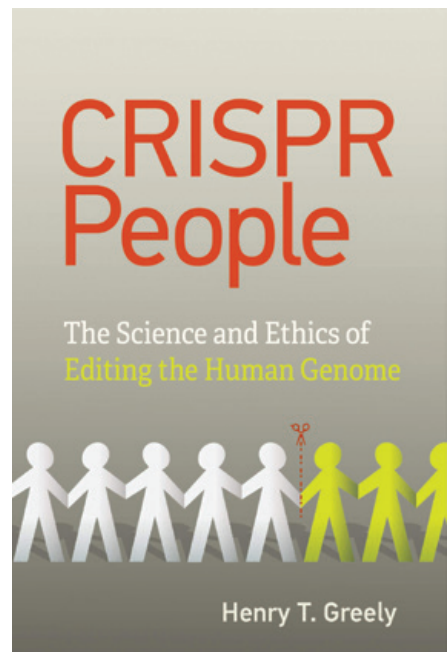


## Not So Fast

ROBERT COOK-DEEGAN

CRISPR gene editing technology, developed in the early 2010s as a precise technique for altering DNA, has inspired a plethora of books—not to mention articles, reports, documentaries, and policy debates—and they keep on coming. The CRISPR story lends itself well to dramatic narrative and thoughtful analysis. There is the classic hero-scientist tale of the technology's development, which Walter Isaacson recounts in his biography of Jennifer Doudna, who shared last year's Nobel Prize in Chemistry with Emmanuelle Charpentier, her coauthor and collaborator, for their work on CRISPR. There are books about the profound ethical implications of editing the human genome, and the dilemmas that advances in reproductive and genetic technology create for parents. And, of course, there's the big-picture take on what the CRISPR-enabled ability to "play god" means for humanity. If the number of books on the topic seems overwhelming now, as the technology becomes an ever-greater part of our lives, still more books will no doubt follow.

Hank Greely's *CRISPR People* is an excellent and prescient addition to this future canon—and a necessity for those interested in ethics and law. Greely is a professor of law at Stanford University, who over the past decade has come to rival New York University's Art Caplan as the most quoted and quotable bioethicist. Greely's tone is informal but serious, with a touch of humor to help turn the pages. But his analysis is clear and incisive. The story Greely tells in *CRISPR People*, about the development of CRISPR technology



**CRISPR People: The Science and Ethics of Editing Humans**

by Henry T. Greely. Cambridge, MA: MIT Press, 2021, 400 pp.

and its first—widely condemned—use in editing the DNA of human embryos, is punctuated by profiles of some of the most important characters in the story, including Doudna, bioethicist and legal scholar R. Alta Charo, and scientists Eric Lander, Stephen Quake, and George Church. The profiles spice up the prose with

personal details, but the focus stays on policy, ethics, and law.

Greely strongly believes that public acceptability of heritable human genome editing (HHGE) is just as important as technical considerations about the technology's safety and effectiveness. Yet public acceptance is repeatedly pushed to the side. He notes that while public acceptability was specified as a criterion at the first international summit on HHGE research in 2015, the process for deciding that there is sufficient social consensus to proceed has been largely ignored since, and it remains cloudy in the policy reports that have proliferated.

One of the central themes of his book is that Science—the capital S signifying the scientific community as a collective—has given short shrift to those societal aspects of the political decisions that need to be made. At times, this process has seemed almost comical. The very first figure in the 2020 *Heritable Human Genome Editing* report from the UK Royal Society and the US National Academy of Sciences and National Academy of Medicine is a beautiful chart, half of which is labeled “Clinical Pathway for a Specific Proposed Use of HHGE,” summarizing the report's findings and specifying criteria that might warrant proceeding with the clinical use of HHGE. The report took the international commission more than a year of labor, and its recommendations for technical review of safety and efficacy are real contributions. The other half of this chart, a parallel column on “Societal Considerations,” in contrast, is simply marked with an asterisk as “Beyond Commission's remit.” This is not the fault of the commission, but the result of how its task was framed—which is, of course, the problem.

Greely calls for scientists to acknowledge the limits of science and the legitimacy of social values. Those values will differ among political

communities globally. Greely's prescription is to let the differing political systems and legal regimes do their work, as he also argues that scientists must be much more open about how they make decisions. In addition, he says, they must be more forthcoming about the technical details of experiments. Greely also urges scientists to come up with effective deterrents for those scientists who violate norms and laws.

The focal point of *CRISPR People* is researcher He Jiankui's experiment that altered the genomes of human embryos that resulted in the live births of three babies. Greely describes precisely what He did and what lessons can be derived from the experiment and the scientific community's response to it. Greely trenchantly critiques the Second International Summit on Human Genome Editing in 2018—where He Jiankui announced his work with human embryos and was roundly condemned by the scientific community and by Greely himself, who called He's research “grossly reckless, irresponsible, immoral, and illegal.”

But despite the peril that He's work suggested, the summit ended with a call for a technical pathway for future clinical application of HHGE. Greely focuses not on what was said by summit organizers and participants, but what they failed to acknowledge: “The primacy of public acceptance should have been the first sentence of any reaction by scientific leaders to He's work.”

Some of the best sections of Greely's book lay out the logic of why technical constraints severely limit the clinical scenarios in which heritable genome editing might make sense. His thorough knowledge of reproductive technologies and his fluid prose are compelling, making those sections fun to read, even for those of us who

have pored over the many reports that reach much the same conclusion.

In contrast to the books, articles, policy reports, and public discussion of HHGE that suggest we are at a momentous inflection point in human history, Greely offers a series of cautionary notes. Nonhuman applications of genome editing in agriculture, environment, and other areas are apt to affect more human lives more profoundly and directly than human genome editing ever will. Greely explains that it makes sense to deliberately engineer the human germline only when a couple wants a genetically related baby and has no alternative for producing a healthy child. The clinical scenarios are narrow and rare.

Moreover, it is dauntingly difficult to produce evidence that the DNA alterations made by CRISPR can transit all of the embryo's development and produce a healthy baby. Given that the human brain has more active genes than any other organ and the effects of changing genes cannot be reliably predicted from animal models, ensuring safety is a high hurdle for CRISPR genome editing. Greely suggests that the prospect of engineered humans is not an immediate possibility. The implication is clear: the policy debate about gene drives and nonhuman uses of CRISPR is likely to prove more important in the long run than the ethics of HHGE.

If you want a popular account of CRISPR science centered on Nobel laureate Jennifer Doudna, pick up the Walter Isaacson book. But if you want a lively bioethicist-lawyer's romp through one of the most intensely debated issues of our day, turn to Hank Greely's *CRISPR People*.

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