

# *The Ethical Frontiers of Gene Editing*

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In the past few years, some scientists and philosophers—Stephen Pinker, Henry Miller, and Tom Koch, to mention a few—have been very critical of the role bioethics is playing with respect to medicine and, in particular, genetic engineering. They worry that bioethical concerns will hinder the development of an area of science that holds great promise for diagnosing, treating, and preventing disease in animals and human beings. They fear that steps that humanity might take to enhance or improve key traits such as intelligence or empathy in animals and humans will founder on the rocks of ethical hand-wringing by those who invoke mysterious concerns such as human dignity, fear any change involving human nature, and, in any event, do not speak for the public.

The doubters of bioethics should not be so worried. Bioethics has done far more good than harm in advancing medical research by creating a framework for responsible research with animals and laying out principles for advancing recombinant DNA research. Perhaps the same cannot be said for lawyers, regulators, politicians, or conservative theologians. But they do not represent all or even a large part of bioethics.

As this special issue shows, bioethicists can oppose certain interventions in altering genomes, or they may well defend and encourage such interventions. Bioethics with respect to genetic alteration of microbes, plants, animals, and ourselves is not just a matter of saying “no” based on abstract fears of possible bad outcomes. Bioethics may try to push science and medicine to go faster or lay out guidelines for seeking public permission to engage in somewhat risky activity, such as the gene drive-mediated elimination of insect pests or mitochondrial transplants to repair damaged embryos, or it may try to battle those who say that genetically modified foods ought to be banned or avoided. The ones who know this best are those who made each of these arguments themselves, which shows nothing about their validity but knocks down the canard that bioethics is always a deadweight on scientific or genetic progress.

Beyond substantive argument, bioethics has useful insights into what is fair and just in resolving disagreements about genetic engineering. If you and your neighbor disagree over whether to release genetically modified mosquitoes in your community as part of a research experiment to battle Zika or malaria, should the experiment go on? Should branding and fail-safe mechanisms such as terminator genes be in place before a genetically modified animal or insect is released into the wild? A prudent path forward for ethics research on gene drives and genetic solutions to environmental challenges will create forums for inclusive public discussions and integrate divergent perspectives into ethics literature and policy.

Consider the rapid development of gene therapies, often combined with stem cell modifications, to combat cancer. When are gene therapies ready for first-in-human use? The deaths of patients in clinical trials of CAR-T (chimeric antigen receptor T-cell) therapy bring this ethical question into sharp focus. It is not settled by patients’ consent. Many terminally ill people and their families desperately

cling to the hope that a novel experimental drug will save them. They value fighting to stay alive more than safety.

On the other hand, regulators often prefer a cautious approach to first-in-human trials. Whether a drug is ready for first-in-human use depends on whether you ask a dying patient, a treating clinician, a drug company's CEO, or a regulatory official. Ethics debate of the sort represented in this special issue clarifies the values in play and develops arguments favoring one approach over the other—workable solutions subject to criticism and revision.

Bioethicists are not the genetics “police.” The field does not exist simply to block innovation or to create boxes that need to be checked by hordes of bureaucrats. Bioethics properly pushes and challenges scientists to acknowledge that they operate within a society that pays for their work and bears the price of success and failure. Bioethicists give voice to divergent moral perspectives and provide a framework to facilitate informed and inclusive discussions that can spur and support progress. In an era when so many pressing challenges will depend on the innovations of genetic science—battling emerging infectious diseases, achieving food security, increasing food safety, eliminating horrific hereditary diseases—the need for bioethics has never been greater. This becomes apparent in various contributions to this Special Section.

This is certainly not the first time that CQ has offered its readership the opportunity to explore arguments about what is morally justified in the field of the most promising contemporary biotechnologies: two previous CQ Special Sections were devoted to the issue of (moral) enhancement. This time, the authors in the Special Section offer seven articles and four commentaries debating biomedical and ethical perspectives on genome editing and raising issues that are among the most pressing ones in contemporary bioethics.

In the article, “Why We Should Defend Gene Editing as Eugenics,” Nicholas Agar subsumes certain types of gene editing as “eugenics.” In his view, this does not necessarily disqualify them as immoral. Agar distinguishes between “morally wrong” practices, which should be condemned, and practices that are “morally problematic.” A “morally problematic” practice ought to be understood quite literally as a practice that we distinguish as containing a moral problem, a moral dilemma. The existence of the problem necessitates the search for a solution. Agar contends that eugenic uses of gene editing fall into this latter category. The same applies to preimplantation genetic diagnosis.

In their paper “From Liberal Eugenics to Political Biology,” Nathan Emmerich and Bert Gordijn argue that specific biomedical technologies and interventions ought to be assessed on their own merits, without being subsumed under “eugenics.” However, this does not imply that a supra-ethical or political analysis is superfluous. Much to the contrary, all emerging biotechnologies, including pre-implantation genetic diagnosis and gene editing, ought to be assessed not only on the basis of their ethical merits, but also on the basis of their broader social and political impact, including their role in public health.

Carolyn P. Neuhaus and Brendan Parent discuss the issue of gene doping in animals. It may only take one generation for gene editing techniques to facilitate enhancing animals' capacities beyond their typical limits. Although gene editing could be used to improve sport animals' well-being, Neuhaus and Parent believe that this is an unlikely scenario. Animals are already treated as mere objects—commodities to be traded, bred, and drugged—irrespective of the effect on the

animals' welfare and well-being. Currently, they are instrumentally valued for the profits they produce, and Neuhaus and Parent do not foresee this attitude changing in the case of gene editing in animals.

In his commentary on the Neuhaus-Parent article, Nicolas Delon takes the argument one step further. He argues that gene editing aimed at enhancement in animals might be morally permissible, provided it were possible to devise mechanisms to acquire their assent. In that case, enhancement would set the bar much higher for ethical sports by giving animals a role in determining their own participation in sports.

In his article "Genome Editing for Involuntary Moral Enhancement," Vojin Rakić discusses an alternative to compulsory moral bioenhancement and voluntary moral bioenhancement: involuntary moral bioenhancement. If possible, involuntary moral bioenhancement might engineer offspring who will be more moral than they otherwise would have been. Moreover, Rakić argues that a complete program of moral bioenhancement could consist of a combination of voluntary moral bioenhancement and involuntary moral bioenhancement of the unborn. Voluntary moral bioenhancement would be directed toward individuals who have the capacity to comprehend morality, enhancing their motivation to act morally. Involuntary moral bioenhancement would target the unborn, possibly by genome editing for moral enhancement in the domains of empathy, reduction in violent aggression, and moral reflection. It might target the unborn individual only or the germ line also.

Nick Agar comments on Rakić's article. He notes that philosophers have the tendency to discuss moral enhancement as a thought experiment. However, Rakić's focus on the possibilities of gene editing locates his contribution in the "implementation ethics" of moral enhancement. As recent advances in gene editing add little to moral enhancement as thought experiment, argues Agar, Rakić's implementation ethics is a valuable contribution to the debate on moral enhancement. Nonetheless, Agar points out, as with any novel implementation proposal, we cannot be confident of its accuracy before we have considered it in the light of moral motivations and how they might impact gene editing for the purposes of moral enhancement.

Kevin Fitzgerald and Maria Šulekova Kolesarova argue that there is a need to transcend the binocular views on technological development advocated either by the "technological conservatives" or the "technological enthusiasts," and they offer the thought of Teilhard de Chardin as a useful guide in reframing the discussion. Central to his work is the maintenance of biosphere and noosphere stability. This stability, however, cannot be understood as static. It is rather a continuous "moving forward" within the process of biosphere and noosphere preservation. In the case of gene editing, the same principles ought to apply: both the enthusiastic and conservative approaches are required, although they should be considered as parts of an inclusive framework. Fitzgerald and Šulekova propose that Teilhard de Chardin's perspective represents a promising basis for finding such an inclusive framework.

The article "Regulating Genome Editing: For an Enlightened Democratic Governance," authored by Giulia Cavaliere, Katrien Devolder, and Alberto Giubilini, discusses two competing views on the regulation of genome editing and proposes a third alternative approach. The first view, which they refer to as the "elitist" view, has as its objective to develop a conception of preferences that

people would have if they were committed to implementing public policies regulating genome editing in a context of ethical pluralism. The second view, which the authors describe as the “democratic” view, emphasizes the importance of including the public’s expressed attitudes in the regulation of genome editing. The authors propose a third alternative approach—the “enlightened democracy” approach—that aims to reconcile the need for democratic engagement involving mutual respect for competing views on the one hand and a well-informed discussion on the other.

In his comments on Cavaliere, Devolder, and Giubilini, Oliver Feeney further develops and translates into practice their “enlightened democracy approach”—something that the authors announced as a future endeavor. Feeney notes that there are a number of forms of “enlightened democracy” already operational in the context of science, medicine, and genetics. Their goal is to increase participation of various stakeholders in genome editing. Hence, Cavaliere, Devolder, and Giubilini already have a foundation on which to build.

Joanna Smolenski raises her concerns regarding the use of CRISPR to alter germ lines because of the possibility of unknowable, serious health conditions continuing or worsening through future generations. Furthermore, altering germ lines opens up various consent considerations that we are not now capable of successfully addressing. Difficulties in providing adequate information about the risks and benefits of this technology give us reason, Smolenski argues, to prohibit research in this domain—at least at this stage.

In his “Let Us Assume that Gene Editing is Safe—The Role of Safety Arguments in the Gene Editing Debate,” Soren Holm analyzes the assertion, frequently made in papers and policy reports, that gene editing should be used in humans only when it is safe. Holm argues that such an assertion is inconsistent with the philosophical commitments of a number of scholars who use this claim in relation to reproductive uses of gene editing. Holm continues by addressing the contexts in which the safety argument is made. He distinguishes five such contexts and concludes that the “only if it is safe” argument is “part of a deliberate obfuscation aimed at hiding the full implications of the arguments made about the ethics of gene editing and their underlying philosophical justifications.”

Lastly, in “A Defense of Limited Regulation of Human Genetic Engineering,” James Hughes develops his argumentation on the basis of the position that human genetic engineering needs to be regulated in the context of the “unfinished project of liberal democracy.” He argues that there is no a priori reason why gene therapies should have higher standards of safety than other therapies. Much of Hughes’ focus is on the United States. The struggle for a liberal regulatory environment for gene therapies is an extension of the struggle in that country for a “more liberal, noncommunitarian democracy, one that maximally respects cognitive, bodily, and reproductive freedom.” Primarily as a consequence of various political factors, the United States still has rather liberal regulations around gene therapy. Hence, argues Hughes, United States gene therapy regulation might serve as a model for other countries—with the exception of the Congressional ban on heritable gene therapy.

As demonstrated by this collection of papers, when bioethicists pick up the challenge to clarify values and develop arguments for an area of inquiry as complex and consequential as gene editing, they succeed in moving the discussion forward and laying the groundwork for the next level of debates.





"Who advertises now, ensures the future!" / "Slashed is cut!" / "Why advertise today?, 1940. The German businessman. Vocational Training journal of the German Labour Front (DAF), output C: Retail, No. 8 (1096) Volume 47, Berlin, August 13, 1940, page 60th. Print. Photo Credit: bpk Bildagentur Location: Staatsbibliothek zu Berlin, Stiftung Preussischer Kulturbesitz, Berlin, Germany / Art Resource, NY. Reproduced by permission