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We know
books

Your Body for Life

Your Physical Body

From birth to old age

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Some words are printed in **bold**, like this. You can find out what they mean by looking in the glossary on pages 60–61.

From cradle to grave

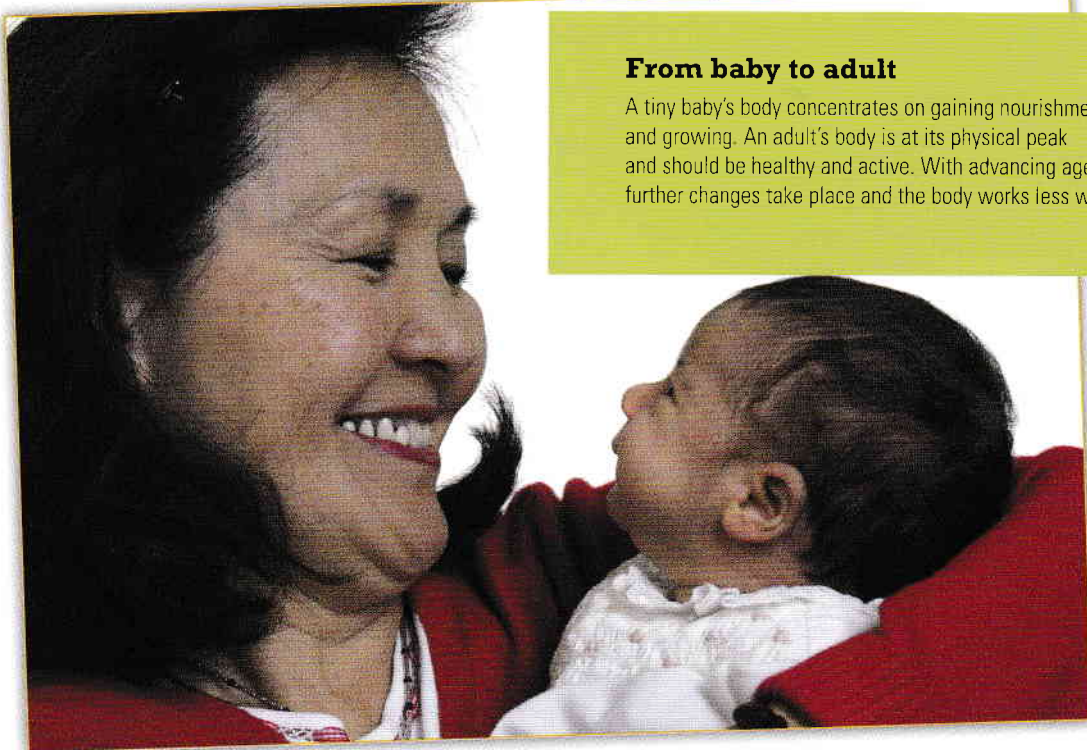
If you compare yourself to your grandparents, you will see that you look very different. This is because our bodies undergo huge changes as we go through life.

Always changing

Your body works hard at all ages to carry out seven basic life processes common to all living things: movement, sensitivity, **excretion**, **nutrition**, **respiration**, growth, and **reproduction**. Its work changes with time, though.

From baby to adult

A tiny baby's body concentrates on gaining nourishment and growing. An adult's body is at its physical peak and should be healthy and active. With advancing age, further changes take place and the body works less well.



Fuel for the body

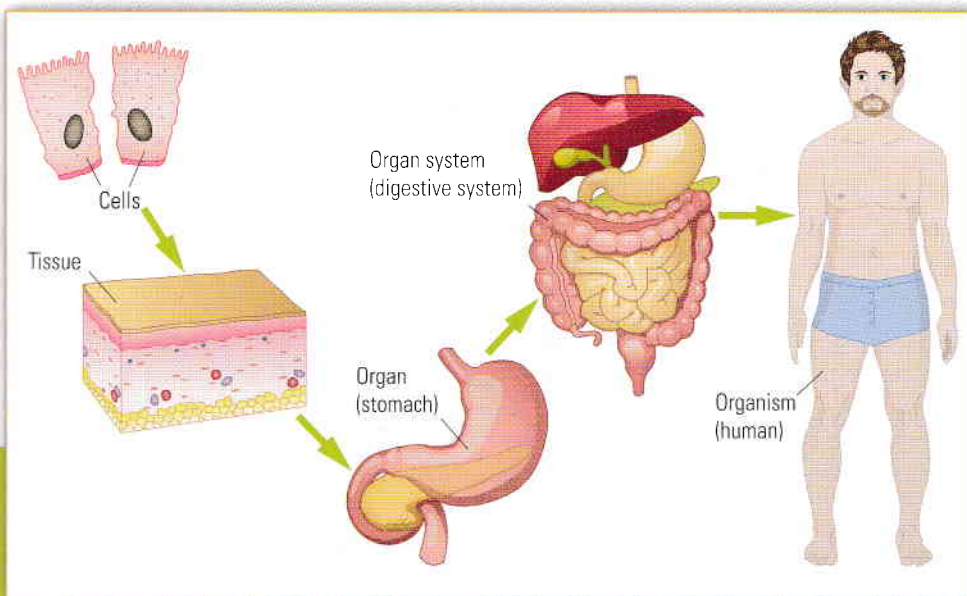
To grow and move, the body needs **nutrients** from food and oxygen from the air. Your body is mostly made up from four basic substances called elements: oxygen (65 per cent), carbon (18 per cent), hydrogen (10 per cent), and nitrogen (3 per cent). Calcium (1.5 per cent) and phosphorus (1 per cent) are also vital. These building blocks make up 99 per cent of the body. The elements are arranged into lots of different chemical combinations making compounds such as water, **fats**, **proteins**, and other substances. Food is made of compounds which the body breaks down, reusing the components to build chemicals the body needs.

Inside and outside

Some of the changes in the body are easy to see. Over time, babies grow larger and the proportions of the body change – the head becomes comparatively smaller and the limbs are longer. Other changes begin at **puberty**: people grow body hair, and their reproductive systems start to work. Elderly people might be stooped, with wrinkled skin and grey hair – clear changes from when they were younger. There are also changes inside the body, which we cannot see. Older people often have brittle bones, which break easily. You cannot see brittle bones, but the effects are painful.

What are you made of?

There are four main types of **tissue** that make up your body: muscle, nerve, connective, and epithelial tissue. Muscles support the body and enable it to move. Nerves carry information to, from, and within the brain. Connective tissue gives structure and support to the body or connects parts together, and it includes bone and blood. Epithelial tissue provides linings and surfaces, such as the skin and the lining of the intestines.



All these tissues are made from **cells**. There are very many different types of cell in the human body. The structure of each type is suited to its function. A blood cell is very different from a muscle cell, for instance.

Cells, tissues, organs, bodies

The body contains organs and structures made of tissue of different types. All these tissues are made from cells. Each type has a structure suited to its own function.

AMAZING BUT TRUE!

Crawling with life

There are about 10 trillion (10,000,000,000,000) human cells in an adult's body – and 10 times as many extra tiny living things in and on it! Most of these tiny living things cause no harm, and many actually help the body. **Bacteria** in the stomach and intestines help break down our food, for example.

A brand new body

The human body grows and develops for 38 weeks before being born. The period before birth is actually when the body grows most quickly.

Starting from scratch

A new baby begins when a **sperm** cell from the father and an egg cell from the mother come together, and the sperm **fertilizes** the egg. The fertilized egg divides into two, and then those two cells divide again, making four cells, and so on. Every new cell contains an exact copy of the **genetic** information in the fertilized egg.

To start with, all the cells are the same – they are called **stem cells**. They can become any part of the growing baby. Around a week after fertilization, when the group of cells is about the size of the dot over this letter “i”, the cells start to differentiate. This means they start forming different types of tissue and grow into the organs and structures of the body. At this stage, the baby is called an **embryo**. After eight weeks, when it is recognizably human, it is called a **foetus**. You can see in detail how the embryo and foetus grow on pages 58 and 59.

More than one!

Sometimes the mother's body releases two eggs, and both are fertilized. Fraternal twins (twins who are not identical) then develop. Identical twins occur if a single fertilized egg splits into two separate embryos early in its development. Identical twins have the same genetic material, since they are from a single fertilized egg.

AMAZING BUT TRUE!

Eggs to spare

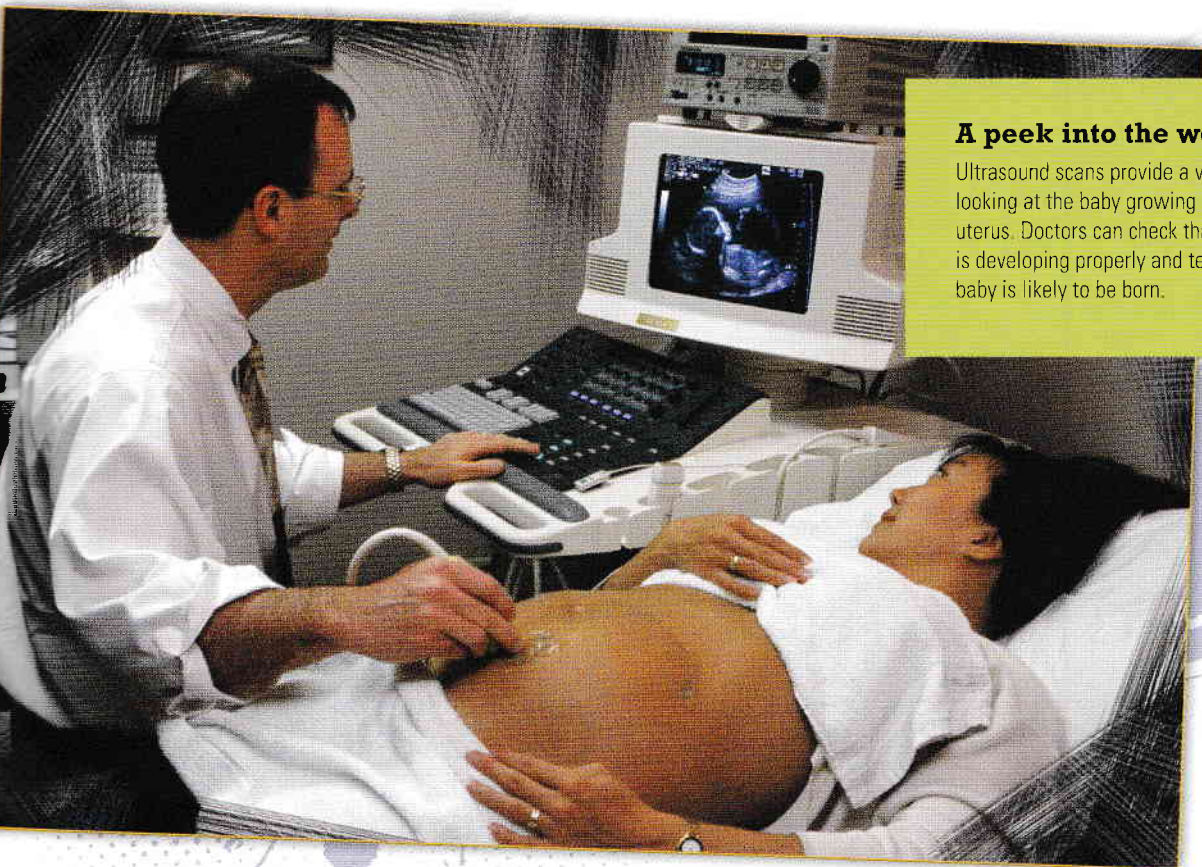
A female embryo at 11 weeks has around two million eggs in her body, meaning she will be ready to have her own babies later. At birth, the number will have dropped to one million eggs, and by age 17 she will have only 200,000. Only around 500 eggs will ever be released and have the chance of being fertilized.

How the unborn baby grows

While the unborn baby grows, the mother's blood provides nourishment for it. The **placenta** is an organ that grows in the mother's **uterus**, forming a connection between her body and the developing baby. Mother and baby have separate circulatory systems (the heart and blood vessels). In the placenta, oxygen and nutrients pass from the mother's blood to the baby's blood. Waste passes from the baby's blood to the mother's. The baby's blood passes through the **umbilical cord** to and from the placenta, but does not mix with the mother's blood. Substances pass through the walls of the blood vessels in the placenta.

Caring for the unborn baby

The unborn baby is affected by how the mother behaves during pregnancy. Harmful chemicals including tobacco and alcohol, and radiation such as X-rays, can damage the baby, especially in the early months of pregnancy. They can cause disability or even death.



A peek into the womb

Ultrasound scans provide a way of looking at the baby growing in the uterus. Doctors can check that the baby is developing properly and tell when the baby is likely to be born.

What will the baby be like?

Each fertilized egg has 23 pairs of **chromosomes**, made up of 23 chromosomes from the sperm and 23 from the egg. Chromosomes carry all the genetic information for a person, coded on around 23,000 **genes**. The genes control growth, development, and obvious characteristics, such as hair colour and skin colour, and less obvious ones, such as whether people are likely to develop some kinds of cancer and the type of noise they make when they sneeze!

Not all outcomes are entirely controlled by genes. Some are influenced by factors in the environment. For instance, if a pregnant woman drinks a lot of alcohol or is exposed to other poisons, this can cause problems in the unborn baby that will affect how it grows and develops.

"We know there are at least 400 toxic chemicals in tobacco smoke. These can get into the pregnant mother and affect her baby."

– Dr. Jonathan Winickoff, associate professor of pediatrics at Harvard Medical School, Boston, USA

Case study:

Famine affects unborn grandchildren

It is not surprising that if there is a famine (shortage of food in an area), babies born to undernourished mothers will be harmed. But it is more surprising that grandchildren and perhaps even later generations might also be affected.

Late in World War II, in 1944–45, the German army prevented food from being delivered to Holland, leading to a famine in which 30,000 people died. People who survived the famine often had children with a low birth weight. These children had unusually high rates of **diabetes**, **obesity**, cancer, and heart disease in later life. They also gave birth to children with a low birth weight, even though they did not themselves suffer from malnutrition (lack of nutritious food) or food shortages. The genes of the malnourished parents were affected by the experience of famine, and this change passed on to future generations.

Scientists believe that the genes were affected, perhaps for three generations, to make the body hoard food in case of scarcity. When there is no scarcity, this leads to obesity and related medical conditions such as diabetes and heart disease.

When things go wrong

Around 3 in every 100 babies born alive in more economically developed countries like the United Kingdom have major birth defects. Some defects have a lifelong impact or even lead to the death of the baby. Birth defects can be structural or functional. A structural defect occurs when part of the body is missing or wrongly formed. Most are heart defects, such as holes in the internal walls of the heart, or major **arteries** going to the wrong part of the heart. One in 100 babies born in the United States each year has a heart defect. A functional defect occurs when the baby is not able to make a chemical the body needs, usually an **enzyme** or another protein. The baby might look normal, but the body does not work properly.

Some birth defects are the result of genetic faults – either there is a defective gene that the baby inherits or something goes wrong with the baby's own genes. Others are caused by an event during pregnancy, such as the mother falling ill or being exposed to dangerous chemicals.

Starving in Holland

This wartime photo shows a boy who was malnourished because of food blockades in Holland in 1944–45. People who suffered during this time often went on to have children and even grandchildren affected by the changes that malnutrition caused in their bodies.

