8 DNA

DNA contains the instructions for all life. These instructions shape the way our bodies form and grow, and influence our appearance, skills and characteristics.

As technology has advanced, our understanding of DNA has increased significantly. Our understanding can now help us to prevent illness and fight crime.

What is DNA?

The letters 'DNA' stand for deoxyribonucleic acid. This is a long molecule with a complicated structure, built from four chemical 'bases'.

The bases of DNA are adenine, thymine, cytosine and guanine. These are usually represented by the letters A, T, C and G. They are also known as 'nucleotides'. The nucleotides bond together to form long strands.

These strands form a very long genetic code of nucleotides – in humans, it's around three billion nucleotides long. There are countless different ways of arranging these nucleotides, meaning that it is all but impossible for two people to share exactly the same code by coincidence.

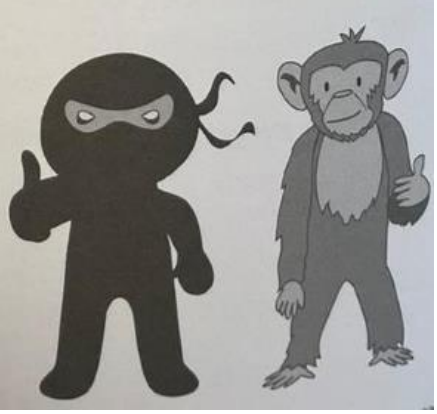
The long DNA chain is broken up into 'chromosomes' that exist in most cells of the human body. Humans have 23 pairs of chromosomes in each cell. DNA gives instructions to cells, telling them how to make particular proteins that help the body to develop.

What does our DNA do?

The instructions given to cells determine the characteristics of living things: they include the way we develop our eye colour, hair colour and blood type. Combined with our diets and environments, they can also determine how tall we grow, how well we can see and how strong we are.

Our genetic code is made up of DNA from both of our parents. Because of this, it is known as 'hereditary' material: information that is passed on – inherited – through the generations. This is why appearances, characteristics and physical features are often similar between parents and their offspring. Siblings may inherit similar features, but their DNA is still different. The only exception is identical twins.

However, the amount of code that actually changes between humans is small: less than 0.1 per cent. In fact, the vast majority of humans' DNA is exactly the same as animals': we share up to 98 per cent with chimpanzees and even 60 per cent with fruit flies. Perhaps most surprisingly, 50 per cent of our DNA is the same as a banana's!



Who discovered DNA?

DNA was first identified in 1869, by a Swiss doctor called Friedrich Miescher. He studied the pus in discarded bandages and discovered microscopic particles in cells. He later distinguished their different nucleotides. Progress in understanding the substance was made by many researchers during the first half of the 20th century – and then, in 1953, scientists James Watson, Francis Crick and Maurice Wilkins discovered the structure of DNA.

Using x-ray data provided by Rosalind Franklin, they saw that DNA contains two strands, which are twisted into a double helix – a structure that looks like a spiral staircase. The two strands are linked together because the nucleotides form pairs: A pairs with T, and C pairs with G. This means that the sequence ATCG on one strand would be linked to TAGC on the other.

This explains how DNA can be copied. When the strands are separated, each one can form another paired strand by bonding with the right kinds of nucleotides.

For this discovery, Watson, Crick and Wilkins shared the prestigious 1962 Nobel Prize for Medicine.

Why does DNA research matter?

In addition to visible features, DNA can pass on instructions that lead to medical conditions. These conditions include cystic fibrosis, autism and Down's syndrome.

It is possible to take a sample of cells from babies before they are born and to test and analyse their DNA. This means that it is possible to find out whether a person is likely to develop a condition due to carrying the related code.

DNA testing can also be used by forensic scientists investigating crime. It allows them to compare DNA from a suspect with DNA samples from the crime scene.

What next?

As society's understanding of DNA develops, we will come to have a better understanding of how to treat and prevent genetic illness. Amongst other things, this may help to improve our understanding of different cancers. It could also improve the quality and effectiveness of medicines that treat cancers.

Even now, some DNA testing can be carried out at home, using simple kits bought from chemists. These allow people to test a sample of cells scraped gently from their mouths and receive information on how their body might respond to some medicines, foods and exercise. People can even discover more about where their ancestors may have originated.