

# CRISPR

Clustered Regularly Interspaced Short Palindromic Repeats, commonly known as CRISPR, is a tool changing the game in modern genetic engineering.

Discovered by Jenifer Doudna and Emmanuelle Charpentier, CRISPR-Cas9 works by finding a specific piece of DNA within a genome, assisted by guide RNA. Scientists can then programme CRISPR to bind, cleave, remove or add DNA to the specific site, or even turn genes on and off.

The technology can bind with extreme specificity and precision, especially compared to current modification methods such as radiation and the use of EMS as a mutagen. Since New Zealand's current HSNO laws were written in 1996, CRISPR use is restricted.

CRISPR has the potential to play a key role in many modern global problems, including New Zealand's Covid response. Current COVID detection involves a procedure called RT-qPCR amplification, where the amount of mRNA in a sample is measured. This method requires expensive equipment, lab access and trained scientist (Rao et al., 2020).

An alternative is using CRISPR to target COVID mRNA. A sample is taken and DNA amplified, before adding CRISPR-Cas and a fluorescent reporter molecule. If the person tests positive for COVID the sample will glow. If the person is negative CRISPR will not bind so no fluorescence will be detected.

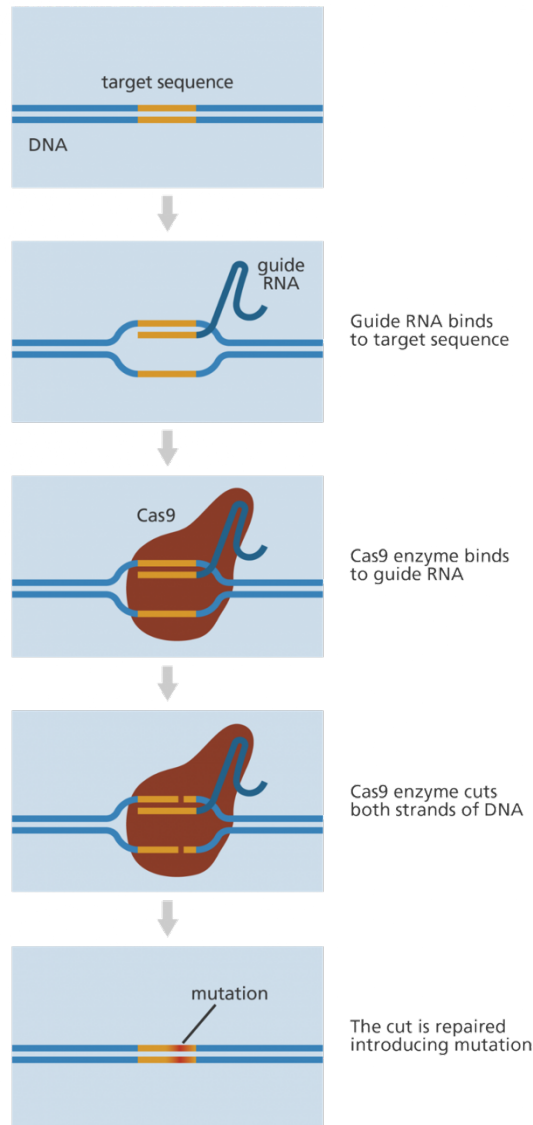
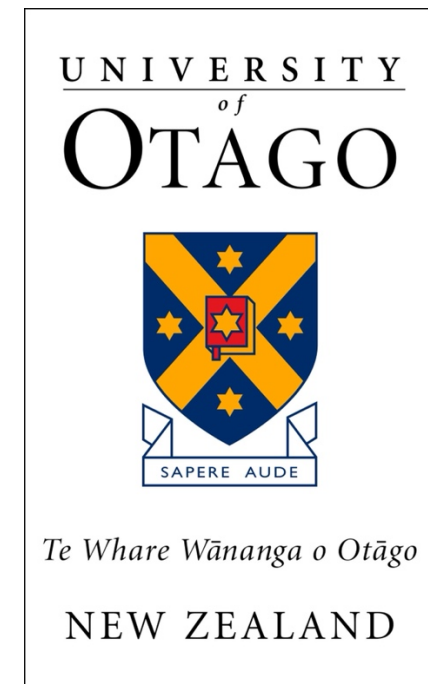


Diagram demonstrating CRISPR mechanism.

A secondary application for COVID treatment is using CRISPR to target a specified COVID gene directly. The Cas9 protein would directly bind to eliminate the virus from the patient to treat the disease. This is an active area of research and more trials are required.

The 1996 HSNO act is coming up for review, with the government requesting submissions until 3rd October 2021.

We urge keen upcoming scientists to have your say!



# What is Biochemistry?

The first signs of life on earth have been suggested to be over 3 billion years old. It began with single cells called microbes, which are essentially just a collection of chemicals. Naturally chemical elements tend to move around somewhat randomly, and will sometimes collide to form new substances. Microbes are made up of these same elements, but organized in a way that it can create specific chemical reactions on demand. This enables microbes to create energy, move and replicate. All life is made up of cells like these, which shows that life is essentially just a bunch of chemicals that can organize themselves in an extremely complex way.

As the name implies, biochemistry is a study that combines chemistry with biology. This means using chemical knowledge to figure out how biological molecules like DNA, RNA and proteins facilitate chemical processes within cells, and how this affects the greater organism. Biochemists study processes such as photosynthesis, DNA replication, protein synthesis and many more.

Biochemistry encompasses all forms of life, from single cells to humans. It has helped us progress our understanding of many fields such as agriculture, medicine and the environment. From figuring out how to make rabbits that glow, to the creation of countless life-saving drugs, biochemistry has seemingly infinite applications. Overall, it is an extremely fascinating field that can greatly expand one's understanding of life.

## University of Otago, biochemistry degree

A biochemistry degree at Otago introduces you to the intricate and amazing molecular world. You will learn about proteins, DNA, RNA, what they're made of, how they interact with each other, how they interact with other chemicals, how these interactions relate to whole organisms and how we can use chemical techniques to study these molecules.

The Otago biochemistry degree is very heavily lab based, which gives in depth understanding of biochemical techniques, enhances ability to think critically and results in strong friendships being formed between classmates.

For more information visit  
University of Otago, biochemistry department  
<https://www.otago.ac.nz/biochemistry/>

## Careers in biochemistry

After completing their biochemistry degree a lot of people do post-graduate study where they conduct their own research.

Generally to be able to work biochemistry research you will need to have done post-graduate study. It can lead to a research career in a diverse range of areas such as disease, agriculture, and even cosmetic development.

This degree can lead to many other jobs outside of biochemistry. It can lead to teaching, overseeing government policies biochemistry or become a science communicator. The degree develops analytical skills, critical thinking and communication skills which translate well into any job



### Medicine

Analyse hospital patient samples to assess for potential diseases



### Research

This encompasses a range of things. Research cellular processes, microbes gene editing. This displays a few, but there are a lot of possibilities



### Disease & pharmaceuticals

Conduct research on diseases such as cancer. identify causes on a molecular level and research and develop new vaccines, drugs and tools to help treat them



### Teaching

Teach biology or chemistry to high school students



### Forensics

Examine biological samples that have been left behind at crime scenes



### Agriculture

Create crops that are more productive or less prone to disease and environmental pressures.



### Patent law

Create or enforce government policies on products and research related to biochemistry