

An Introduction to the Brain

This worksheet offers an introduction to how the brain works.

The brain is the most complex, mysterious part of our bodies. An adult brain weighs about 3lbs. This is around 2 % of bodyweight, but the brain manages 98 % of human functions.

The brain is shaped like a wrinkled walnut; if the surface of the brain was flattened out it would cover approximated 4 sheets of A4 paper.

This miniature supercomputer gathers and processes information from all of our senses. It also sends out lots of information, telling our limbs to move and our eyes to blink. The brain also determines how we behave, what we say, and our complex thought processes.

This is a whistle-stop tour of the brain, and how its different parts or 'regions' influence our lives. Scientists describe different areas of the brain as lobes. These parts work together for complicated activity such as speech or movement.

Brain parts and functions

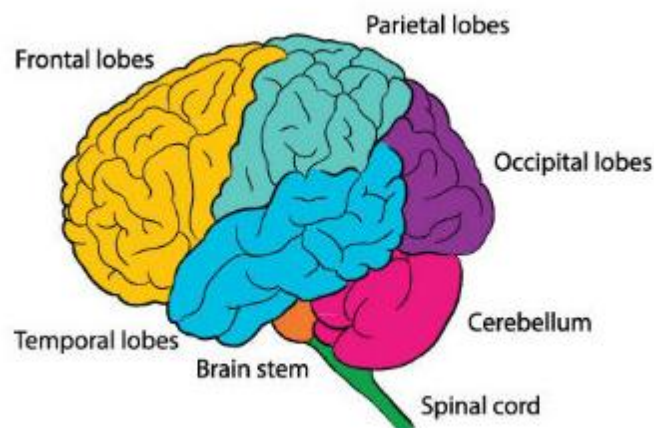
The brain controls all the functions of the body even those that we are not conscious of such as breathing and swallowing. The brain has a cortex, and a subcortex where the automatic functions are controlled.

The brain has two halves joined by a mass of neurons which communicate information from one side to the other. The two halves are called the right and left cerebral hemispheres.

For physical tasks the left side of the brain is responsible for controlling the right side of the body and the right side controls the left. Generally there are specific functions associated with either the left or right hemisphere e.g. language is more associated with left hemisphere and musical appreciation with the right.

The brain is surrounded by cerebrospinal fluid which fills in all the gaps around the brain. It also offers some protection and cushioning.

As well as the two hemispheres the brain can be split into areas, known as lobes.



Frontal lobes

The frontal lobes sit behind our forehead and are one of the biggest parts of the brain. They look after the 'executive functions' such as our judgement, decision-making, planning, what we choose to focus our attention on, and the control of our behaviour and emotions.

They also 'override' and checks our more basic impulses and behaviours and plays a large role in speech and language, and in memory. The frontal lobes also include the motor cortex, which controls our planned movements (as opposed to involuntary ones).

Parietal lobes

Found just behind the frontal lobes, the parietal lobes process a lot of the information that comes in from around the body. They help us with our perception and how we make sense of the world. They contain the primary sensory cortex, which controls sensations, like touch, pain and whether something feels hot or cold.

Occipital lobes

The occipital lobe is where we process all visual information. It helps us to perceive different shapes and colours, faces and objects.

Cerebellum

At the very back of the brain, the cerebellum looks after our balance, movement and coordination. It tells us which way is up and stops us from colliding into things as we move.

Brainstem

The brainstem looks after our 'involuntary functions'. These are crucial for keeping us alive – we do them without thinking about them. The brainstem regulates our heart rate, breathing, blood pressure and swallowing, all without conscious thought. It keeps us alert, but it also keeps us calm. It regulates our hormones.

Temporal lobes

The temporal lobes are at the side of the brain, near the ears. They process sound entering the ears, so we can understand and produce speech, and listen to music. The temporal lobes are also part of the wider system controlling memory.

How the parts of our brain work together

Most of the things we do every day require us to use many different parts of our brain to work together. One example used by our clinicians would be getting to and taking part in school registration:

- Remember what time registration starts
Temporal, Parietal, Frontal and Occipital
- Use watch to check the time
Occipital, Temporal, Parietal and Frontal
- Remember which room to go to and how to get there
Temporal
- Navigate to the classroom and sit down
Frontal, Temporal, Parietal and Occipital
- Recognise class mates and teachers
Parietal, Occipital and Temporal
- Listen to name and respond
Frontal and Temporal

This task may appear simple but actually involves the whole brain working together

Nerve cells

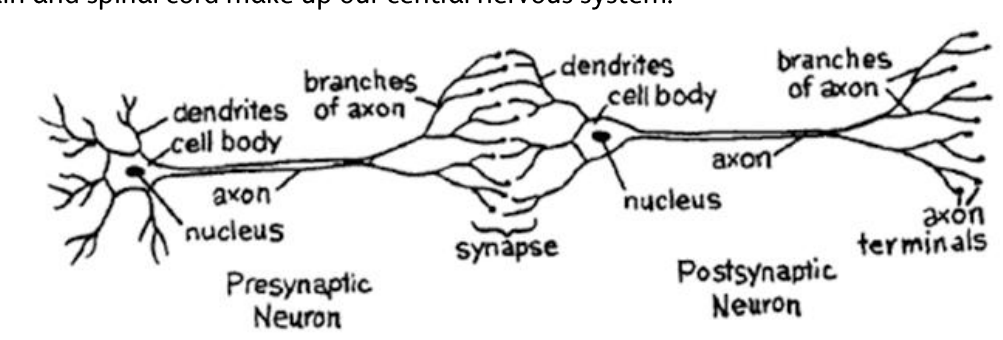
Your brain is packed with tiny nerve cells called neurons. A piece of brain the size of a grain of sand contains 100,000 neurons! Each individual cell is in contact with thousands of other nerve cells.

Nerve cells are connected to other neurons by long fibres called axons which then branch like a tree to form dendrites. They send messages very quickly from one part of the brain to another using electrical and chemical impulses. They also send messages through the spinal cord to the rest of the body.

These pathways are like trampled snow on a sidewalk in the winter. After a person has walked on the sidewalk over and over again, a path forms and it is easier to walk. That is why tasks such as tying a shoe or reciting multiplication tables becomes easier the more they are done.

The nerve cells themselves are grey in colour while the fibres connecting them are white. Often they are known as grey and white matter.

Our brain and spinal cord make up our central nervous system.



Structure of a nerve cell. Source: National Institutes of Health website.

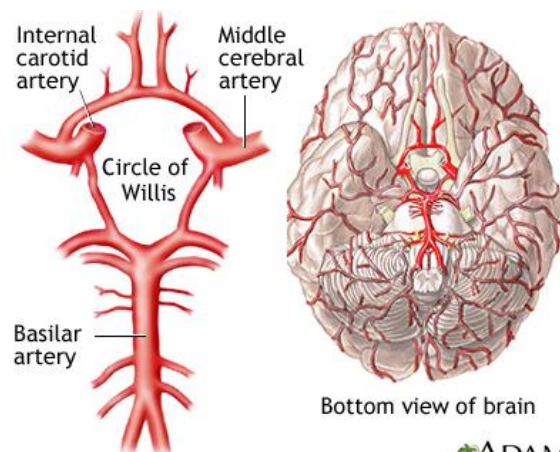
There are gaps between neurons called synapses. When an impulse arrives, chemicals are released from the dendrites at the end of an axon of one neuron. The chemicals move across the synapse and start an impulse off on the next neuron.

Blood supply

The brain is absolutely dependent on a continuous supply of oxygenated blood. Blood moves through blood vessel tissue to nerve tissue in the brain. It delivers the oxygen and nutrients brain cells need to release energy.

Although the brain accounts for just 2% of the body's weight it requires 20% of the body's energy supply.

Circle of Willis which has 5 arteries and forms the main blood supply to brain, it forms a ring so that if one route becomes blocked another one can compensate for it.



Circle of Willis. Source: Medline Plus website.

Useful Websites

Neuroscience for Kids: information for adults and kids on the basic functioning of the brain

<http://faculty.washington.edu/chudler/neurok.html>

Sam's Brainy Adventure: how the brain works in small digestible steps

<http://faculty.washington.edu/chudler/flash/comic.html>

Brain Facts and Figures

<http://faculty.washington.edu/chudler/facts.html>

Common Questions about the brain

<http://faculty.washington.edu/chudler/what.html>

Brainline Kids: stories and resources about acquired brain injury in children and young people

http://www.brainline.org/landing_pages/features/blkids.html

Cerebra: information about acquired brain injury in children and young people

<http://www.cerebra.org.uk/English/getinformation/conditions/Documents/ABI%20brief.pdf>

Information on traumatic brain injury for parents

<http://www.parentcenterhub.org/repository/tbi/>