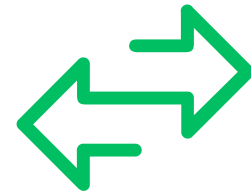


## What is it?

CRISPR is a key tool in the field of genetic engineering, allowing scientists to edit DNA with precision. CRISPR originally comes from bacteria and is a natural defence system that recognises DNA sequences from threats like viruses and slices up the foreign DNA to remove the threat. Scientists found a way to repurpose this adaptable recognition system and turn it into a powerful tool for precision genetic editing, with it being first used in 2008. **Since then, it has revolutionised the genetic engineering sector, allowing for targeted and accurate gene editing, and is involved in many genetic methods such as transgenics, gene drives and de-extinction.** It has also been used for gene therapy to treat inherited genetic disorders in humans.

## How it works

Think of an organism's DNA as a word document and CRISPR as a 'find and replace' tool. Just like the 'find' function locates a certain word in a document, CRISPR can recognise a certain part of a DNA sequence. **Then, like using replace, insert, delete or replace words, CRISPR allows scientists to modify DNA sequences by cutting, adding, or altering genetic information.** Just like writers tweaking a story, scientists use CRISPR to rewrite the genetic code to correct errors, break genes, enhancing desired ones, or even add new genes.



## Does it change the DNA?

**Yes,** CRISPR edits the DNA of an organism, whether it is passed down to offspring, however it depends on how the tool is used.

## How could this be used in Aotearoa?

In Aotearoa, CRISPR could be used to combat myrtle rust. Arriving in 2017 from Australia, myrtle rust has already had devastating effects on taonga species like Pōhutukawa, Rātā and Ramarama. Some scientists argue that creating plant breeds that are immune to myrtle rust would safeguard our taonga species better. Specifically, they could use CRISPR to edit the genes of myrtle plants that allow myrtle rust to take hold or add a gene that helps to stop the disease. This would mean that a new population of more resilient taonga species could be bred to protect these important species from extinction.

CRISPR is also key to the development of pest control strategies like gene drives. Gene drives are seen as a promising tool to achieve Predator Free 2050. Genes could be edited by CRISPR to render rats infertile or to alter behaviours that contribute to their invasive success. Implementing such a gene drive system could help mitigate the ecological damage caused by rats in New Zealand's delicate ecosystems, offering a potentially targeted, sustainable, and humane approach to pest control. To learn more about gene drives, see our one-pager on it.

## Has it ever been used?

**Yes**, In medicine, research has used CRISPR to modify gene leading to fatal blood disorders, and to modify immune system genes which can increase HIV resistance. In Agriculture, CRISPR has been used to create button mushroom varieties that do not go brown, as well as higher yield corn varieties. In conservation, applications of CRISPR are being explored through gene drives (see our one pager on these), but CRISPR has not been used in this space as of the time of this writing.

## Why should you care?

Today, CRISPR is being used, and recommended, in many fields such as medicine, agriculture and environmental conservation. In addition to becoming a core part of modern biotechnology techniques, it is also frequently brought up in public debate as a silver bullet for pest control, therefore, it is essential for the public to know how it works, and how it could be utilised. Specifically, CRISPR is a tool for doing genetic work, and in any given example it is more important to know how it is being used, rather than just being used. Although, an understanding of this method is still important as CRISPR is the underlying tool behind many others.

## References and Additional Information

[Genetic Engineering Will Change Everything Forever](#) – YouTube Video

[Molecular biology at the cutting edge: A review on CRISPR/CAS9 gene editing for undergraduates](#) – Academic Article

[Gene-editing offers hope for people with hereditary disorder](#) – Article

[Should NZ use contentious gene tech in our war on pests?](#) – Article

**Disclaimer:** While we are committed to being a part of these conversations regarding Aotearoa New Zealand's future in synthetic biology, Te Tira Whakamātaki are neither for nor against the use of synthetic biology technologies for environmental protection purposes. The purpose of this information sheet is to inform, educate, break down and explain some of the different terms and tools. This tool has been selected because it is frequently in the media and mentioned to us often, not because we hold any opinion on them.