

CRISPR-Cas9: a world first?

On Nov 26, when the world heard the claims that the first genetically edited children had been born, the reaction was one of deep and profound shock. He Jiankui announced on the eve of the Second International Summit on Human Genome Editing in Hong Kong that the CRISPR-Cas9 gene editing technique had been used to edit the genome of twin girls born earlier that month in China. It seemed that the world had changed weeks ago and we were just catching up.

Although human germline editing has been done, the embryos have never been allowed to develop to full term. The CRISPR-Cas9 technique is in its infancy and data is still emerging on the potential for off-target gene editing and mosaicism, meaning that not all copies of the target gene are edited. Targeting the *CCR5* gene has also been widely criticised. The girls, whose genomes were apparently healthy before editing, were born to an HIV-negative mother and an HIV-positive father, however, *CCR5* is just one of the potential route for HIV entry into the cell, which is not the most common HIV cell-entry pathway within Chinese populations. This was also not a situation of unmet medical need, since there are well-established and effective ways to prevent transmission of HIV or to treat it. Moreover, the role of *CCR5* in the immune system is not fully understood, the girls may be more susceptible to other infections. It has become clear that this is really is no more than a human experiment, a proof of concept unlikely to confer any real benefit to the recipients but with unknown and potentially incredibly serious risks.

The international response to this experiment has been swift, with widespread condemnation and criticism. The Chinese Academy of Medical Sciences, Chinese Academy of Engineering, and Chinese Academy of Sciences called attention to the prohibition of genetic manipulation of human gametes, zygotes, and embryos for reproductive purposes in China, and called for stronger ethics committees and better ethical education. Marcia McNutt and Victor Dzau, presidents of the US National Academies of Sciences and Medicine respectively, issued a joint statement raising deep concerns that the researcher did not follow the National Academies 2017 recommendations or other international norms of scientific conduct, and stressed the need for more specific standards and principles agreed by the international community.

Since the announcement, the scientific community has begun to reflect more deeply. Many experts had suggested that this development was imminent. Were we guilty of looking away and allowing this to happen? Not according to Dominic Wilkinson, neonatologist and professor of medical ethics from the University of Oxford, who told *The Lancet* "this was not a case of science outpacing ethical guidance or the law. There were guidelines in place that warned against research of this sort. This appears to be a researcher who had no interest in attending to ethical guidelines relating to scientific research." Wilkinson asserts that these researchers have undermined the contract that scientists have with society; that contract allows research in situations where the risk to the patient is clearly calculated and the implications to the community at large have been appropriately considered. By ignoring these risks, this research team has potentially undermined community trust in research and technology and this threatens the research endeavour more generally along with research into this potentially important technology.

Scientific culture has long been to accredit individuals with steps forward instead of recognising group achievement or incremental progress. This has created an ethos of celebrity in academia, which has sometimes rewarded maverick behaviour. The increasing speed of scientific research—from conference late breakers to techniques for rapid and public dissemination of research that come with less critical oversight—adds to a constant fear of getting scooped. These factors, combined with strong incentives for research and a less regulated research framework, have created an atmosphere in which some scientists seem ready to act outside of clear ethical frameworks.

Although it seemed like the world had changed overnight with the birth of these twin girls, it will be the reaction of the scientific and wider communities that has the power to determine the path of these irrevocable changes. How this case is handled will set a precedent for the future, determining in part whether this development ultimately accelerates progress towards a useful and safe therapeutic intervention or whether the consequences of the broken compact between science and society will be to delay this and other innovative technologies. ■ [The Lancet](#)



Westend61/Gettyimages