

The global governance of genetic enhancement technologies: Justification, proposals, and challenges*

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Abstract

The prospect of human genetic enhancement requires an institutional response, and probably the creation of new institutions. The governance of genetic enhancement technologies, moreover, needs to be global in scope. In this article, I analyze the debate on the global governance of human genetic enhancement. I begin by offering a philosophical justification for the need to adopt a global framework for governance of technologies that would facilitate the improvement of non-pathological genetic traits. I then summarize the main concrete proposals that have recently emerged to govern genome editing at the global level. Finally, I develop some impediments that limit the impetus for global governance of genetic enhancement.

Keywords: CRISPR; GenEthics; Global Bioethics; Human Enhancement Politics; Technological Governance

Resum. *La governança global de les tecnologies de millora genètica: justificació, propostes i desafiaments*

La possibilitat de la millora genètica humana exigeix una resposta institucional i, probablement, la creació de noves institucions. A més, la governança de les tecnologies de millora genètica ha de tenir un abast mundial. En aquest article analitzo el debat sobre la governança global de la millora genètica humana. Començo oferint una justificació filosòfica de la necessitat d'adoptar un marc global per a la governança de les tecnologies que facilitaríen la millora dels trets genètics no patològics. A continuació, resumeixo les principals propostes concretes que han sorgit recentment per governar l'edició genètica a escala planetària. Finalment, exposo alguns impediments que limiten l'ímpetu en la governança global de la millora genètica.

Paraules clau: CRISPR; bioètica global; GenÈtica; governança tecnològica; polítiques de la millora humana

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Summary

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1. Introduction

Human genetic enhancement refers to the use of emerging technologies for improving non-pathological traits with a genetic contribution (Rueda, 2022a). Among the emerging technologies that could facilitate the improvement of our genetic characteristics beyond therapeutic purposes, CRISPR-based genome editing stands out as one of the most promising methods (Baylis, 2019a; Doudna & Sternberg, 2017; Gyngell et al., 2017). CRISPR can edit germ-line and somatic cells in humans. Germ-line interventions consist in the modification of gametes (sperm and eggs) and the zygote (the unicellular embryo), producing inheritable changes in the DNA.¹ Somatic interventions, by contrast, produce non-heritable genetic changes that remain in the modified individual.

The prospective use of genome editing beyond mere therapeutic purposes raises both hope and concern. Of course, the therapeutic use of CRISPR is also subject to substantial ethical debate, as it is still an experimental technique, especially when it can produce heritable changes in the next generations. In this article, however, I will focus on enhancement uses, which would produce changes in healthy or normal individuals in order to improve diverse traits at cognitive, cosmetic, athletic, emotional, moral, immunity and longevity levels. The reason is that genetic enhancement is generally considered to be more ethically controversial than the therapeutic application of genetic technologies (Baylis, 2019a; Buchanan et al., 2001; Glannon, 2001; Habermas, 2003; Robertson, 1994).² Also, as enhancement applications are still a foreseeable but future impact of CRISPR, we have time to align gene editing developments with mainstream public interests.

Therefore, reinforcing the governance of genetic enhancement applications is crucial. What does the concept of ‘governance’ mean in this context? Following John M. Conley and colleagues, governance “refers to both formal

1. I have explained elsewhere, along with Jonathan Pugh and Julian Savulescu, how genetic enhancement may work at the reproductive level (Rueda et al., 2023).
2. In this article, I will not analyze the normative distinction between therapy and enhancement at the global policy level. The treatment-enhancement distinction is not only controversial at the ethical level, but is also problematic at the descriptive level (Rueda et al., 2021), and contingent to cognitive factors as the perception of the normality of the interventions (Martín et al., 2023). The interested reader on the demarcation between therapy and enhancement can consult the extensive literature on this issue (Harris, 2007; Malmqvist, 2014; Parens, 1998; Resnik, 2000; Schwartz, 2005).

regulation by national governments and international authorities and activities by non-state actors such as scientific and medical organizations, patient groups, funders, universities and other nonprofit research centers, journal editors, civil society participants, and private industry” (Conley et al., 2023; see also Marchant, 2021: 386). Regarding genetic enhancement, nonetheless, governance initiatives are not restricted to nation-states. Genetic enhancement generates challenges that go beyond the local level, crossing national borders. So, unsurprisingly, calls for *global* governance have been a widespread response to the advance of genome editing techniques (Baylis, 2019a; Dryzek et al., 2020; Hurlbut et al., 2018; Jasanoff & Hurlbut, 2018; Marchant, 2021; Saha et al., 2018; Schaefer et al., 2021; Yu et al., 2021).

The objective of this article is precisely to address the global governance of emerging genetic enhancement technologies in humans. I shall develop a critical overview of the governance frameworks with global scope proposed in recent years. I argue that it is necessary to take a global perspective when planning the governance of genome editing for enhancement purposes. As will be seen, this view is consistent with a burgeoning series of concrete proposals to facilitate governance at the global level. I will note, however, that this ambitious vision also faces a number of obstacles.

The structure of the article goes as follows: In the second section, I shall offer a rationale for adopting a global approach to the governance of genetic enhancement. In the third section, I summarize the main proposals for global governance of human genome editing, including the global moratorium, the Global Genome Editing Observatory, a Global Deliberative Assembly, international reporting mechanisms of unethical gene editing experiments, and a couple of recently created organizations. After that, in the fourth section, I elaborate on some hurdles to bear in mind in discussions on the global governance of genetic enhancement. Then, I close with some final thoughts.

2. Justification of the global approach

Why is it necessary to embrace a global approach to the governance of gene editing, especially for enhancement purposes? This section provides an answer to that question. Although there are multiple arguments to justify the need for global governance, I will develop four important reasons.

First and foremost, scientific activity today transcends national borders. A large amount of genome editing research is conducted in international collaborative networks, involving researchers and laboratories from multiple countries (Cadigan et al., 2022). Science, after all, is globalized. There are thousands of institutions involved in the field of genome editing, forming a very geographically and culturally diverse scientific community (Yu et al., 2021). Moreover, most scientists investing in gene editing believe that self-regulation or self-governance is not enough, but that global governance guidelines are needed (Cadigan et al., 2022). One possible explanation for this phenomenon is the fear of the proliferation of rogue actors, especially after the infamous He

Jiankui case. He Jiankui is a Chinese scientist known for being the first to edit human embryos and carry them to term after inactivating the *CCR5* gene to prevent paternal transmission of HIV (Cyranoski, 2018). Improving the resistance to HIV may be considered a case of immunity enhancement (see Anomaly, 2020; So et al., 2017). The He Jiankui case has been widely condemned by the international community for its high risks, few clinical benefits, concealing the existence of alternative methods, deception, and violation of informed consent (Alonso & Savulescu, 2021; Cyranoski & Ledford, 2018; Savulescu & Singer, 2019). For our argument, the curious thing about this event is that prominent researchers from various countries were aware of this experiment before it was made public (Cohen, 2019b). Thus, scientific advances in genome editing are likely to be brewing in multiple countries in unison.

Secondly, CRISPR can produce inheritable changes in the human genome, which is considered a common heritage of humankind. On 11th November 1997, the Universal Declaration on the Human Genome and Human Rights was approved unanimously at UNESCO's 29th General Conference (UNESCO, 1997). The first article of this document famously declared the human genome as a heritage of humanity. So, as Françoise Baylis mentioned, "the human genome, metaphorically speaking, belongs to all of us" (Baylis, 2019b: 44). Therefore, as far as genome editing may modify this common heritage, affecting future generations, we all should have a say in this controversy (Baylis, 2019a: 193; 2019b). Genetic enhancement is thus everybody's business. We have a responsibility to deliberate on how these technologies can influence our societies and future generations by altering the human genome. As mentioned by Sheila Jasanoff and colleagues:

The human genome is not the property of any particular culture, nation, or region; still less is it the property of science alone. It belongs equally to every member of our species, and decisions about how far we should go in tinkering with it have to be accountable to humanity as a whole. (Jasanoff et al., 2015: 2)

Thirdly, and partially related to the previous argument, genetic enhancement innovations are species-altering technologies. Although in the past some believed that genetic technologies cannot alter human evolution (Gordon, 1999), the prevailing view now is that the multigenerational effects of genome editing can indeed transform our species in the long run. Global governance is relevant because genome editing may affect the future of the human species (Hurlbut et al., 2018). What is more, "genetic enhancement could even divide humans into subspecies" (Lander et al., 2019: 167). This vision had already been mentioned in the 1990s by some of the enthusiasts of reproductive and genetic technologies (Harris, 1992; Silver, 1997).³ I myself have recently

3. For a philosophical analysis of the possible problems of coexistence between enhanced and unenhanced populations, see the article by Marcos Alonso (2024) in this volume.

explained how genetic enhancement could produce cumulative changes that, in the very long term, may lead to posthuman speciation (Rueda, 2022b).⁴ Posthuman speciation could occur when unenhanced and radically enhanced populations are reproductively isolated from each other (Agar, 2010; DeGrazia, 2012; Rueda, 2022b). Moreover, the use of these technologies could accelerate our own extinction (Baylis, 2019a: 193; Rueda, 2022b). Therefore, it is advisable to adopt what in the literature on existential risks is called the “perspective of humanity” (MacAskill, 2022; Ord, 2020). In this way, humanity can be thought of as a collective agent that must decide on the impact that genetic enhancement may have on our remote future.

Last but not least, the regulation of some countries will affect others, which may result in genetic and reproductive tourism from one country to another. Different standards of safety and effectiveness may be set between countries (Marchant, 2021; Shoji et al., 2021). In addition, some countries may enforce more restrictive legislation, while others will be more permissive (Kaan et al., 2021). Therefore, citizens who do not have access to genetic enhancement technologies due to high requirements or prohibitions in their country may be willing to travel to others where the service is more accessible and affordable. Genetic tourism may thus become a global challenge in the future (Macintosh, 2019; Mehlman, 2003).

All in all, global governance seems an appropriate approach in response to those four reasons. Genetic enhancement may affect our shared human genome, becoming species-altering, being developed by a globalized scientific community, and eliciting different regulatory frameworks that trigger the phenomenon of genetic tourism.

3. Proposals for global governance

The global governance of genetic enhancement technologies can occur in many ways. After having seen the rationale for why a global approach is necessary, it is worth looking at the specific proposals that have been offered in the last few years. In this section, I summarize some of the most important recent proposals for global governance of genome editing innovations.⁵ I will limit myself to presenting the proposals as descriptively as possible, and leave the evaluation of the critical aspects for the next section.

4. According to transhumanism, the ‘transhuman’ would come before the arrival of the posthuman. The transhuman would constitute a kind of radically enhanced human, an intermediary being in the evolutionary transition to posthuman existence (Humanity+, 2021; Porter, 2017; Rueda, 2020).
5. Among the non-recent proposals, the Convention on Human Rights and Biomedicine, or so-called “Oviedo Convention”, is one of the most important documents. Since 1999, this document is legally binding in the 29 European countries that have signed it (Council of Europe, 1999). See <<https://rm.coe.int/inf-2021-14-etat-sign-ratif-reserves-bil/1680a50e48>> [last access on 9 December 2023]. Article 13 establishes the prohibition of making heritable enhancements in the offspring. For a discussion of Article 13 of this document, see De Miguel Beriain et al. (2019).

A much-discussed initiative has been the *global moratorium*. In 2015, Edward Lanphier, Fyodor Urnov and colleagues tentatively suggested a moratorium (Lanphier et al., 2015), as a response to the first case of CRISPR editing in (non-viable tripronuclear) human embryos for research purposes (Liang et al., 2015). Similarly, a report from the International Bioethics Committee of UNESCO on genome editing and human rights suggested a moratorium on editing the human germ-line in the same year (International Bioethics Committee of UNESCO, 2015). Others, by contrast, argued that we have a moral duty to continue these investigations (Savulescu et al., 2015). More recently, and in response to the He Jiankui affair, Eric Lander and colleagues argued for the adoption of a voluntary global moratorium on heritable gene editing for clinical uses, in an article published in *Nature* (Lander et al., 2019). By 'clinical uses', they meant employing genome editing to produce pregnancies that would result in offspring with modified genes, thus excluding research in embryos that would later be discarded. To be clear, a moratorium is a temporary prohibition or suspension (Baylis, 2019a: 133; Kaan et al., 2021), not a permanent ban on genome editing, a strategy that others have previously advocated (Annas et al., 2002; Botkin, 2020). In particular, Lander and colleagues suggested a moratorium of five years to give precious time for establishing an international framework for heritable genome editing in humans (Lander et al., 2019). In any case, moratoria can be reviewed in the light of new evidence and arguments.

A second interesting proposal is the *Global Genome Editing Observatory*,⁶ proposed by Sheila Jasanoff, Benjamin Hurlbut, Krishanu Saha and other colleagues in various publications (Hurlbut et al., 2018; Jasanoff & Hurlbut, 2018; Saha et al., 2018). This observatory would fulfill three main functions (Jasanoff & Hurlbut, 2018). First, it would serve as a clearing house, facilitating the multilateral exchange of information and coordination between different agencies. Second, the observatory would help track the evolving debate on genome editing and identify emerging areas of consensus. Third, it may be useful to facilitate the organization of periodic meetings. Overall, the observatory would be an infrastructure to promote a plural ethical dialogue based on a cosmopolitan spirit (Hurlbut et al., 2018; Jasanoff & Hurlbut, 2018; Saha et al., 2018).⁷

A third remarkable enterprise is the *Global Deliberative Assembly*, proposed in a multi-author article led by John S. Dryzek in *Science* (Dryzek et al., 2020). The global citizens' assembly aims to foster a meaningful discussion on genome editing around the world. This assembly would be bigger than traditional citizens' juries, being composed of a minimum of 100 people. These individuals would constitute a representative sample and would be recruited

6. See <<https://global-observatory.org/>> [last access on 13 December 2023].

7. For a philosophical justification of the cosmopolitan approach to the debate on enhancement technologies, see the article by Javier Rodríguez-Alcázar and Lilian Bermejo-Luque in this special issue (Rodríguez-Alcázar & Bermejo-Luque, 2024).

all around the globe. The stratified random sampling would permit a broad spread in cultures, religions, gender, income, nationality and level of education (Dryzek et al., 2020). The assembly would not have legislative power, but it may help influence the global agenda on genome editing.

Another proposal is the international reporting mechanism of unethical gene editing experiments. In light of the infamous case of He Jiankui, G. Owen Schaefer and colleagues have argued that an international governance mechanism for reporting ongoing unethical gene editing research would be beneficial (Schaefer et al., 2021). The World Health Organization (WHO) would be the natural locus for hosting this international mechanism. This global whistleblowing platform would enable alerting of cases that violate the established legal frameworks and ethical agreements in force, and could lead to paralyzing them to prevent their undesirable consequences. According to these authors, reporting unethical cases is not only a responsibility of the researchers, but would help maintain the public confidence in science needed to advance socially beneficial developments (Schaefer et al., 2021).

Finally, there are other newly created groups and organizations that also seek to promote the global governance of these technologies. In 2018, the Association for Responsible Research and Innovation in Genome Editing (ARRIGE) was founded in Paris, with a kick-off meeting that brought together approximately 160 participants from 35 countries (Montoliu et al., 2018). This organization aims to foster the global debate on the governance of genome editing. ARRIGE organizes annual meetings and diverse seminars, and publishes various statement documents.⁸ Furthermore, in 2019, WHO's Expert Advisory Committee on Developing Global Standards for Governance and Oversight of Human Gene Editing was established. This body has convened various meetings on global governance aspects, and has issued corresponding reports.

4. Challenges to the global approach

Global governance of genetic enhancement has a compelling rationale, and we already have proposals aimed at this purpose. However, the global approach to governance faces several challenges. Some are criticisms of specific measures, others are more general concerns. In this section, I present various constraints that limit the appeal of global governance. My aim is in no way to show that global governance is undesirable in the case of genetic enhancement, but rather to point out some obstacles to be considered in future discussions on this issue.⁹

8. See <<https://www.arrige.org/>> [last access 8 June 2023].

9. I exclude from this discussion the practical and logistical costs of global governance. Undoubtedly, setting up and maintaining global governance mechanisms is time- and resource-intensive. This is a disadvantage to consider, and one that may place a considerable burden on less resourced countries to participate in governance at the global level (Marchant, 2021).

The first hurdle is that the global moratorium, one of the most discussed instruments since Lander et al.'s 2019 proposal, has significant weaknesses. Some authors sympathetic to the spirit of preventing experiments in human genome editing have pointed out that the moratorium is insufficient without legal enforcement mechanisms by the individual states, defending the temporary boycott of researchers to colleagues conducting such research as a way of self-regulation (Hough & Ajetunmobi, 2019). Others have been critical of the proposal itself. The moratorium is unnecessary in many countries that already have restrictive legislation, and, in countries that do not, it would limit promising scientific inquiry in controversial ways (Adashi & Cohen, 2019; Charo, 2019; Cohen, 2019a; Kaan et al., 2021). A global moratorium would conflict, moreover, with “the sovereign state principle in international law (i.e., that states have exclusive sovereignty over their territory)” (Kaan et al., 2021: 3). More importantly, Kerry Lynn Macintosh has identified three major problems with this global moratorium (Macintosh, 2019). First, historical experiences show that the temporary nature of the moratorium may not be easily revocable and may lead signatory countries to paralyze this research indefinitely. Second, the global moratorium will hinder the development of safe and effective therapies to treat many heritable diseases. Third, this tool sends a negative social message about human gene editing that may increase the stigmatization of genetically modified babies in the future.

Global governance faces more general problems as well. A crucial challenge is how to mitigate the power imbalances between countries and world regions in the genetic enhancement debate to maximize inclusiveness. This is not a trivial issue. The debate on gene editing is dominated by expert scientists and bioethicists, mostly from high-income countries.¹⁰ If voices from all sides are not included, or if those coming from economically and culturally dominant countries are imposed, global governance would be unsatisfactory. Given this danger, some have warned that “internationalism can function as imperialism unless care is taken to investigate and confront such imbalances” (Hurlbut et al., 2018: 640). African scholars have also warned against neocolonialist overtones in bioethical discourses on the governance of genetic technologies (Shozi & Thaldar, 2023). Hence, proposals for global governance of genetic enhancement must take into account the inequalities of power between countries and world regions so as not to systematically favor the positions of the global North in this discussion.

Moreover, when it comes to the global village, consensus-oriented deliberation is even more difficult than in nation-states. Achieving ‘broad societal consensus’ has been one of the most recurrent proclamations since its defense at the *2015 International Summit on Human Gene Editing*. Françoise Baylis has been one of the most prominent philosophical advocates on the goal of achieving broad societal consensus on heritable uses of CRISPR (Baylis, 2017,

10. For some, the extensive scholarship about the future possibilities of human enhancement by high-income countries may be a problem of distributive justice in academic research. I have analyzed this problem at length in (Rueda, 2023).

2019b, 2019a). Yet, achieving a broad societal consensus at the global level is a daunting activity (Marchant, 2021). As Alta Charo has skeptically argued on the regulation of genome editing, “A global consensus (by majority? calculated by polling? calculated by voting?) is simply impossible” (Charo, 2019). On similar grounds, Eric T. Juengst has noted

Instead of trying to come to consensus on incommensurable community worldviews and personal values, perhaps it would be better to encourage the public to prepare for a world in which gene-edited enhancements and occasional inadvertent germ-line changes are a reality and to discuss the human rights protections that the variegated inhabitants of such a world will need. (Juengst, 2017: 27)

Still, according to Baylis, we should not conflate ‘consensus’ with ‘unanimity’ or ‘majority rule’ (Baylis, 2019b). Unanimity is surely an unattainable ideal in this global challenge. Furthermore, Baylis herself acknowledged that deliberation commonly occurs in local contexts framed with concrete cultural, legal and political contexts, creating a clear limitation for a global policy challenge as human genome editing (Baylis, 2019a: 202). But she points out that global citizen consultation initiatives such as World Wide Views can help in this endeavor, just as they have done previously on issues such as the climate emergency. In any case, I think that recognizing the enormous plurality¹¹ of agents participating in the deliberative community and the difficulties of achieving consensus in the global sphere does not oblige us to renounce the purpose of seeking consensus. It only leads us to assume that we should not bet all the cards of global governance on the search for consensus, because we may not be able to build it.

Moreover, the proposal for global governance must be aware that there may be particular national challenges to which each state can respond based on its own sovereignty. In the USA, for instance, the policy challenge in the near term is more focused on controlling off-label enhancement uses of supposedly therapeutic intervention, rather than the regulation of genetic enhancement application per se (Juengst & Moseley, 2019). Likewise, supranational organizations such as the European Union may have specific aspirations that distinguish them from other regions, such as trying to harmonize regulatory frameworks to avoid genetic tourism among citizens of member countries. There may also be regions of the world with their particularities. For example, the citizens of many Asian countries show greater moral approval of genetic enhancement than Western countries (Macer, 2012; Marchant, 2021). These countries may claim sovereignty to legislate favorably for these technologies, even if this does not accord with the dominant view in Western countries.¹²

11. Plurality is so remarkable that consensus is even difficult to reach within the scientific community. Unlike other historical debates on biotechnologies led by a few scientists such as Asilomar, the scientific community of gene editing is huge and very diverse (Yu et al., 2021).

12. Although a global social media survey conducted in 185 countries showed that the enhancement of non-pathological traits in embryos elicits negative attitudes worldwide

Finally, national sovereignty may also prompt some countries to take specific measures on genetic enhancement technologies to improve the welfare of their populations. These measures need not be restrictive. Although it could be argued that this could increase differences between countries, this issue is difficult to resolve. If we consider access to enhancement technologies as just another part of human development, the problem is even more salient. As Allen Buchanan puts it, “Few of us would say that India should not be allowed to continue its gain in development until Ethiopia catches up” (Buchanan, 2011: 53). Undoubtedly, countries are differentiated by unequal rates of development. Justifying that a country should prevent access to technologies that can be socially beneficial in order not to widen the gap with less advantaged countries is a difficult debate on global distributive justice that is beyond the scope of this article. But it does at least serve as a warning that future contributions to global governance should be devoted to looking at possible solutions to the injustices created at the international level by genetic enhancement.¹³

5. Concluding remarks

Human genetic enhancement is a global challenge that requires an institutional response, and probably the creation of new (global) institutions. In this article, I have argued for the relevance of adopting a global approach to deal with the governance of emerging genetic technologies that may allow us to modify non-pathological traits and make heritable changes. I have summarized the most prominent proposals in the global governance of gene editing. I have also shown some of the limitations that restrict the enthusiasm for the global approach.

In conclusion, global governance of genetic enhancement is a difficult, albeit unavoidable task. I hope that this article may motivate future contributions to this emerging debate, which will undoubtedly be intensified as research on genetic enhancement technologies progresses. In particular, it would be useful to devote more attention to distributive justice issues related to the unequal development and access to these technologies not only at the intra-national level, but also between countries and regions of the world. For example, studying how the legal ecosystem of patents shapes the diffusion of innovations at the global level is a pressing issue that requires further analysis. Genetic enhancement can have very diverse and differentiated consequences across countries, which cannot be overlooked from a global governance approach.

(McCaughey et al., 2016), the tendency to disapprove of genetic enhancement is more pronounced in Western countries such as the USA (Gaskell et al., 2017; Pew Research Center, 2018; Scheufele et al., 2017), Western Europe (Gaskell et al., 2017) and Australia (Critchley et al., 2019).

13. Buchanan himself had proposed the creation of the Global Institute for Justice in Innovation to facilitate the diffusion of enhancement technologies worldwide (Buchanan, 2011: Chapter 8).

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