The Academy of Medical Sciences

The Academy of Medical Sciences' response to the Nuffield Council on Bioethics 'Genome editing and human reproduction' Call for Evidence

June 2017

Summary

- The ethical questions raised by genome editing technologies deserve ongoing consideration alongside discussions about safety and efficacy, particularly in the context of human reproduction. We therefore welcome the opportunity to respond to this consultation as part of ongoing discussions about genome editing.
- The Academy has expressed a commitment to supporting discussion around genome editing, and its use in basic and preclinical biomedical research.
- While we note that there is a clear and valid distinction between the use of genome editing within research and its potential use for clinical purposes, we are also supportive of the future development of non-heritable and heritable therapeutics based on genome editing, provided their introduction is based on a strong evidence base, is in line with societal values, and is informed and supported by active engagement with patients and the public. We are therefore also supportive of the public survey which was issued alongside this call for written evidence.
- Our position on the ethical nature of genome editing has previously been submitted to the Nuffield council on Bioethics in February 2016, during the earlier stage of this project.
- **Our position on genome editing technologies as stated in our previous submission remains unchanged**, especially with regard to the underlying ethical, legal, and social considerations of genome editing technologies. We maintain that the use of genome editing in research should proceed, and that the potential of non-heritable and heritable therapeutics based on genome editing should similarly be explored provided its introduction is based on a sound scientific evidence and is supported by active engagement with patients and the public.
- We note however that this field has received intense focus, and is fast paced. **To supplement our earlier submission, we have taken this opportunity to submit the report from a one-day international workshop on *'Human genome editing in the EU'*,** which provides a detailed explanation of the scientific and regulatory landscape for human genome editing across the EU.

Introduction

1. The Academy of Medical Sciences promotes advances in medical science, and campaigns to ensure that these are translated into healthcare benefits for society. Our elected Fellowship includes experts drawn from a broad and diverse range of research areas.
2. The Academy is committed to supporting discussion around genome editing, and its use in basic and preclinical biomedical research.[1] We therefore welcome the opportunity to respond to this call for evidence, and wish to express our support of the public survey which was issued alongside this call in order to gather views and facilitate further discussion about genome editing technologies.

[1] *Genome editing in human cells - initial joint statement.* http://www.acmedsci.ac.uk/viewFile/55e6b4e90f49c.pdf

Support for previous submission

3. **Our views on genome editing have previously been submitted to the Nuffield Council on Bioethics in February 2016**.[2]
4. Through further engagement with our Fellows, we are confident that our earlier response remains valid in the context of this more recent consultation and focus on genome editing and human reproduction. **We are also encouraged that a number of our Fellows have been approached by Nuffield to feed their expertise directly into this project.**
5. In particular, we would like to reiterate our position that genome editing holds the potential to progress our basic understanding of human biology, development, and disease and the use of such technologies in research should therefore be allowed to proceed.
6. The Academy further believes that the potential of non-heritable and heritable therapeutics based on genome editing should also be explored.
7. Nonetheless, we maintain that that there is a clear and valid distinction between the use of genome editing within research and its potential use for clinical purposes (whether somatic cell or germline (heritable) genome editing). The introduction of clinical therapeutics based on genome editing must, therefore, be based on a strong evidence base, be in line with societal values, and be supported by active engagement with patients and the public to effectively communicate the conditions in which genome editing can, and cannot, be helpful.
8. We similarly maintain that ethical nature of genome editing in the context of human reproduction can be informed in part through comparison with other forms of scientific research and other clinical applications which have some impact on the human genome, for example gene therapy and reproductive technologies including pre-implantation genetic diagnosis (PGD) and mitochondrial replacement therapies. We would therefore encourage opportunities to reflect and learn from previous discussions regarding the ethics and morality of manipulating the human genome.
9. Finally, we would like to reiterate our belief that the UK is particularly well placed to address the ethical questions, regulation, and governance of genome editing due to its extensive history of debating similar topics and robust regulatory environment.

Update to previous submission

10. Since the advent of CRISPR-Cas9 in particular, the use of genome editing in both a research and clinical capacity has remained the focus of intense attention. We are aware that this has resulted in the publication of various academic papers exploring the accuracy and efficiency of genome editing technologies, and we support progress in these endeavours which are necessary should they be used in a clinical setting.
11. Through engagement with our Fellows, some papers were submitted to us regarding the accuracy (in terms of desired on-target edits and undesirable off-target effects) of CRISPR–Cas9 when performed in mice zygotes, which note a higher rate of off-target effects than previously reported.[3,4]
12. We submit these in order to reiterate that while we are supportive of therapeutic applications of genome editing – including its potential use for heritable applications - such use must be

[2] Academy of Medical Sciences (2016). *Submission to the Nuffield Council on Bioethics call for evidence on genome editing*. https://acmedsci.ac.uk/file-download/38579-56bc88dc0dea4.pdf
[3] Schaefer KA, *et al* (2017). *Unexpected mutations after CRISPR–Cas9 editing in vivo*, Nature Methods **14**, 547–548.
[4] Shin HY*, et al* (2017). *CRISPR/Cas9 targeting events cause complex deletions and insertions at 17 sites in the mouse genome.* Nature Communications **8**,15464.

based on sound and robust scientific evidence. We therefore believe that their ongoing use in a research setting is vital, and support further such work.

13. The Academy notes that one of the aims of this Nuffield Council project is to *'review relevant institutional, national and international policies and provisions, and to assess their suitability in the light of the ethical questions examined'.*
14. With this in mind, we would also like to draw attention to a **one-day workshop titled *'Human genome editing in the EU'*** which was held by the Academy together with the Federation of European Academies of Medicine (FEAM) and the French National Academy of Medicine on 28 April 2016.[5]
15. This workshop was held to facilitate international discussions, and explore the scientific and regulatory landscape for human genome editing across the EU. It was informed by a background paper and a report of the discussions was also subsequently published.[6,7]
16. In the context of human reproduction, the report details the various ethical views and regulations in place throughout Europe that affect the ability to use genome editing techniques in human germlines cells and/or embryos within research. In no country is the clinical application of genome editing in human germline cells or embryos permitted.
17. The report further notes that divergent views are seen at the national level across individual EU Member States on the acceptability of such research, particularly where the use of embryos is involved. Such divergent views were also identified as a key barrier to the provision of research funding by the European Commission (via Horizon 2020).
18. We hope that the details and outputs of this meeting are useful for your considerations, and would be very happy to provide more information should this be helpful.

[5] https://acmedsci.ac.uk/policy/policy-projects/genome-editing
[6] *'Human genome editing in the EU' background paper: A review of the current state of the regulations and ongoing debates in the EU*. (2016). https://acmedsci.ac.uk/file-download/41517-573f212e2b52a.pdf
[7] Federation of European Academies of Medicines (FEAM) (2017). *Human Genome Editing in the EU report*. https://acmedsci.ac.uk/file-download/36206238