

# BIOCHEMISTRY at OTAGO

Here you'll find a snapshot of research from the department, interactive puzzle to test your knowledge, and a look into the life of a biochemistry student...

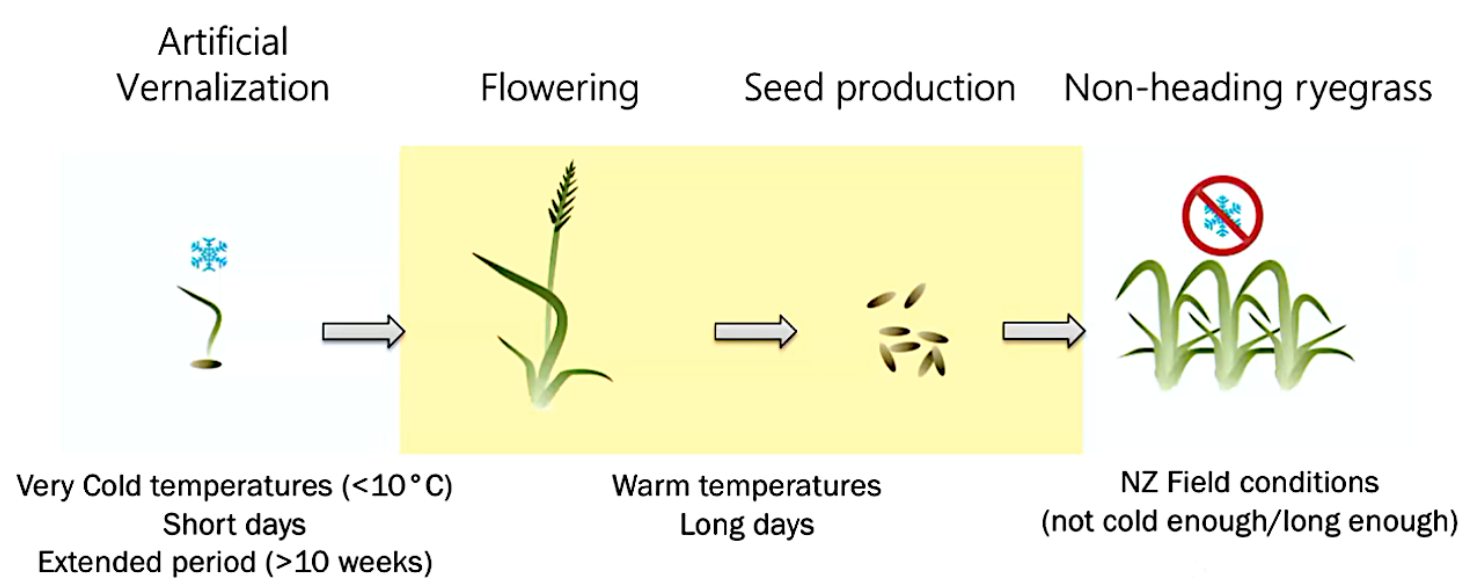
## Research Example 1: Creating a Non-Heading Ryegrass

### Problem

Flowering ryegrass is less nutritious for sheep and cows and results in lower milk production during the summer months. Prof. Richard Macknight's lab aims to produce ryegrass that doesn't flower in NZ fields so sheep and cows will have nutritious food to eat all year round.

### Background

Ryegrass requires a period of cold before flowering (vernalization). Ryegrass has varying requirements for cold depending on the plant. The aim is to make ryegrass with a requirement for colder temperatures than NZ currently has, so, when planted as a seed in the field, the ryegrass won't flower.



### Methods

**Finding the genes and alleles for ryegrass flowering (VRN1, VRN2a/b, VRN3):** Nanopore sequencing is used to sequence the DNA and find genes and alleles important for long vernalization/cold requirement. Nanopore sequencing involves passing long pieces of DNA through a pore. Different bases (A, T, C, G) distort the pore differently and the resulting electrical signals create the DNA sequence.

**Using allele information for breeding ryegrass species:** Ryegrass plants from NZ and/or other countries with the best alleles for long cold requirement are crossed together.

**Gene editing:** If breeding NZ ryegrass is unsuccessful, the CRISPR-Cas9 system may be used like molecular scissors, to add genes from other ryegrass varieties to the NZ ryegrass.

## Student Life Q and A

Q. What is a typical university day like?

A. A university day can vary depending on what course you are taking, normally you will have 2 or 3 lectures per day and at least 1 lab or tutorial per week.

Q. How do you choose your papers?

A. Every degree has compulsory papers you must take to meet its requirements and sometimes you will have free paper slots, and these can be from whatever course you like as long as you meet the prerequisites.

Q. What sort of access is there to study areas?

A. Around campus there are several shared spaces you can freely sit and study at. You can also book private study rooms online through the library website.

Q. What is biochemistry about?

A. Biochemistry is the study of the processes and mechanisms that happen within living organisms such as cell components and organelles as well as proteins and lipids.

Q. How do you get help on a paper?

A. When you start a paper, you will be given the name and email of the paper coordinator. This is who you will contact if you require an extension or for or for general questions about the paper.

Q. How can I meet people at university?

A. At university, there are student run clubs that can be a great chance to meet people with similar interests.

## Research Example 2: Health and Biochemistry – Research from Dr Louise Bicknell

There are 3 ways we use biochemistry to look at rare genetic diseases – Clinical, Genetic, and Mechanistic.

### Clinical Approach

This approach looks at people's symptoms first. For example, a child has symptoms that do not 100% match a disease of the start of DNA replication. By discovering the symptoms match diseases of ongoing DNA replication, we are able to conclude this mutation affects both processes.

### Genetic Approach

This approach looks at people's DNA first. For example, a rare mutation in a gene is discovered, then 30 others with mutations in the same gene are found. The mutations are all in similar places and result in neurodevelopmental disorder. We discover it is the ratio of affected protein to normal that determines the risk of neurological effects, so, the protein could have a key role in the brain. Just 1 change in DNA can affect cells enough to cause disease!

### Mechanistic Approach

This approach looks at finding out what is going on inside the cell. For example, there is a disorder from a mutation in the gene of a protein that we do not know much about, DONSON. We do know it prevents breaks in the DNA during replication. Then we found in patients with symptoms normally caused by a mutation affecting the start of DNA replication, but with a DONSON mutation. This suggests that it has a role in the start of DNA replication as well as fixing breaks.

## Eterna Game – Solve Puzzles, Invent Medicine

Test your biochemistry knowledge of RNA base pairing and structure with this interactive puzzle whilst contributing to medical research!

Scan the QR code or follow the link:  
[eterna.org/](http://eterna.org/)

