

Questioning the Go-Slow Approach to Human Germline Modification

Author : Carl Coleman

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Julia D. Mahoney & Gil Siegal, [Beyond Nature? Genomic Modification and the Future of Humanity](#), 81 *Law & Contemp. Probs.* 195 (2018).

Over the past decade, the emergence of [CRISPR-Cas-9](#) as a means to “edit” the human genome has brought human genetic modification out of the realm of science fiction and into the real world. This revolutionary technology enables users to “make [specific and efficient modifications](#) to a genome” through a process that is “simple, inexpensive, and remarkable effective.” A [variety of efforts](#) are now underway to harness this technology to treat inherited diseases and cancers. Most scientists and bioethicists, however, have collectively shuddered at the possibility of using CRISPR-Cas-9 to make [germline genetic modifications](#)—i.e., changes in sperm, eggs, or early embryos that would be passed on to future generations. Groups ranging from [UNESCO](#) to the [National Academies of Sciences, Engineering and Medicine](#) have called for extreme caution in proceeding with research on human germline editing, and for a complete moratorium on clinical applications of the technology pending further public deliberation.

In a provocative analysis, *Beyond Nature? Genomic Modification and the Future of Humanity*, [Julia Mahoney](#) and [Gil Siegal](#) challenge this “go-slow” approach on both theoretical and practical grounds. They argue that the chief arguments for extreme caution—the interests of future generations, safety considerations, equality concerns, the “evils of eugenics,” and the importance of public trust in science—not only fail to withstand rigorous analysis, but in fact “militate instead for advancing with all deliberate speed.” (P. 196.) In addition, they warn that efforts to limit human germline modification are unlikely to be effective; instead, they will simply “drive cutting edge work into the shadows,” (P. 197) thereby “decreasing public transparency and accountability by moving activity out of sight of democratically responsive entities” (P. 213).

Mahoney and Siegal offer thoughtful responses to the common justifications offered in favor of a moratorium on germline genetic modification. First, while they acknowledge that germline modification will have uncertain impacts on future generations, they point out that the same is true for many other practices and technologies currently in use. For example, antibiotics and other medical treatments allow individuals with disease-causing mutations to survive to reproductive age, thereby altering the frequency of these mutations in the human gene pool. In addition, pre-implantation genetic diagnosis and prenatal genetic testing allow parents to screen out embryos, or terminate pregnancies, based on genetic characteristics they deem undesirable. Reasoning that “human behavior already has a significant impact on the genotypes of members of future generations,” (P. 205) they conclude that germline genetic modification’s impact on future generations is not fundamentally unique.

Second, Mahoney and Siegal challenge the claim that germline modification necessarily raises greater safety concerns compared to other technological developments. Noting that “[a]ll new medical technologies entail risks,” they question whether “the ‘heritable’ component of genomic editing is such a reliable proxy for danger that it makes sense to continue to put a heavy thumb on the scale for developing somatic genome editing applications while stalling heritable ones.” (Pp. 206-207.) As an example, they cite the case of [Jesse Gelsinger](#), who died in a trial of an experiment involving somatic cell gene transfer. Mahoney and Siegal do not deny the possibility that particular applications of germline genetic modification might be excessively dangerous; rather, their point is that “[i]nsisting on a bright line between somatic and heritable genome editing...is not a reliable means of ensuring safety.” (P. 207.)

Third, contrary to critics who fear that allowing germline genetic modifications “will worsen social inequalities and lead to a world of genetic haves and have-nots,” Mahoney and Siegal argue that the possibility of eradicating devastating

heritable conditions “will result in greater, not lesser, equality” because more people will be able to enjoy life free of serious disease. (*Id.*) In addition, they point out that complex traits like intelligence and athletic ability are unlikely to be susceptible to genetic manipulation. Moreover, to the extent they are, a ban on germline genetic modification would not prevent wealthy people from using somatic gene editing to enhance these characteristics in themselves.

Fourth, Mahoney and Siegel reject the claim that allowing germline genetic modification would “usher in a new era of ‘eugenics.’” The evil of eugenics, they argue, was the belief that certain individuals should not reproduce “for the benefit of society.” (Pp. 208-209.) Germline genetic modification is “the opposite” of eugenics, as its goal is “to expand the options available to individuals while leaving sensitive decisions about family life up to them.” (P. 209.)

Finally, Mahoney and Siegel dispute the assumption that a moratorium on germline genetic modification is necessary to preserve public support for science. Pointing to public opinion polls showing substantial support for both somatic and germline gene therapies, they suggest that arguments based on public trust “amount to little more than overwrought speculation.”

Mahoney and Siegel also offer a more practical reason for rejecting a go-slow approach to genetic modification—it simply won’t work. The simplicity and low cost of gene editing techniques have already led some scientists to engage in what Mahoney and Siegel call “genomic moonshining”—i.e., clandestine experimentation by “entities not beholden to the policies and value judgments of the establishment organs that produce ethical and legal guidelines.” (P. 202.)¹ These secretive practices, they argue, pose far greater dangers than publicly funded, transparent, and accountable research. Their analogy to moonshining is apt here: “What makes moonshine hazardous, after all, is not that it is an alcoholic beverage. It is that making alcohol on the sly often entails methods and materials that pose grave risks—both short and long-term—to end users.” (P. 203.)

Personally, I must admit to some lingering hesitation about the prospect of germline genetic modification. While other practices and technologies may also involve unknown risks to future generations, germline genetic modification seems to heighten those risks to an unprecedented degree. Yet Mahoney and Siegel have convinced me that many of the objections to germline modification are not logically defensible, and that in any event the idea of calling a time-out on technological development is probably naïve. Policy-makers concerned about the ethics and regulation of new technologies would be well advised to consider Mahoney and Siegel’s arguments before concluding that a moratorium on germline modification is the best way to ensure that technologies like CRISPR-Cas-9 are used in an ethically responsible way.

1. Indeed, this week the AP reported that [a Chinese researcher claims to have created the world’s first gene-edited baby twins](#).

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