

Early brain development

The specification says....

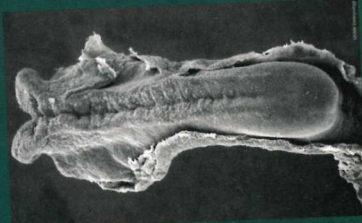
Early brain development: A basic knowledge of brain development, from simple neural structures in the womb, of brain stem, thalamus, cerebellum and cortex, reflecting the development of autonomic functions, sensory processing, movement and cognition.

The roles of nature and nurture.

You started life in your mother's womb. It is a lovely safe environment where you developed over a period of nine months.

You started as one cell. This cell divided into 2 and then they divided into 4 and so on. Each of these cells moved into position so gradually they started to take a shape of a tube.

This is what you looked like after 3 weeks.



← Head

← Spinal column forming

This was the beginning of your spine and brain. Some of the cells formed a rudimentary heart which started to beat.

A week later you were about 4 mm long and looked like this. You can see the beginning of a head and brain, and the umbilical cord which connected you to your mother so you could get nutrients and oxygen.



Basic outline of early brain development

The brain is the most wonderful organ in our body. There are many different separate structures and components. You will learn more about them in Chapter 7. We will focus on four key parts of the brain.

Brain stem

The **brain stem** is the part of the brain that connects to the *spinal cord*.

- Motor and sensory functions – The brain stem carries motor and sensory nerves to the brain from the rest of the body, and from the brain to the rest of the body via the *spinal cord*.
- **Autonomic functions** – The brain stem also controls many basic life functions such as heartbeat, breathing, sleeping and eating. Many of these functions are controlled by the *autonomic nervous system*. It is called 'autonomic' because it is *automatic* – we do not have to consciously direct our heart to beat or stomach to digest food.

The brain stem is the most highly developed part of the brain at birth. The rest of the brain goes on developing through infancy but the brain stem is important in directing basic, autonomic behaviours and needs to be well developed for survival.

Cerebellum

Cerebellum means 'little brain'. It is located near the top of the spinal cord. It plays a very important role in the co-ordination of movement, for example your balance. It also co-ordinates sensory information with motor activity – called *sensorimotor*. And, finally, the cerebellum also has some input into other functions such as language and emotions.

The cerebellum is one of the last parts of the brain to reach maturity.

Thalamus

The **thalamus** is located deep inside the brain. In fact there are two of them – one in the right half of the brain and one in the left half (each half of the brain is called a *hemisphere*). You can only see the thalamus if you cut the brain in half. It is the size and shape of a walnut. The thalamus acts as a hub of information, receiving signals from other areas of the brain and sending signals on. For example:

- The thalamus receives sensory signals from the retina in the eye and sends the signals onto the *visual area* where visual information is processed.
- The thalamus also co-ordinates motor signals, sending information from the *motor area* to the body.

Cortex

This is the principal part of the brain, also called the *cerebral cortex*. The **cortex** is divided in two halves (or hemispheres). Each hemisphere has more or less the same structures.

The word 'cortex' means 'bark'. The cerebral cortex is the outer covering of the brain, which is like a tea cosy covering the other structures. The cerebral cortex is only 3mm thick and is only found in mammals.

All our thinking and processing goes on in this thin layer of the brain. It is very thin but very folded so there is actually a lot of it.

- Thinking (or **cognition**) mainly takes place in the *frontal cortex*. The part of the brain behind your forehead.
- Sensory processing takes place in various places such as the *visual area* at the back of the brain and the *auditory area* (for hearing) at both sides of the brain.
- Motor processing is controlled by the *motor area* also at the sides of the brain, near the top. The motor area directs movement.

The sensory and motor areas of the cortex are functioning in the womb – the developing baby starts to learn sensorimotor coordination. At birth the cortex is still fairly primitive and goes on developing throughout our lives.

THINK LINK

The structure and function of the brain is explained in Chapter 7 (see the whole of that chapter). In fact the whole chapter is about the brain.

Imagine a cauliflower is your brain. Slice the cauliflower in half and label the brain stem, cerebellum and thalamus. The outer thin layer of the brain is the cerebral cortex, sometimes just called the 'cortex'. It is quite remarkable because that is where all your thinking happens.

The roles of nature and nurture

One of the biggest questions in psychology is whether we are born or made – **nature** or **nurture**?

The term *nature* refers to things that you have inherited, which are present from the moment that first cell is formed.

The term *nurture* refers to any other influences such as the kind of home we grew up in, our teachers and friends, what we eat, and good and bad experiences we may have had.

Most of the way that your brain forms is due to nature but not all. The actual physical shape of the brain and its folds are not the same in identical twins. Chance events affect the brain as it grows – experience in the **womb** counts as 'nurture'.

It may surprise you how many things may affect the growing brain. Here are a few.

Smoking

It is fairly well known that mothers who smoke give birth to smaller babies. Smoking affects the size of the brain as well as the body because nicotine (in cigarettes) slows down brain growth.

Infection

It is also fairly well known that pregnant mothers should avoid contact with anyone with German measles (rubella). One of the effects of rubella is brain damage, most especially hearing loss if a mother develops the illness during the first 20 weeks of pregnancy.

Even though such an infection is biological, this still counts as 'nurture' because it is the baby's environment that has caused the effect.

Voices

Babies appear to recognise their mother's voice immediately after birth (they suck on a special device more if a tape of their mother's voice is played than if the tape is of someone else). This shows that the brain is changing before you are born in response to external stimuli.

Perhaps even more surprising is that babies respond to particular passages in a book – babies who had heard *The cat in the hat* read to them while they were in the womb, sucked more when this was read to them after birth compared with a passage from a different kind of book (DeCasper and Spence 1986).

The interaction between nature and nurture

At one time psychologists talked about whether our characteristics and abilities were due to nature or nurture. Nowadays no one thinks in terms of one or the other – they both operate at the same time. So your brain is in part a product of your genes but from the minute that first cell was fertilised, the environment has had an effect on your development.

What is meant by ...

Autonomic functions The word 'autonomic' means 'automatic'. It refers to functions in the body which we do not consciously control, such as heart beat, digestion and emotions such as fear.

Brain stem develops early because it controls vital autonomic functions. It passes information to and from the brain and the body.

Cerebellum The 'little brain' at the base of the brain above the spinal cord that coordinates movement with sensory input (sensorimotor) and also has a role in cognition.

Cognition refers to 'thinking' and all mental processes.

Cortex is the outer covering of the brain where mental processing takes place.

Nature refers to genetic influences, characteristics you inherit from your ancestors.

Nurture refers to all other influences – how you were raised, your experiences and your environment in general.

Thalamus is a key hub of information in the brain, relaying sensory and motor signals to the cortex.

Womb is the part of a woman's body where a baby develops. It is located in the lower abdomen, between the bladder and the rectum. It provides a cushioned environment for the developing baby as it is filled with fluid.

THINK LINK



Nature and nurture are discussed in relation to Gibson and Gregory's theories in Chapter 2 (see pages 46 and 48).

Study tip

Scary big words

Biological insights are fascinating – it's your body! Don't let the terminology put you off because you think the words are difficult. *Supercalifragilistic* is much more difficult.

Apply it – research

What do you mean?

A researcher played a recording of Justin Bieber's *What Do You Mean?* to 20 pregnant women once a week for the last 12 weeks of each pregnancy. Once each baby was born, the researchers then played ten songs to the babies including the Bieber track. They measured recognition by the number of sucks each baby took on a special device.

1. Explain what results the researchers were hoping to find. [2 marks]
2. Identify a control group the researchers could have used and explain why they should have used it. [1 mark + 2 marks]
3. The researchers conducted their study in the participants' homes. State **one** strength and **one** weakness of conducting research in a natural setting. [1 mark + 1 mark]
4. Explain **one** way in which the researchers should have standardised the method used in the study. [2 marks]

1. (a) Identify **one** part of the brain that has been shown to affect the development of movement. [1 mark]
(b) Use your knowledge of the part of the brain identified in part (a) to explain how it affects movement. [3 marks]
2. Briefly explain the function of the thalamus. [3 marks]
3. With reference to **at least one** example outline how nature and nurture may affect the development of the growing brain. [6 marks]

Check it