This response was submitted to the Call for Evidence held by the Nuffield Council on Bioethics on *Genome editing* between 27 November 2015 and 1 February 2016. The views expressed are solely those of the respondent(s) and not those of the Council.

1 February 2016

GM Freeze response to Nuffield Council on Bioethics call for evidence on Genome Editing

1. Introduction and summary

1.1. GM Freeze is the UK's umbrella campaign for a moratorium on genetically modified food. We aim to help create a world in which our food is produced responsibly, fairly and sustainably. Our members include organisations such as the Soil Association, Friends of the Earth, Scientists for Global Responsibility, Garden Organic, Action Against Allergy, Islamic Medical Association, Christian Ecology Link, organic and conventional farmers, retailers, scientists, grassroots campaigners and concerned individuals.

1.2. Genome editing techniques share many of the same risks as current Genetic Modification (GM) methods and also present a number of additional potential problems. There is much that can go wrong and it is vital that new techniques are subject to proper regulation, traceability and end-product labelling.

1.3. People have a wide range of ethical concerns about all forms of genetic engineering. These encompass the techniques themselves, the application of patents, corporate control, the impact of the traits expressed and the crowding out of alternative solutions and approaches.

1.4. Public concern about genome editing encompasses cultural, value-based and scientific issues, which many people have difficulty articulating. It is vital that the Nuffield Council's Genome Editing group engages in a thorough public dialogue that is not constrained by scientific terminology. Individuals without the advantage of a technically accurate vocabulary must be heard and understood.

2. Risks and regulation

2.1. Genome editing can mean anything from a single point mutation (changing a single nucleotide) to the addition or deletion of several genes and the alteration of entire metabolic pathways. Repeated small changes can lead to a deep intervention in the genome, significantly altering genetic and metabolic processes.

2.2. There are a number of hazards involved in altering the genome including off-target alterations; unintended effects of intended alterations; and genome-wide mutations caused by the genome editing techniques themselves. This last group includes the delivery of targeted nucleases and specific DNA templates, specific types of tissue culture and transformation processes.[1] Newer

Contact address: 80 Cyprus Street, Stretford, Manchester M32 8BE
Tel: 0845 217 8992 **Email:** liz@gmfreeze.org **Web:** www.gmfreeze.org **Twitter:** @GMFreeze
Registered office: 50 South Yorkshire Buildings, Silkstone Common, Barnsley S75 4RJ

genetic engineering techniques share many of these hazards with existing, regulated GM techniques, and bring others of their own.

2.3. The dominant narrative in public discussion of newer genetic engineering techniques underplays such risks by focusing on the ways in which these techniques differ from existing GM. Discussion in the media is usually accompanied by very simplified diagrams which leave out many steps in the process. Techniques are frequently referred to as "precise".

2.4. Precision is not the same as predictability. Our understanding of the interconnections between genes, and of the ways in which genes interact and are controlled, is still limited. Even if one is successful in altering the molecular formation of the genome exactly as planned, unexpected effects can still occur.

2.5. Once released into the environment, genetic alterations are incredibly difficult to contain, as evidenced by the number and severity of GM contamination incidents.[2] Contamination of crops, seeds and wild relatives can cause problems regardless of the traits passed on, but if genome edited organisms give rise to unintended negative effects, such contamination could damage the whole ecosystem, threatening agriculture, livelihoods, human and animal health. Such risks are equally serious when considering the genetic engineering of microorganisms, algae, fish or insects.

2.6. The application of gene drives in addition to genome editing would exponentially increase the speed at which both intended and unintended effects could take hold and spread.

2.7. If the products of genome editing techniques are not classified in the EU as GM, they could be entirely exempt from regulation. Companies profiting from such products could bypass requirements for environmental and food safety risk assessments and to label end products. This would run counter to the precautionary principle, the current legal and scientific requirements of the EU and its member states.

2.8. A large number of new techniques have been developed in recent years. This is an exciting time for genetics but with no history of safe use, it is imperative that genome editing techniques are studied carefully before being used to produce organisms that will be released into the environment.

Relevant published material

Steinbrecher, 2015, Genetic Engineering in Plants and "New Breeding Techniques (NBTs)" Inherent risks and the need to regulate. http://econexus.info/sites/econexus/files/NBT%20Briefing%20-%20EcoNexus%20December%202015.pdf

Cotter, Zimmerman, van Bekkem, 2015 Greenpeace Research Laboratories Technical Report: Applications of the EU and Cartagena definitions of a GMO to the classification of plants developed by cisgenesis and gene-editing techniques. http://www.greenpeace.to/greenpeace/wp-content/uploads/2015/11/Application-of-GMO-definitions-to-plants-developed-by-cisgenesis-and-gene-editing-techniques.pdf

3. Ethical concerns and broader context

3.1. The application of patents is a core ethical issue for many people concerned about the use of genetic engineering. A stated core value for GM Freeze reads: "We believe that genetic resources are a public good and should not be controlled by any individual, group or company."[3].

3.2. The application of genome editing techniques in agriculture and food production is likely to extend the penetration of patented products and techniques, preventing traditional practices such as seed saving and swapping. This will increase the power of multinational corporations at the expense of those who work the land.

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3.3. Although genetic engineering techniques (including existing GM and new genome editing techniques) could theoretically be used to achieve a vast range of outcomes, in reality the only GM traits which have proved commercially successful are those focused on pest management. They support an industrial model of farming that reduces biodiversity and has led to the widespread development of pesticide resistant weeds, secondary pests and pests resistant to Bt. [4] [5] [6] [7] [8]

3.4. The promotion of new genome editing techniques focuses heavily on potential public-benefit uses. These carry their own risks of significant environmental impact but could also act as a "smoke screen" for more commercially motivated developments. If the potential for a technique to do good is a valid consideration, then so is its potential to be used in ways that harm, either directly or indirectly, including by distracting attention and investment from systemic problems such as waste, poverty and distribution of resources.

3.5. There are currently strong calls, from both political and commercial voices, for consideration of the potential benefits of the products of genetic engineering techniques (including current GM techniques and genome editing) to be weighed against any risks. This is a seductive concept but in fact the two sides of this equation are far from equal. Public debate most often focuses on *potential* benefit, while risk is narrowly defined around quantifiable hazards to either health or the environment. This framing of the issues around genetic engineering ignores significant potential harms such as the risk of financial ruin for an organic farmer subject to contamination; the risk of concentrating power over food production; the risk of drawing funding away from alternative solutions.

3.6. Individuals have many different reasons for being concerned about genome editing. Whether they are motivated by concern for the environment; a desire to reject corporate control of the food chain; a preference for organic; or by deeply held cultural or religious beliefs, they have a right to exercise choice. That right can only be respected if the products of all genetic engineering techniques are subject to proper regulation, traceability, segregation and labelling.

Relevant published material

International Federation of Organic Agriculture Movements, EU Group, 2015 Position Paper: New Plant Breeding Techniques. http://www.ifoam-eu.org/sites/default/files/ifoameu_policy_npbts_position_final_20151210.pdf

Wallace, Genewatch UK, 2016, Open letter to European Commission http://www.genewatch.org/uploads/f03c6d66a9b354535738483c1c3d49e4/geneediting_EUreglet_fin.pdf

Achterberg, Greenpeace, 2016, New GM food could end up on your plate untested and unlabelled (blog post) http://www.greenpeace.org/eu-unit/en/blog/new-gm-food-untested-unlabelled/blog/55344/

4. Public opinion

4.1. Public concern about GM in our food is high [9] and increasing [10] but opposition to GM is frequently characterised as unscientific, emotional and even superstitious.

4.2. Many people's concerns are, in fact, focused on the areas of scientific risk described in section 2, above. However, as most people in the UK have not benefitted from a scientific education, they express concepts such off-target and unexpected effects in less precise language. It is entirely unacceptable for any serious attempt to gauge public opinion and examine the ethical context of new scientific developments to dismiss the views of individuals who do not have the vocabulary to express themselves in scientifically-accurate terms.

4.3. Beyond the narrowly-defined issues of scientific risk, cultural and ethical values are vital considerations in the adoption of any new technology. Food production in particular is closely tied up with our cultural, ethnic and family identities. However, the language used by proponents of genetic engineering frequently dismisses and belittles such a focus on values as weak and inappropriate. This must be challenged at the highest level.

4.4. GM Freeze welcomes the opportunity to participate in the Genome Editing Group's process of deliberation on the issue of genome editing and notes that this particular call for evidence is only part of the process. We trust that the Council truly wants to understand public opinion and will initiate a thorough public dialogue, employing consultation methods that allow individuals with strongly held views, but without the advantage of a technically accurate vocabulary, to be heard and understood.

Liz O'Neill
Director, GM Freeze

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http://www.ucsusa.org/sites/default/files/legacy/assets/documents/food_and_agriculture/rise-of-superweeds.pdf

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http://www.greenpeace.org/international/Global/international/planet-2/report/2010/1/herbicide-resistance-forces-fa.pdf

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http://webarchive.nationalarchives.gov.uk/20080306073937/http://www.defra.gov.uk/environment/gm/fse/

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Registered office: 50 South Yorkshire Buildings, Silkstone Common, Barnsley S75 4RJ

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http://onlinelibrary.wiley.com/doi/10.1111/j.1752-4598.2012.00196.x/abstract

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[9] Food Standards Agency, May 2015 *Biannual Public Attitudes Tracker*
https://www.food.gov.uk/sites/default/files/public-attitudes-tracker-may-15.pdf

[10] Food Standards Agency, February 2015 *Biannual Public Attitudes Tracker*
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