

Cerebral Cortex

by Sophia



WHAT'S COVERED

This tutorial will discuss the functions of the brain's cerebral cortex. You will reflect on which part of your brain is responsible for developing your self and social awareness skill. You will do this by focusing on:

1. Cerebral Cortex

The **cerebral cortex** is probably the most recognizable part of the brain. The cerebral cortex is the outer layer of the brain made up of wrinkles, little folds, and bumps that are put together from grey matter and sometimes some white matter.

This cerebral cortex area is responsible for most of the recognizable aspects of a person's mind—things like personality, thought, language, the storage of memory, movement, and the senses. This means that your **problem solving skill** is definitely related to processes of the cerebral cortex—including thought and memory.

Humans have a very developed cerebral cortex compared to a lot of other animals, which is why we're considered to be more intelligent and aware than those animals. It's important to note that humans don't have the largest brains out of every animal. That would be the whale, which is a much bigger animal, and as a result, it has a much bigger brain.



DID YOU KNOW

Humans do not have the most wrinkled or defined cerebral cortex. The dolphin has a larger, more developed cerebral cortex than humans.



TERM TO KNOW

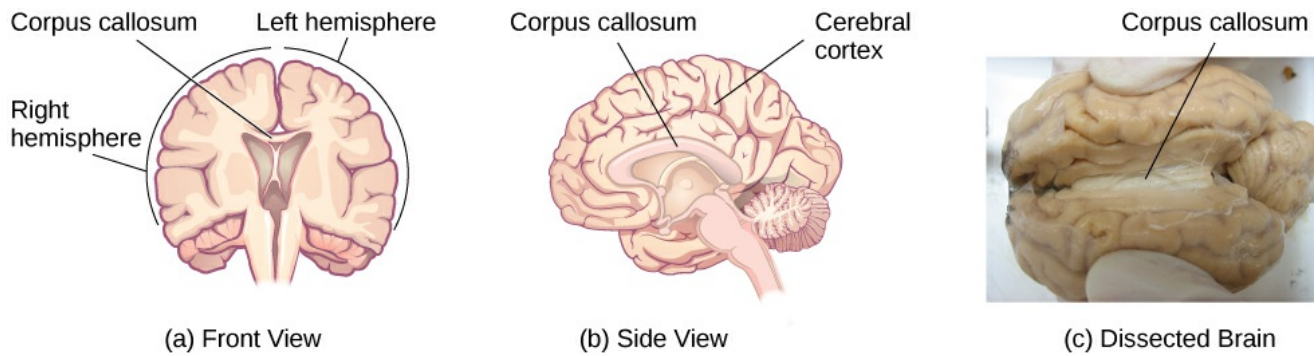
Cerebral Cortex

The outer layer of wrinkled grey matter on the outside of the brain, responsible for a person's personality, thought, language, storage of memory, movement, and senses.

2. Hemispheres of the Brain

If you were to look at the brain from the top, you would see that the brain, or the cerebral cortex specifically, is divided into two halves, or **hemispheres**: the left hemisphere and the right hemisphere, with a little space in

between, called the medial longitudinal fissure.



(a, b) The corpus callosum connects the left and right hemispheres of the brain. (c) A scientist spreads this dissected sheep brain apart to show the corpus callosum between the hemispheres.

The two sides of the brain are connected by a bundle of neurons in between. That connecting area of the two hemispheres is known as the **corpus callosum**.

It is important to note that we have two different hemispheres because it provides a sort of backup system for any brain function. There are two of each structure, so if one of them has a problem, the other one can help out.

Each side of the brain is responsible for specific functions. This specialization is called lateralization of function.



DID YOU KNOW

Five percent of people might have the functions assigned to each hemisphere flip-flopped, versus the rest of the population.

Generally, what is meant by lateralization of function is that people are neither left-brained or right-brained, as each side controls a different side of the body.

The left brain actually controls the right side of the body, meaning that your left brain sends signals to the right side of your body to move. Conversely, the right side of your brain controls the left side of your body.

➞ **EXAMPLE** If a stroke victim is having trouble moving their right arm, this means that the stroke damaged the left side of their brain.

Each side also controls different types of thinking. To determine this, there were studies done on people known as “split-brain patients.” These are people who have had their corpus callosum—that connecting part in the middle of the brain—severed.

The corpus callosum is cut mainly because of epilepsy. This is a procedure to help people who experience major epileptic seizures.

What did they discover when the corpus callosum was cut? Surprisingly, people acted the same, because both eyes were able to see what was happening around them, which means that both sides of the brain could also see and react in their normal ways.

However, if you showed each eye a different image separately, they found that because that corpus callosum was severed, each eye only responded to one part of the brain.

➔ **EXAMPLE** When the left hemisphere/right eye was shown an object, a person with a severed corpus callosum could identify the object. However, if the right hemisphere/left eye was shown an image, they couldn't actually say what that image was. If they were asked to draw whatever came to their mind, they were able to draw the image.

This is because the left side of the brain is related to logic, language, coordination. It's the analytical side of the brain, which is how a left-brained person would be described.

The right side of the brain is related to spatial, visual, or emotional aspects; it is the artistic or holistic side of the brain.



Self and Social Awareness: Skill Reflect

Which side of the brain do you think is responsible for your self and social awareness skill?



TERMS TO KNOW

Hemisphere

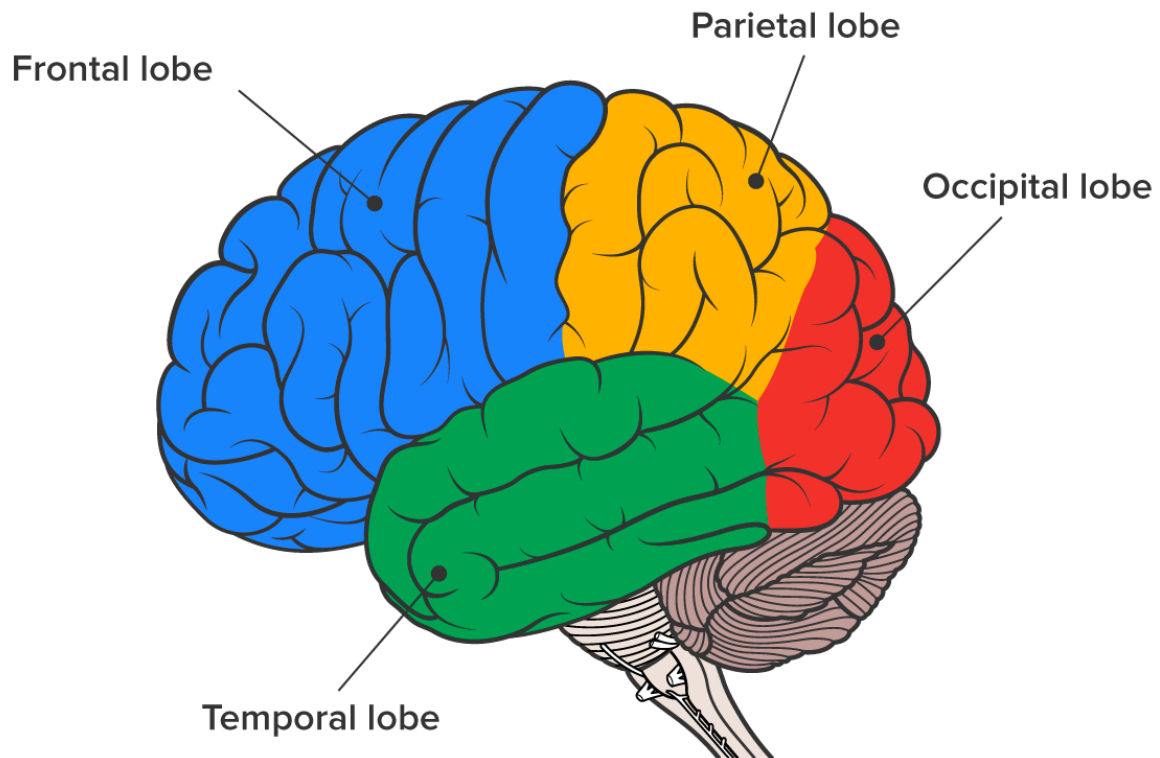
Half of the brain (left or right), divided by the longitudinal fissure; each hemisphere controls certain parts of the brain and can have certain specialized functions.

Corpus Callosum

A large bundle of neurons that joins the two hemispheres of the brain.

3. Lobes of the Cerebral Cortex

Each hemisphere, the left and the right, is further divided into the four different **lobes of the cerebral cortex**. Each of these lobes is a specific or generally defined area of the cerebral cortex that is related to different kinds of functions of the brain.



The frontal lobe is related to higher-level thinking tasks, like the sense of self, self-awareness, and personality, as well as movements. This is an area of the brain that is very highly developed in humans.

The parietal lobe is the area that is related to sensory issues, such as touch or temperature. The temporal lobe is related to hearing and language. Lastly, the occipital lobe is related to sight. So, each part of the brain is divided first into two hemispheres, right and left, and then into four lobes—frontal, parietal, temporal, and occipital.



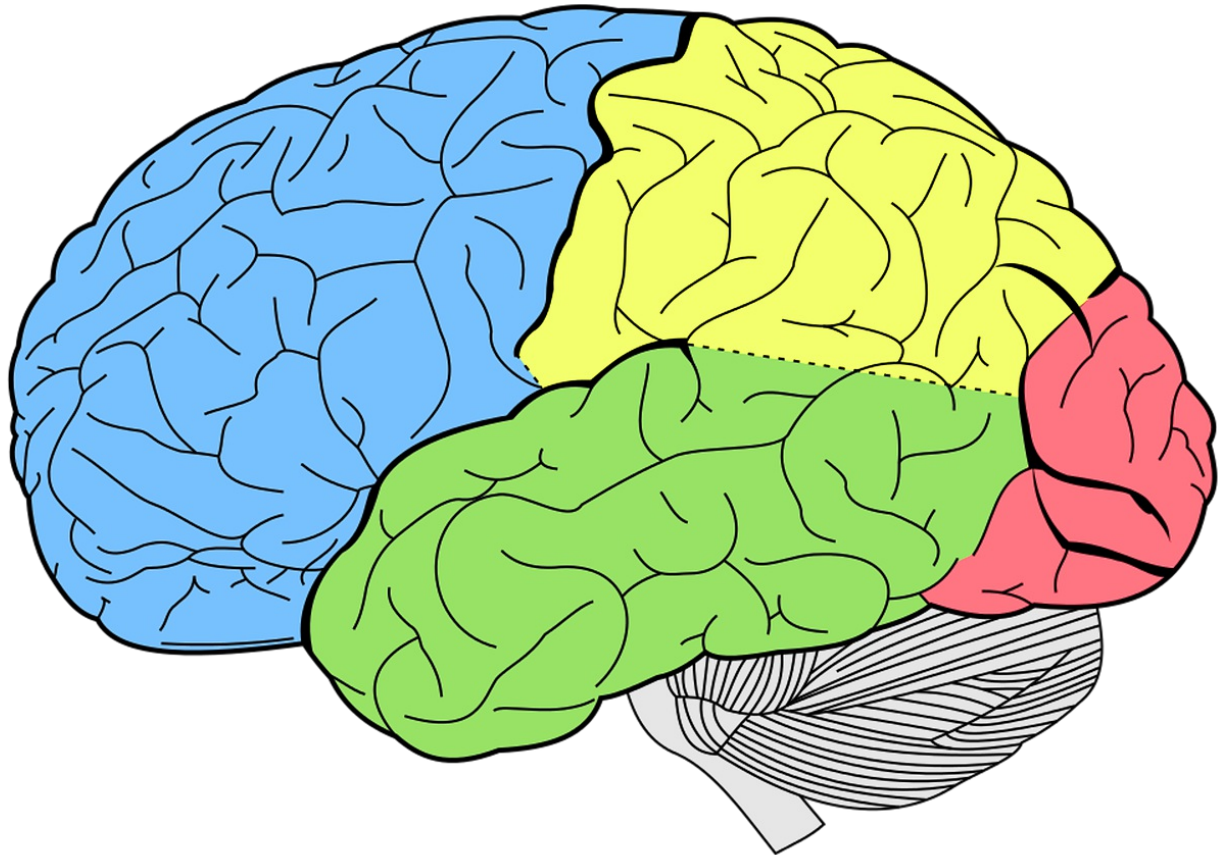
TERM TO KNOW

Lobes of the Cerebral Cortex

Specific or generally defined areas of the cerebral cortex related to different functions.

3a. Frontal Lobe

The **frontal lobe** is related to many different mental processes and functions that are recognized as being uniquely human. These include functions like the control of movement of our bodies, long-term memory, planning, reasoning, and even judgment.



Research exploring damage to the frontal lobe has proven to assist in the discovery of the impact that the frontal lobe has on changes in an individual's personality and behavior.



TERM TO KNOW

Frontal Lobe

The area of the cerebral cortex that controls movement, long-term memory, planning, reasoning, and judgment, as well as aspects of language and movement.

3.a.i. Prefrontal Cortex

The **prefrontal cortex** is the foremost part in the front of the frontal lobe. It's basically the first half area of the frontal lobe, going all the way up to the front.

The frontal lobe is responsible for a person's sense of self (e.g., self-awareness, impulse control, and emotions). Damage specifically to the prefrontal cortex can lead to changes in personality.

The prefrontal cortex is also related to reasoning and planning. It is responsible for higher-level cognitive abilities specific to humans.



TERM TO KNOW

Prefrontal Cortex (Prefrontal Area)

The foremost part of the frontal lobe, involved with sense of self: self-awareness, impulse control, and emotion.

3.a.ii. Association Areas and Broca's Area

Another important aspect of the frontal lobe includes the **association areas**, which comprise the rest of the

frontal lobe, moving up towards the parietal lobe. Those areas help to process information and relate to the formation of memory. Much of the sensory information coming into a person is processed in these association areas.

One of the association areas that is important to language production specifically is **Broca's area**. Broca's area is named for the French neurosurgeon, Paul Broca.

Dr. Broca noticed that patients with brain damage to this area of the brain were able to understand words, but could not actually produce speech. This is a condition called Broca's **aphasia**, where subjects are unable to produce speech even though they understand what other people are saying to them.

Specifically, this is an issue related to motor production and includes problems with grammar and pronunciation. Any kind of language the person is able to produce is very difficult to understand.



TERMS TO KNOW

Association Areas

Parts of the brain that help to process sensory information and form memories.

Broca's Area

An association area in the frontal lobe related to language production.

Aphasia

When patients with damage to Broca's area were able to understand speech but had trouble producing it.

3.a.iii. Primary Motor Cortex

The **primary motor cortex** is the little area bordering the parietal lobe. This area in particular is related specifically to movement and the control of the body's muscles.

The primary motor cortex is arranged in such a way that larger areas of the prefrontal cortex are devoted to more important and specific, or more sensitive, areas of the body.

➞ **EXAMPLE** Hands have a much larger corresponding area in the brain because they're very sensitive and we need to manipulate them in complex ways. Similarly, the face and the tongue have larger areas of the prefrontal cortex devoted to their function because they are very sensitive and contain minute areas that people want to be able to control with a lot of precision.



TERM TO KNOW

Primary Motor Cortex (Primary Motor Area)

The area of the frontal lobe bordering the parietal lobe related to movement and control of body's muscles.

3b. Parietal Lobe

The **parietal lobe** borders the frontal lobe. This is the lobe that is directly related to the somatic senses, meaning touch, pressure, temperature—essentially all the information that we're receiving from our skin. As you can see, this is a very large area of function, and therefore it corresponds to an important area of the brain as well.

A noteworthy area of the parietal lobe is the **primary somatosensory cortex**. The primary somatosensory cortex is the area that is directly related to processing all of the somatic sensory information received from the

skin throughout the body.

There are larger areas of the somatosensory cortex devoted to more sensitive or intricate areas of the body, so the area in the brain devoted to feet is much smaller than the area devoted to hands, because function of hands is much more complex and intricate, and ultimately the things that we need to sense with them are more important.



TERMS TO KNOW

Parietal Lobe

The part of the cerebral cortex related to somatic senses (touch, pressure, temperature).

Primary Somatosensory Cortex

Area next to frontal lobe across from primary motor cortex related to senses across the body.

3c. Temporal Lobe

The **temporal lobe** is located directly on the side of the brain. It is related specifically to hearing and information received by our ears.

The **primary auditory area** is the area directly at the top of the temporal lobe, located underneath the somatosensory cortex. This is the area that processes all information related to hearing.

In addition, there is an area in the temporal lobe that is related to the understanding of language, which makes sense because this concerns hearing. How do we understand language? Through hearing.



TERMS TO KNOW

Temporal Lobe

The part of the cerebral cortex located on the side of the brain related to the processing of hearing.

Primary Auditory Area

The area at top of the temporal lobe near the primary motor/somatosensory cortices, related to hearing and language understanding.

3d. Occipital Lobe

The **occipital lobe** is located at the back of the brain and is related to seeing and understanding visual information. It is connected to the eyes via the optic nerve, so there is a type of visual pathway going from our eyes directly to this area of the brain. The important area to note is the primary visual area, which is located at the very back of the occipital lobe. This area is related to processing all of that visual information.

People with damage to this area of the brain, the primary visual area, can have all different sorts of **agnosia**. Agnosia means that a person is able to see an object, but they can't recognize it. Essentially, they take in the information, but they can't process it and make meaning out of it.

IN CONTEXT

Suppose Samantha has damage to her left occipital lobe and has visual agnosia. She can describe what she sees and can create some visual information, but she cannot create meaning out of it.

When Samantha sees a chair, she describes long, straight legs and a flat surface on the top, but she is unable to put those pieces together to say that it's a chair.

People can also have facial agnosia or prosopagnosia, which means they cannot recognize others by sight. They are unable to identify a person even if it is a close family member. However, if there is some auditory recognition when the person speaks, they can automatically recognize them. Why is that? Because the area of the brain involving auditory recognition has not been damaged.



TERMS TO KNOW

Occipital Lobe

The part of the cerebral cortex related to the processing of visual information and seeing.

Agnosia

When a person has damage to the left occipital lobe and can describe what they see but cannot say what it is, or create meaning out of the visual information.



SUMMARY

In this lesson, you learned about the **cerebral cortex**, the outer layer of the brain, composed of wrinkled grey matter. The left and right **hemispheres of the brain** are responsible for specific behaviors, and each corresponds to the opposite side of body, respectively. The left hemisphere is generally responsible for analytical situations, and the right side is responsible for spatial awareness. You considered which side of the brain impacts your self and social awareness skill. There are four **lobes of the cerebral cortex**: frontal, parietal, temporal and occipital. The frontal lobe is highly developed in humans and is related to higher level thinking such as self-awareness. The **parietal lobe** is responsible for touch and pressure, and the **temporal lobe**, which is associated with hearing. Finally, the **occipital lobe** relates to seeing and the processing of visual information.

Good luck!

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TERMS TO KNOW

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Aphasia

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