

# UNDERSTANDING THE BRAIN

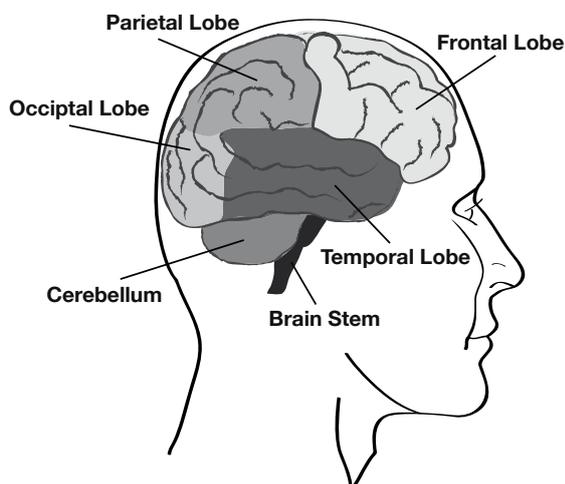
## The Brain

The brain is the body's control centre. It may only weigh about 1.5kg but it is estimated to have about 100 billion cells. It controls everything we do from basic body functions, such as breathing, heart beat and blood pressure to our movements, speech, senses and aspects of our personality.

## Cerebral Hemispheres

The brain is divided into two cerebral hemispheres – the left hemisphere and the right hemisphere. Each hemisphere tends to specialise in certain functions, but the two hemispheres work seamlessly together, sharing information.

- > **Right hemisphere** – tends to be more visual, thinking in pictures. It sees, recognises and organises information for the left side to analyse and process further. Generally speaking, the right hemisphere controls muscles on the left side of the body.
- > **Left hemisphere** – mostly responsible for speech, language, calculations, maths and logical abilities. It generally controls muscles on the right side of the body.



The brain is divided further into four “lobes” that handle specific areas of function.

**The frontal lobes** look after planning, organising, reasoning, decision-making, judgement and the emotions.

**The parietal lobes** are concerned with the perception of sensations, such as touch, pressure, temperature and pain and the understanding of words and sentences, reading and writing and sometimes the ability to use numbers. They deal with spatial awareness, such as our ability to find our way around a house, to drive a car and to reach for objects.

**The temporal lobes** also have a role in language, particularly in the ability to hear and understand it. They are concerned with memory, the emotions, the ability to enjoy music and to recognise and identify things we see, such as faces or objects.

**The occipital lobes** are primarily concerned with vision but also our ability to recognise what we see in terms of identifying colours, locating objects in the environment and seeing objects accurately, for example.

You can see how easily damage to the brain might affect many different functions and abilities.

## Cerebellum and Brain Stem

Below the cerebral hemispheres are the cerebellum and the brain stem, which connect with the spinal cord.

**The cerebellum** is involved in “doing” rather than “thinking” activities. It carries out orders from the cerebral hemispheres above and keeps

a number of vital but routine functions kicking over, such as maintaining balance and ensuring our muscles move in a smooth, coordinated way.

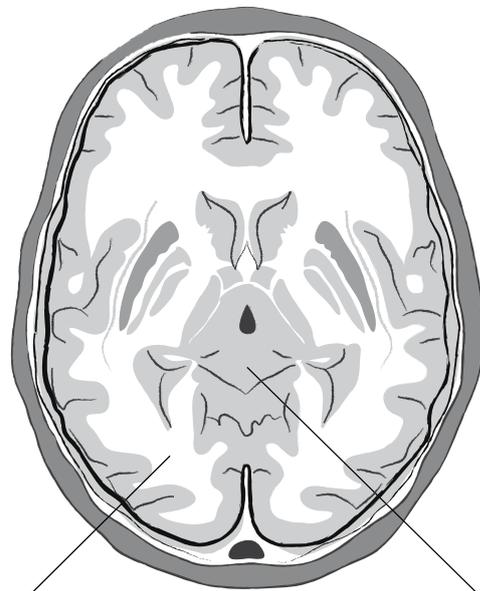
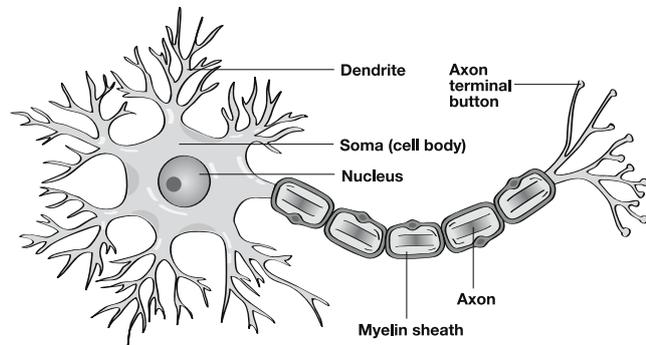
**The brain stem** controls many vital functions including breathing, blood pressure, blood circulation, swallowing, appetite, body temperature and digestion, as well as the need for water, staying awake and sleeping, among other things. It is also the main route for nerve fibres running between the cerebral hemispheres and the spinal cord. Any damage in the brain stem can produce widespread and profound effects.

## The Nervous System

The brain communicates messages through a complex network of nerves that travels throughout our body. The brain and spinal cord together make up the **central nervous system**. The brain and nerves together are known as the **nervous system**.

On their own, the nerves that run throughout our body are called the **peripheral nervous system**. They relay information from your brain through your spinal cord to the rest of your body and back again. The **autonomic nervous system** is part of the peripheral nervous system. It conveys messages from all of the organs in our chest, abdomen and pelvis. For example, it manages our “fight and flight” responses, our “rest and digest” responses. It looks after the automatic activities of our heart and blood vessels and plays an important part in sexual response and bladder control.

## Neurones – Basic Building Blocks



The basic building blocks of the nervous system are nerve cells or neurones. We are born with about 100 billion neurones that must last a lifetime. Unlike all the other cells in the body, neurones do not replace themselves if they die or are damaged. When neurones cluster together, they form grey matter on the outer part of the brain and inner part of the spinal cord.

**White matter** is found on the inner part of the brain and outer part of the spinal cord. It is made up of bundles of nerve fibres called axons, which are really just the long, thin extensions of neurones. These **axons** are covered by a white, fatty substance called **myelin** (hence the term “white matter”), which insulates them, like the plastic coating of an electric wire. The axons then bundle together, like the individual telegraph wires in a cable, to form a nerve.

## How it all Works

The brain is in constant contact with all parts of the body, sending instructions and receiving feedback from the senses. The axons carry these messages as tiny electrical currents or nerve impulses.

- **Outgoing messages:** Messages sent from the brain to activate the muscles of the body travel along the motor pathways. The neurones that make up these pathways are called motor neurones.
- **Incoming messages:** Messages sent from the senses back to the spinal cord and brain come along the sensory pathways. These are called sensory neurones.

## How Change Affects the Nervous System

Various conditions from illness (encephalitis) and incidents (heart attack, stroke) to accidents (near drowning, a skateboarding fall) can cause brain damage, which affects the way the nervous system functions by:

- Affecting brain function itself.
- Affecting the brain’s ability to communicate with the rest of the body.
- Affecting the ability of muscles to respond to the brain’s orders (nerve impulses).

Damage to the brain is called acquired brain injury (ABI). This can occur in two ways: firstly, an accident, illness or incident can cause direct injury to the brain cells and secondly, any interruption to the blood supply to the brain may cause further damage. Without a constant blood supply, the brain is unable to maintain its extraordinary level of functionality. For example, a lack of oxygen (hypoxia) during near drowning affects blood supply to the brain, as does severe bleeding in other parts of the body or any excessive pressure within the skull, which might occur due to brain swelling or bruising.

Some of the effects of ABI are obvious and profound while others are subtle, yet disabling. The effects will vary widely from person to person. Changes to the brain and nervous system can lead to these kinds of issues:

**Medical problems:** Headache and epilepsy are two of the most common.

**Sensory difficulties:** Sight, hearing, touch, smell, taste, body-temperature control and awareness of body position can be affected. Some people may become hypersensitive to sound, heat or cold. For example, losing awareness of your body position creates problems with buttoning shirts, using a spoon or stepping off a curb safely.

**Physical difficulties:** The most obvious problems are paralysis and limb weakness or problems with coordination, balance and tremor. Fatigue is also very common.

**Thinking abilities:** Poor concentration, memory loss, difficulties in planning and organisation, problem-solving, abstract thinking or responding effectively may arise. Slowness in thinking is very common.

**Communication and speech difficulties:** Speech may be affected, becoming slurred or difficult to understand. Some people may have trouble

swallowing. Others have difficulties using language, such as finding the right words or understanding sentences.

**Behaviour:** A person may become aggressive, lack initiative or be poorly motivated. They may have difficulty regulating their own behaviour in a way that is socially acceptable. For example, the person may make inappropriate jokes or comments.

**Personality:** There may be mood changes, depression, overactivity, euphoria or lack of insight. A person may become irritable or they may laugh or cry too easily. A previously compassionate person may become selfish or uncaring and a happy person may become quiet and withdrawn.

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