Gene editing

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Gene editing occurs when humans make changes to the DNA of a living organism by inserting, deleting or replacing sections of genetic material. This can change the characteristics of the organism, and has many possible applications, including in research, medicine, agriculture, and pest management. The last few decades have seen massive advances in the field of genetics, including gene editing, which has become more precise, easy, and rapid with the development of new techniques like the CRISPR-Cas9 system.[1]

Royal Society Te Apārangi call for public conversation and regulatory review

In 2016, the Royal Society Te Apārangi published an evidence update[2] outlining the science and history of gene editing, new techniques, and possible applications. In 2019, the Royal Society Te Apārangi developed a series of gene editing scenarios in healthcare, pest control, and the primary industries, which it used to explore scientific, ethical, social, and legal questions associated with gene editing and its applications. The subsequent report on gene editing[3] was informed by public engagement, with key findings from that engagement copied below.

- "In healthcare, there was an appetite to consider certain therapeutic gene-editing applications as long as it was safe enough to rule out negative side effects, and that it would enhance human health.
- In pest control, there was some appetite to consider gene drives for pest management if the benefits outweighed the risks. However, there were concerns over unintended consequences of removing species and around the risks of gene-edited pests finding their way back to their native countries.
- In the primary industries, comments on the benefits of using gene-editing technology included that it could provide a useful tool for supporting competitive advantage, and for protecting New Zealand's flora and fauna. There were concerns about unintended consequences, a need for better understanding of the relevant genetics, and that use of gene-editing technology would compromise the New Zealand brand and any 'GM free' competitive advantage.
- Across all scenarios, feedback from Māori participants highlighted the importance of whakapapa and mauri, involving tangata whenua around indigenous species, protection of data, and intellectual property implications of gene editing taonga species."

In addition, the report argued that Aotearoa New Zealand needs to develop its own perspective on gene editing, informed by public engagement, and should ensure our regulatory frameworks are fit for purpose, noting that other countries are reviewing or have recently reviewed their regulatory systems, including the US, Europe, Australia, and Japan.

In a briefing to the Prime Minister[4] in 2019 in response to the Royal Society Te Apārangi report, the Prime Minister's Chief Science Advisor agreed that Aotearoa New Zealand lacks a clear regulatory and legal framework on gene editing, and that current frameworks need modernising. She also endorsed the panel's observation that the gene editing debate requires widespread public engagement. In particular, she noted the importance of substantive engagement with Māori.

In response to the Royal Society Te Apārangi report, Environment Minister Hon David Parker asked his officials[5] to advise him "of where lower regulatory hurdles ought to be considered to enable

medical uses that would result in no inheritable traits, or laboratory tests where any risk is mitigated by containment," and noted that "the recommendation to clarify conflicting or inconsistent definitions across the regulatory framework will also be considered." We await the outcome.

Read more

- *Victoria University of Wellington Law Review* paper on legal considerations of gene editing, published in 2019[6]
- *Frontiers in Bioengineering and Biotechnology* paper on te ao Māori views on genetic technologies,[7] published in 2019
- Human genome editing recommendations from a WHO-convened expert committee,[8] published in 2021 (summarised and contextualised in a *Nature* article)[9]

Endnotes

[1] *Science* paper – A programmable dual-RNA-guided DNA endonuclease in adaptive bacterial immunity (2012), accessed on 23 February 2022 https://pubmed.ncbi.nlm.nih.gov/22745249/

[2] Royal Society Te Apārangi Evidence Update – Gene Editing (2016), accessed on 23 February 2022 https://www.royalsociety.org.nz/assets/documents/Gene-editing-evidence-update2.pdf

[3] Royal Society Te Apārangi compilation report – Gene editing (2019), accessed on 23 February 2022 https://www.royalsociety.org.nz/assets/Uploads/Gene-Editing-FINAL-COMPILATION-compressed.pdf

[4] OPMCSA briefing – Briefing to the Prime Minister on the Report on Gene Editing from Royal Society Te Apārangi (2019), accessed on 23 February 2022 https://cpb-ap-se2.wpmucdn.com/blogs.auckland.ac.nz/dist/f/688/files/2020/02/Briefing-on-genetic-editing-final.pdf

[5] Beehive press release – Government responds to Royal Society Te Apārangi report on gene editing (2019), accessed on 23 February 2022 https://www.beehive.govt.nz/release/government-responds-royal-society-te-ap%C4%81rangi-report-gene-editing

[6] *Victoria University of Wellington Law Review* paper – Gene Editing in Aotearoa: Legal Considerations for Policy Makers (2019), accessed on 23 February 2022 https://ojs.victoria.ac.nz/vuwlr/article/view/5990

[7] *Frontiers in Bioengineering and Biotechnology* paper – Indigenous Perspectives and Gene Editing in Aotearoa New Zealand (2019), accessed on 23 February 2022 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6470265/

[8] World Health Organisation – Human genome editing: recommendations (2021), accessed on 23 February 2022 https://www.who.int/publications/i/item/9789240030381

[9] *Nature* article – WHO should lead on genome-editing policy, advisers say (2021), accessed on 23 February 2022 https://www.nature.com/articles/d41586-021-01922-y