especially fear.

### **Hippocampus**

Crescent-shaped structures on both sides of the brain, related to the formation of memories.

### **Hypothalamus**

A smaller, circular center in front of thalamus, involved in motivation and emotions in people.

### **Limbic System**

Areas of the forebrain involved in emotions, motivation, and memory formation.

### **Thalamus**

A small, football-shaped structure central to brain; acts as conduction and switching center for sensory information being sent to the cerebral cortex.