Human genome editing requires difficult conversations between science and society

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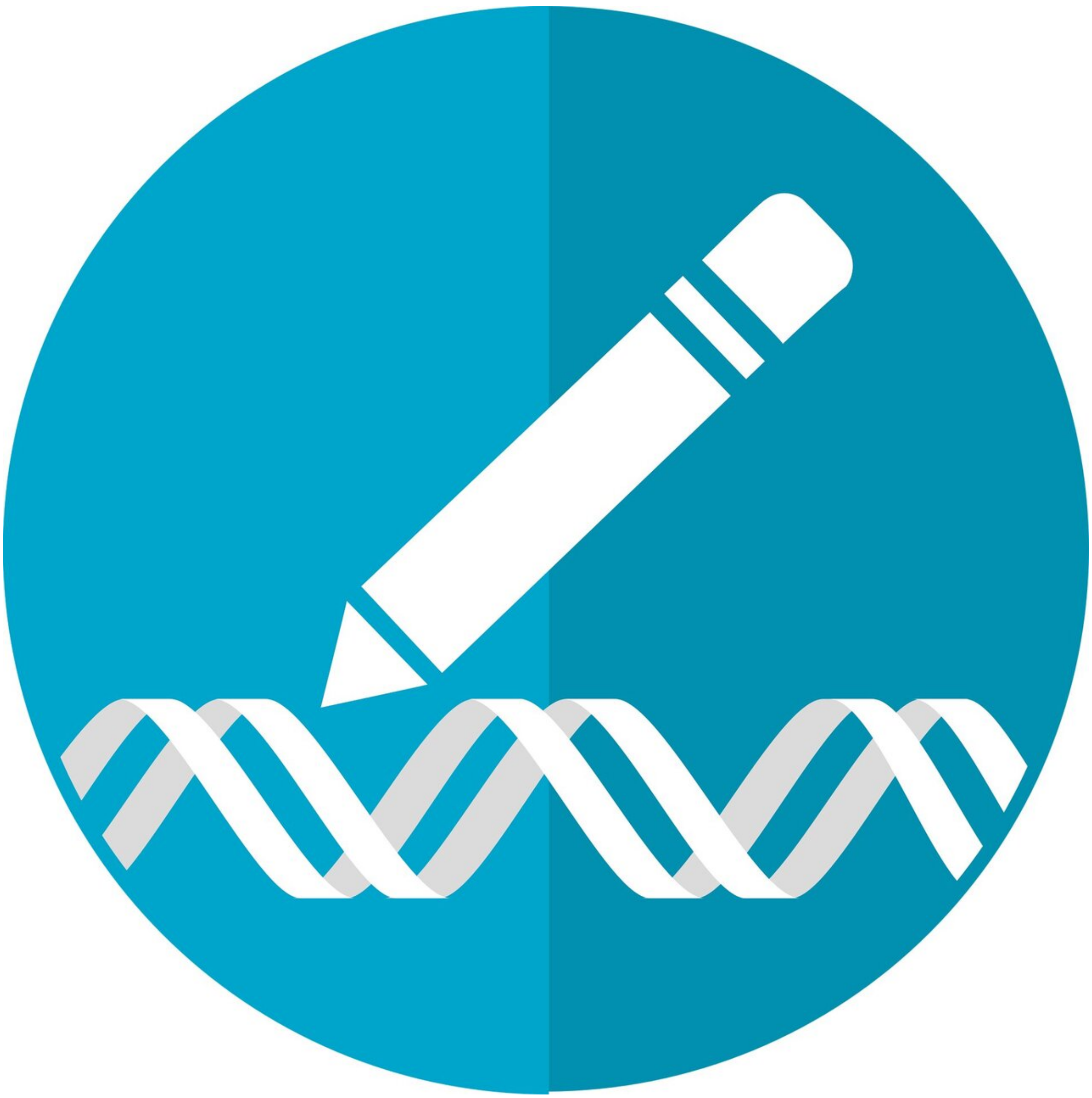

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In October of 2020, Jennifer Doudna and Emmanuelle Charpentier were awarded the Nobel Prize in chemistry for their discovery of an adaptable, easy way to edit genomes, known as CRISPR, which has transformed the world of genetic engineering.

CRISPR has been used to fight lung cancer and correct the mutation responsible for sickle cell anemia in stem cells. But the technology was also used by a Chinese scientist to secretly and illegally edit the genomes of twin girls—the first-ever heritable mutation of the human germline made with genetic engineering.

"We've moved away from an era of science where we understood the risks that came with new technology and where decision stakes were fairly low," says Dietram Scheufele, a professor of life sciences communication at the University of Wisconsin-Madison.

Today, Scheufele and his colleagues say, we're in a world where new technologies have very immediate and sometimes unpredictable but significant impacts on society. In a paper published the week of April 26 in the *Proceedings of the National Academy of Sciences*, the researchers argue that such advanced tech, especially CRISPR, demands more robust and thoughtful public engagement if it is to be harnessed to benefit the public without crossing ethical lines.

The authors say that being thoughtful and transparent about public engagement goals and using evidence from social science can help facilitate the difficult conversations society must have about scientific issues like CRISPR and their societal implications. Effective public engagement, in turn, lays the groundwork for public ownership of advances that do arise from CRISPR.

Life sciences communication Professor Dominique Brossard and graduate student Nicole Krause, along with University of Vienna research assistant Isabelle Freiling, co-authored the report with Scheufele. The paper stems from a 2019 National Academy of Sciences colloquium on CRISPR.

Since 2012, when the CRISPR system was first described, scientists have understood both its genetic engineering potential and the need for public engagement to discuss the possible uses of the technology. Many scientists wanted to avoid rehashing the controversies surrounding genetically modified organisms, which have been harshly criticized as unnatural and unnecessary by some activists despite broad scientific support for their use.

Yet, Krause says, some scientists who supported using CRISPR began by errantly repeating the public engagement methods employed for GMOs, which "assumes that people just need more knowledge, more of an ability to understand the science." Instead, Krause adds: "Solutions focused on tailoring communications to people's values would make more sense."

This values-based public engagement strategy is supported by social science research into how people form and change their opinions around new technologies. Some public engagement methods engage value systems, and encourage thoughtful conversation, more than others.

For example, what researchers term "public involvement" and "public collaboration" are methods of two-way communication involving the joint exchange of information and values and the identification and design of science-based decisions that adhere to those values. That contrasts with "public communication," which focuses only on the dissemination of scientific information.

Scheufele and his colleagues say that such collaborative approaches could help scientists widen the representation of voices in debates around science to groups who are often overlooked, such as people with disabilities or racial minorities.

"As the scientific community, we don't have a long track record of effective engagement mechanism with these communities," says Scheufele. This failure to reach broader groups stems in part from the low participation rates of most science engagement events, which also attract highly selective audiences.

Another challenge is rewarding scientists for public engagement. "There's very little incentive in academia to do this kind of work," says Scheufele.

A recent report by Brossard and others found that a majority of land-grant faculty felt that public engagement was very important, but believed it was less important to their colleagues. That divide suggests scientists feel their engagement efforts won't be rewarded by their peers, says Brossard.

Now, Brossard, Krause, Scheufele and colleagues have a grant from the National Science Foundation to research how to depolarize debates around CRISPR. Previous studies suggest that making people accountable for their positions helps them think more critically about their underlying reasoning. And when social scientists emphasize the complexity inherent in people's values, it helps people consider controversial issues with more nuance.

But engaging a diverse society with pluralistic value systems in deliberations on the latest technologies will never be easy.

"The policymaking process involves a lot more than just science. Science will inform how we regulate technologies, and so will religious, political, ethical, regulatory and economic considerations," says Scheufele. "And so the ability to actually do engagement in this much broader setting where we meaningfully contribute and guide the debate with the best available science is a major challenge."

More information: Dietram A. Scheufele el al., "What we know about effective public engagement on CRISPR and beyond," *PNAS* (2021). www.pnas.org/cgi/doi/10.1073/pnas.2004835117

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