[Template:About](/wiki/Template:About" \o "Template:About)

**Split-brain** is a lay term to describe the result when the [corpus callosum](/wiki/Corpus_callosum) connecting the two [hemispheres of the brain](/wiki/Cerebral_hemisphere) is severed to some degree. It is an association of symptoms produced by disruption of or interference with the connection between the hemispheres of the brain. The surgical operation to produce this condition results from transection of the [corpus callosum](/wiki/Corpus_callosum), and is usually a last resort to treat refractory [epilepsy](/wiki/Epilepsy). Initially, partial callosotomies are performed; if this operation does not succeed, a complete callosotomy is performed to mitigate the risk of accidental physical injury by reducing the severity and violence of [epileptic seizures](/wiki/Epileptic_seizures). Before using callosotomies, epilepsy is instead treated through pharmaceutical means. After surgery, neuropsychological assessments are often performed.

After the right and left brain are separated, each hemisphere will have its own separate perception, concepts, and impulses to act. Having two "brains" in one body can create some interesting dilemmas. When one split-brain patient dressed himself, he sometimes pulled his pants up with one hand (that side of his brain wanted to get dressed) and down with the other (this side didn't). Also, once he grabbed his wife with his left hand and shook her violently, so his right hand came to her aid and grabbed the aggressive left hand. However, such conflicts are actually rare. If a conflict arises, one hemisphere usually overrides the other.[[1]](#cite_note-1) When split-brain patients are shown an image only in their left visual field (the left half of what both eyes take in (see [optic tract](/wiki/Optic_tract))), they cannot vocally name what they have seen. This can be explained in three steps: (1) The image seen in the left visual field is sent only to the right side of the brain; (2) For most people, the speech-control center is on the left side of the brain; and (3) Communication between the two sides of the brain is inhibited. Thus, the patient cannot say out loud the name of that which the right side of the brain is seeing. In the case that the speech-control center is on the right side of the brain, the image must now be presented to only the right visual field to achieve the same effect.

If a split-brain patient is touching a mysterious object with only the left hand, while also receiving no visual cues in the right visual field, the patient cannot say out loud the name of that which the right side of the brain is perceiving. This can be explained in three steps: (1) Each cerebral hemisphere of the primary [somatosensory cortex](/wiki/Somatosensory_cortex) only contains a tactile representation of the opposite (contralateral) side of the body; (2) For most humans, the speech-control center is on the left side of the brain; and (3) Communication between the two sides of the brain is inhibited. In the case that the speech-control center is on the right side of the brain, the object must now be touched only with the right hand to achieve the same effect.

The same effect occurs for visual pairs and reasoning. For example, a patient with split brain is shown a picture of a chicken and a snowy field in separate visual fields and asked to choose from a list of words the best association with the pictures. The patient would choose a chicken foot to associate with the chicken and a shovel to associate with the snow; however, when asked to reason why the patient chose the shovel, the response would relate to the chicken (e.g. "the shovel is for cleaning out the chicken coop").

"Scientists have often wondered whether split-brain patients, who have had the two hemispheres of their brain surgically disconnected, are 'of two minds'" (Zilmer, 2001).

## Contents

* 1 History[[edit](/index.php?title=(none)&action=edit&section=1)]
  + 1.1 Visual test[[edit](/index.php?title=(none)&action=edit&section=2)]
  + 1.2 Tactile test[[edit](/index.php?title=(none)&action=edit&section=3)]
  + 1.3 Combination of both tests[[edit](/index.php?title=(none)&action=edit&section=4)]
* 2 Hemispheric specialization[[edit](/index.php?title=(none)&action=edit&section=5)]

## History[[edit](/index.php?title=(none)&action=edit&section=1)]

In the 19th century, research on people with certain brain injuries made it possible to suspect that the "language center" in the brain was commonly situated in the left hemisphere. One had observed that people with lesions in two specific areas on the left hemisphere lost their ability to talk, for example. Research was pioneered by [Roger Sperry](/wiki/Roger_Sperry) and his colleagues. In his early work on animal subjects, Sperry made many noteworthy discoveries. The results of these studies over the next thirty years later led to Roger Sperry being awarded the Nobel Prize in Physiology or Medicine in 1981. Sperry received the prize for his discoveries concerning the functional specialization of the cerebral hemispheres. With the help of so-called "split brain" patients, he carried out experiments, and for the first time in history, knowledge about the left and right hemispheres was revealed.[[2]](#cite_note-2) In the 1960s Sperry was later joined by [Michael Gazzaniga](/wiki/Michael_Gazzaniga) a psychobiology Ph.D. student in his work on split-brain research at [Caltech](/wiki/Caltech) in Pasadena, California. Even though Sperry is considered the founder of split-brain research, Gazzaniga’s clear summaries of their collaborative work are consistently cited in psychology texts. In Sperry and Gazzaniga's, “The Split Brain in Man” experiment published the [Scientific American](/wiki/Scientific_American) in 1967 they wanted to explore the extent to which two halves of the human brain were able to function independently and whether or not they had separate and unique abilities. They wanted to examine how perceptual and intellectual skills were affected in someone with a split-brain. At Caltech, Gazzaniga worked with Sperry on the effects of split-brain surgery on perception, vision and other brain functions. The surgery, which was a treatment for severe epilepsy, involved severing the corpus callosum, which carries signals between the left-brain hemisphere, the seat of speech and analytical capacity, and the right-brain hemisphere, which helps recognize visual patterns. At the point of which this article was written, only ten patients had undergone the surgery to sever their corpus callosum. Four of these patients had consented to participate in Sperry and Gazzaniga’s research. After the corpus callosum severing all four participants personality, intelligence, and emotions appeared to be unaffected. The testing done by Sperry and Gazzaniga showed however, the subjects demonstrated unusual mental abilities. The researchers created three types of tests to analyze the range of cognitive capabilities of the split-brain subjects. The first was to test their visual stimulation abilities, the second test was a tactile stimulation situation and the third tested auditory abilities.

### Visual test[[edit](/index.php?title=(none)&action=edit&section=2)]

The first test started with a board that had a horizontal row of lights. The subject was told to sit in front of the board and stare at a point in the middle of the lights, then the bulbs would flash across both the right and left visual fields. When the patients were asked to describe afterward what they saw, they said that only the lights on the right side of the board had lit up. Next when Sperry and Gazzaniga flashed the lights on the right side of the board on the subjects left side of their visual field, they claimed to not have seen any lights at all. When the experimenters conducted the test again, they asked the subjects to point to the lights that lit up. Although subjects had only reported seeing the lights flash on the right, they actually pointed to all the lights in both visual fields. This showed that both brain hemispheres had seen the lights and were equally competent in visual perception. The subjects did not say they saw the lights when they flashed in the left visual field even though they did see them because the center for speech is located in the brain’s left hemisphere. This test supports the idea that in order to say one has seen something, the region of the brain associated with speech must be able to communicate with areas of the brain that process the visual information.

### Tactile test[[edit](/index.php?title=(none)&action=edit&section=3)]

In a second experiment Sperry and Gazzaniga placed a small object in the subject's right or left hand, without being able to see (or hear) it. Placed in the right hand, the isolated left hemisphere perceived the object and could easily describe and name it. However, placed in the left hand, the isolated right hemisphere could not name nor describe the object. Questioning this result, the researchers found that the subjects *could* later match it from several similar objects; tactile sensations limited to the right hemisphere were accurately perceived but could not be verbalized. This further demonstrated the apparent location (or lateralization) of language functions in the left hemisphere.

### Combination of both tests[[edit](/index.php?title=(none)&action=edit&section=4)]

In the last test the experimenters combined both the tactile and visual test. They presented subjects with a picture of an object to only their right hemisphere, and subjects were unable to name it or describe it. There were no verbal responses to the picture at all. If the subject however was able to reach under the screen with their left hand to touch various objects, they were able to pick the one that had been shown in the picture. The subjects were also reported to be able to pick out objects that were related to the picture presented, if that object was not under the screen.[[3]](#cite_note-3) Sperry and Gazzaniga went on to conduct other tests to shed light on the language processing abilities of the right hemisphere as well as auditory and emotional reactions as well. The significance of the findings of these tests by Sperry and Gazzaniga were extremely telling and important to the psychology world. Their findings showed that the two halves of the brain have numerous functions and specialized skills. They concluded that each hemisphere really have functions of its own. One’s left hemisphere of the brain is thought to be better at writing, speaking, mathematical calculation, reading, and is the primary area for language. The right hemisphere is seen to possess capabilities for problem solving, recognizing faces, symbolic reasoning, art, and spatial relationships.

Further research had continued by Roger Sperry up until his death in 1994 and Michael Gazzaniga still is researching the split-brain. Their findings have been rarely critiqued and disputed, except today there is a wide belief that some people are more “right-brained” or “left-brained”. In the mid 1980s a psychobiologist, Jarre Levy, at the University of Chicago had set out and been in the forefront of scientists who wanted to dispel the notion we have two functioning brains. She believes that because each hemisphere has separate functions that they must integrate their abilities instead of separating them. Levy also claims that no human activity uses only one side of the brain. In 1998 a French study by Hommet and Billiard was published that questioned Sperry and Gazzaniga’s study that severing the corpus callosum actually divides the hemispheres of the brain. They found that children born without a corpus callosum demonstrated that information was being transmitted between hemispheres, they concluded that subcortical connections must be present in these children with this rare brain malfunction. They are unclear about whether these connections are present in split-brain patients though. Another study by Parsons, Gabrieli, Phelps, and Gazzaniga in 1998 demonstrated that split-brain patients may commonly perceive the world differently from the rest of us. Their study suggested that communication between brain hemispheres is necessary for imaging or simulating in your mind the movements of others. Scientist Morin’s research on inner speech in 2001 suggested that an alternative for interpretation of commissurotomy according to which split-brain patients exhibit two uneven streams of self-awareness; a “complete” one in the left hemisphere and a “primitive” one in the right hemisphere.[[4]](#cite_note-4)

## Hemispheric specialization[[edit](/index.php?title=(none)&action=edit&section=5)]

The two hemispheres of the [cerebral cortex](/wiki/Cerebral_cortex) are linked by the corpus callosum, through which they communicate and coordinate actions and decisions. Communication and coordination between the two hemispheres is essential because each hemisphere has some separate functions.[[5]](#cite_note-5) The right hemisphere of the cortex excels at nonverbal and spatial tasks, whereas the left hemisphere is more dominant in verbal tasks, such as speaking and writing. The right hemisphere controls the primary sensory functions of the left side of the body. In a cognitive sense the right hemisphere is responsible for recognition of objects and timing, and in an emotional sense it is responsible for empathy, humor and depression. On the other hand, the left hemisphere controls the primary sensory functions of the right side of the body and is responsible for scientific and math skills, and logic.[[6]](#cite_note-6) The extent of specialized brain function by an area remains under investigation. It is claimed that the difference between the two hemispheres is that the left hemisphere is "analytic" or "logical" while the right hemisphere is "holistic" or "intuitive."[[7]](#cite_note-7)