

2021 TE PUIAKI KAIPŪTAIAO MAEA MACDIARMID EMERGING SCIENTIST PRIZE

Tracing the COVID-19 family tree

Dr Jemma Geoghegan, one of the scientists behind New Zealand's COVID-19 genome sequencing programme, has won the 2021 Te Puiaki Kaipūtaiao Maea Prime Minister's MacDiarmid Emerging Scientist Prize.

Jemma is a Rutherford Discovery Fellow based at the University of Otago and an Associate Scientist at the Institute of Environmental Science and Research (ESR).

As a researcher who is fascinated by how viruses evolve and spread, Jemma was ideally placed to help with New Zealand's COVID-19 response. "I never really thought that virus evolution would be as important as it is today but here we are," Jemma said.

In 2020, Jemma helped to establish genome sequencing of COVID-19 cases in New Zealand through collaboration with ESR.

"Sequencing a genome is like reading the instruction manual of that living organism. All living organisms have a genome. They are made up of letters which basically provide instructions about what that organism will do and viruses actually have quite small genomes," Jemma explains.

Jemma says that the coronavirus genome is 30,000 letters in length, which is very small compared to the human genome.

"What we do is basically read that genome, read those letters, and then we can compare those letters to the other letters in another virus and see how they compare and contrast."

As the result of this programme, genomic sequencing has been used as a key tool for understanding and limiting the spread of COVID-19 in New Zealand and has been critical to New Zealand's public health response.

"Genomics sequencing data has helped to identify, for example, sources of infections where physical links were unclear, or clarify the cluster membership cases during community outbreaks. It has also identified the causes of various incursions at the border," Jemma said.

With this information, public health decision makers were able to avoid multiple costly lockdowns and better understand in-flight transmission, and transmission within MIQ quarantine facilities, so that changes to protocol could be made. The selection panel noted that the research in this area has been world-leading.

Jemma's broader research aims to better understand why and how viruses jump to new hosts in the first place, and to expand knowledge of the true diversity of viruses that exist in nature. She has worked on various diseases infecting, for example, wildlife and domestic animals, as well as humans.

Jemma's work has identified that biological features of viruses could predict human-to-human transmissibility. Furthermore, she has shown that while many viruses seem to co-diverge with their hosts – overall 'host jumping' plays a much greater role in shaping virus evolution than previously thought. Moreover, she has applied a suite of new phylodynamic approaches (expanded family trees) that combine genomic and epidemiological data to uncover important insights into the spread

of infectious disease within populations. The selection panel noted the unique perspective that Jemma brings to her research, which is highly cited and influential.

A familiar face in the media, Jemma is committed to communicating her science.

“I think one of the most important jobs you have as a scientist is to communicate your scientific findings, and usually for most of us, that's done through academic peer review. But when your expertise just happens to be in a field that is particularly relevant to the general public and public health, I think it's important to reach outside of your academic circle.”

While Jemma says it's been “fascinating and satisfying” to be involved in the genomic sequencing effort during the pandemic, it wasn't without its stresses.

“As an academic, you're not really used to dealing with an often high pressure, high stakes environment. And during the pandemic it was quite surreal and often overwhelming. Having said that, all that work was extremely rewarding at the same time.

“I think the best thing about this work is the collaborators that I now get to work with on a daily basis. Seeing what started out as our research project quickly become integrated into helping New Zealand better understand and respond to the pandemic has been particularly rewarding.

Only the second woman to have won this prize that comes with a \$200,000 prize, Jemma hopes to inspire more women into science and “help to demolish the stereotypes about what a scientist looks like”.

“I plan to use this money for ongoing research in my lab to explore viruses in nature and to better understand their ecology and evolution. And I also want to build more capability in this area to train the next generation of scientists so that we are better prepared for the next pandemic.

“It's an ideal time for infectious disease research to be in the spotlight and I'm hopeful that we will continue to highlight the importance of this work, and build capacity and capability in this area to respond to future disease threats.”

Mō Te Puiaki About the Prize

TE PUIAKI KAIPŪTAIAO MAEA MACDIARMID EMERGING SCIENTIST PRIZE

Awarded to an outstanding emerging scientist who has had their PhD or equivalent qualification conferred within the last eight years.

This is one of five prizes awarded each year.

The Government of New Zealand introduced The Prime Minister's Science Prizes in 2009 as a way of raising the profile and prestige of science among New Zealanders, in Aotearoa and internationally.

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