

# The Human Brain

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The human brain is the centre of our nervous system. It is the most complex organ in our body and is responsible for everything we do - every thought we have, action we take, memory we have and feeling we experience. This fact sheet gives an overview of the brain and some of the key structures within it.

## In this fact sheet:

- The purpose of this fact sheet is to give a comprehensive overview of some of the key structures in the brain and to outline their functions.

## About the brain

The brain is made up of around 100 billion nerve cells - each one is connected to another 10,000. (This would be written as 1,000,000,000,000,000). This means that, in total, we have around a thousand trillion connections in our brains. These are ultimately responsible for who we are. Our brains control the decisions we make, the way we learn, move, and how we feel.

What makes the human brain unique is its size. Our brains have a larger cerebral cortex, or cerebrum, than any other animal. (See the Cerebrum section of this factsheet for further information). This enables us to have abilities, such as complex language, problem solving and self-control.

The brain is protected by the thick bones of our skull and a protective and nourishing fluid called 'cerebrospinal fluid' (CSF). It is separated from the rest of the body's blood stream by the 'blood-brain barrier', which also serves to

protect the brain - from infection and fluctuations in hormones and other substances in the blood. This helps to keep the environment of the brain constant.

## **The cerebrum (also known as the cortex or forebrain)**

The cerebrum is the largest part of the brain. It is split in to two 'halves' of roughly equal size called hemispheres. The two hemispheres, the left and right, are joined together by the corpus callosum. The right hemisphere controls the left side of the body and the left hemisphere controls the right side of the body. The cerebrum is further divided in to four lobes: frontal, parietal, occipital, and temporal, which have different functions.

### **The frontal lobe**

The frontal lobe located at the front of the brain. It has a huge role in what we do and who we are and controls our personality, emotions, memory and behaviour. A higher (more complex) function of the frontal lobe is helping us to think through the consequences of our actions and understanding social norms. The frontal lobe also contains the Broca's area, which is associated with language production. If the Broca's area is damaged, it can lead to problems with communication.

A tumour in the frontal lobe may cause changes in mood and personality and may also affect the senses of sight and smell.

### **The parietal lobe**

The parietal lobe sits directly behind the frontal lobe at the top of the brain. It consists of two areas: the 'sensory cortex', which receives information from our senses, such as touch, pain and pressure, and the 'motor cortex', which helps control how we move our limbs and body in the space we are in. It is, therefore, involved with spatial awareness (i.e. recognition of the distance between two objects) and navigation. It also helps us to respond to internal sensations.

A tumour in the parietal lobe could impact on abilities such as finding your way around, writing, speaking and understanding speech.

### **The temporal lobe**

The temporal lobe is located at the middle, lower half of the brain. It is a complex part of the brain, which is involved in many 'higher' functions, such as intellect and behaviour. The temporal lobe has a large role in auditory perception (hearing) and is important in processing the meaning of speech. It contains a structure called the 'Wernicke's area', which is essential for

understanding and forming speech. Damage to the Wernicke's area, therefore, can result in problems with communication.

As the temporal lobe is also involved in emotional memory, a tumour in this area may create a feeling of 'déjà vu' (a sense of having been somewhere or done something before).

## **Occipital lobe**

The occipital lobe is the smallest of the four lobes. Although it is located towards the very rear of the skull, it is still technically classed as part of the forebrain. The primary role of the occipital lobe is the control of vision.

A tumour in the occipital lobe may lead to a loss of vision on one side. It can also cause partial loss of vision e.g. loss of peripheral vision (vision around the centre of where you are looking) or visual field defects, such as small blind spots.

## **Brain stem**

The brain stem connects the cerebrum with the spinal cord. It controls many of the functions we would not usually think about, including breathing, swallowing, blood pressure and digestion. The two main parts of the brain stem are the pons and the medulla oblongata.

### **Pons**

The pons is part of the brain stem. It takes its name from the Latin word meaning 'bridge'. It links together, or acts as a bridge between, different parts of the brain. The pons helps to relay information from the medulla oblongata to higher parts of the brain. Childhood brain tumours in the brain stem usually originate in the pons.

### **Medulla oblongata**

The medulla oblongata is also part of the brain stem and carries messages between the brain and the spinal cord. It is partly responsible for heart rate and lung functioning, and controls reflexes such as swallowing, coughing and the gag reflex.

## **Spinal cord**

The spinal cord consists of all the nerve fibres that pass down from the brain to the different parts of the body. It is filled with cerebrospinal fluid (CSF), which nourishes and protects it.

## Meninges

The meninges is the collective term for the three thin layers of tissue separating the brain from the skull. They are called the dura mater (outermost), the arachnoid (middle) and pia mater (innermost). Their function is to protect the brain.

## Cerebellum

The cerebellum, also known as the hindbrain, is the second largest structure of the brain. It sits at the very back of the skull and plays a key role in our balance and co-ordination (which you may hear referred to as 'motor control' functions).

The cerebellum and the brain stem are in, or near, a small cavity (space) at the back of the skull called the **posterior fossa**. ('Posterior' means back and 'fossa' means cavity.) Health teams use this term quite often when referring to the location of a tumour.

## The pituitary gland

The pituitary gland is a gland of the endocrine system. This means it is a hormone producing gland. It is often referred to as the 'master' gland as it controls several other hormones producing glands, such as ovaries, testes and adrenals. It is about the size of a pea and is not strictly part of the brain, but is found at the base of the brain close to the part of the brain called the hypothalamus. It is made up of two main parts, the anterior (front) and the posterior (back), each of which releases hormones targeting different parts of the body. The pituitary gland works with the hypothalamus to control different functions of the body, such as heart rate and body temperature.

## The hypothalamus

The hypothalamus is located near the pituitary gland at the base of the brain, just above the brain stem. It is an area of the brain whose primary function is the control of hormones. This is done by linking the nervous system to the endocrine system via the pituitary gland. The hypothalamus regulates hormone levels by monitoring them - when a particular hormone drops to a level below where it should be, the hypothalamus signals to the pituitary gland that it should produce more. When the correct level is reached, the hypothalamus signals to the pituitary gland to stop.

## Resources

This fact sheet outlines the functions of the main parts of the brain. From this you can see which functions are likely to be affected depending on the location of a tumour. Below are some interactive resources that you may find useful.

<http://www.newscientist.com/movie/brain-interactive>

<http://www.bbc.co.uk/science/humanbody/body/interactives/organs/brainmap/>

## What if I have further questions?

If you require further information, any clarification of information, or wish to discuss any concerns, please contact our Support and Information Team.

- Call 0808 800 0004 (free from landlines and most mobiles including 3, O2, Orange, T-mobile, EE, Virgin and Vodafone)
- Email [support@thebraintumourcharity.org](mailto:support@thebraintumourcharity.org)
- Join our online forums at [www.thebraintumourcharity.org/forums](http://www.thebraintumourcharity.org/forums)

## About us

The Brain Tumour Charity makes every effort to ensure that we provide accurate, up-to-date and unbiased facts about brain tumours. We hope that these will add to the medical advice you have already been given.

Please do continue to talk to your doctor if you are worried about any medical issues. We are the UK's leading brain tumour charity. We fund scientific and clinical research into brain tumours and offer information and support to those affected, whilst raising awareness and influencing policy.

We rely 100% on charitable donations to fund our vital work. If you would like to make a donation, or want to find out about other ways to support us including fundraising, leaving a gift in your will or giving in memory, please visit us at [www.thebraintumourcharity.org](http://www.thebraintumourcharity.org) or call 01252 749043.

## About this fact sheet

This fact sheet has been written and edited by The Brain Tumour Charity's Support and Information Team. The accuracy of medical information has been verified by a leading neuro-oncologist. Our fact sheets have been

produced with the assistance of patient and carer representatives and up-to-date, reliable sources of evidence. If you would like a list of references for any of the fact sheets, or would like more information about how we produce them, please contact us.

## **The Human Brain**

### **Your notes**



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