

## **Animation transcript: what is gene editing and how does it work?**

What is gene editing or genome editing as it is also known, and how does it work?

Let's start by talking about genes. These are sections of the long DNA molecules coiled up inside each cell of every living thing – from micro-organisms and insects, to plants and animals, including humans. Think of DNA as the instruction manual for an organism; in people, genes can influence characteristics such as your height and the colour of your eyes.

DNA is inherited from our parents; we have a combination of two sets of genes, one from each parent, brought together to produce a new set of instructions, and reshuffled in each generation. But sometimes these instructions carry errors, and these can create problems. Faulty genes can cause serious illnesses.

Humanity has a long history of figuring out ways to modify genes. We have been cross breeding plants to make them better to eat for thousands of years. But with gene editing, we've made a great leap forward. This increasingly accurate new technology is faster to use, relatively simple and cheap compared with previous methods, and promises huge benefits.

In a nutshell, it works by identifying then cutting pieces of DNA. One way of doing this uses a component known as CRISPR to pinpoint the precise DNA sequence within the gene to be altered. Then an enzyme called Cas9 snips through the DNA, changing it or allowing it to be replaced by another stretch of DNA that is introduced at the same time. This can either replace a faulty gene with a healthy one, or change a gene to make it behave differently. The methods act like a find-and-replace for the genetic instruction manual.

By making these microscopic changes to DNA, gene editing has the potential to make big changes to our lives.

Gene editing or genome editing, as it is also known, is already transforming genetic research.

But at this early stage of such a powerful technology, it's crucial that we weigh the potential benefits against the possible negatives.

First, let's look at the positives.

Gene editing could make radical improvements to human health. For example, in 2015 doctors used genome editing techniques to cure a baby girl's leukaemia. In the future, we may be able to fix the gene mutations that predispose some people to cancer, or enable new therapies for HIV, or edit the genes that cause hereditary diseases.

In the plant world, it could make crops more nutritious, disease-resistant, and able to grow in difficult conditions.

By editing animals' genes, we could help them resist diseases. Scientists are currently working to edit the genes of mosquitos, to prevent them from carrying malaria.

So genome editing has enormous positive potential.

But what about possible downsides?

Genes could be edited in early human embryos to alter characteristics such as eye colour, that have no bearing on health. This raises the possibility of 'designer babies', and changing an embryo's DNA would affect not only the child, but their descendants too. These same techniques could also be used to create designer pets, or develop more virulent microbial diseases.

So alongside the many benefits of genome editing, there are also some ethical and societal concerns to consider. The technology is already in our hands. Now's the time to debate how we use it, regulate it, avoid negative uses and unlock its potential to provide life-changing solutions to some of the world's biggest challenges.