

## Commentary

# Gene-Edited Baby by Chinese Scientist

## The Opener of the Pandora's Box

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**SUMMARY**

Gene editing is not limited to human and animal systems only but also in plant technology for improved food production. Gene editing have also been applied in disease control, manufacture of drugs, and vector control. The concept of gene-editing could accelerate the field of gene therapy as a major source of scientific and biotechnology circles. Utilization of this technology may have a number of positive impacts and consequently negative impacts on human life and the environment. Gene editing technology also comes with unintended consequences which offset any positive effects. It can be time-consuming to characterize the basic parameters in the system. Chinese scientists claimed to have successfully produced the first ever gene edited babies. The central objective of the procedure was to protect the twins from contracting HIV virus. Gene editing can result in an alteration of genes other than those targeted by scientists. Moreover, safety concerns have been raised and the Chinese scientists championing for its implementation have been asked to stop for a while. The researchers and scientists should, therefore, focus on advancing the technology in order to prove it safe and ethical. It is equally important to appreciate and improve on what the technology can do. ■

**KEYWORDS** Gene-edited Baby; CRISPR-Cas9; Human Genome; Ethics; Science

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**T**HE Chinese group has become the first to perform an injection to a person with cells containing genes edited using the CRISPR-Cas9 technique. CRISPR is a modern technique which is more efficient than other techniques and is probably expected to increase the process of getting gene-edited cells into the clinic worldwide. A number of Chinese signed a letter which condemned experimentation on the human as being crazy. Jiankui He, a Chinese researcher claimed to have altered a pair of twins while they were still embryos (1). During the process, the scientists reported that The Pandora's Box had been opened and that they may still have a chance of closing it before it becomes irreparable following the safety and ethical considerations (1).

Chinese researchers have claimed that they have successfully made the first ever gene edited babies using CRISPR though not every person support this experiment which is deemed controversial (2). The aim of editing the genes was to protect the newborn from HIV virus infection. It is reported that in the trial process, the fathers were HIV carriers and the couples had accepted to participate in the trial by signing consent forms. However, the claims have not been published in any journal and it would require submission to science for peer review. The researchers suggest that the society will decide on what to do next on the basis of the results of the trial.

The gene editing tools offer a number of solutions and are at the phase of entering the clinical area. T-cells have been proven to be the target cells for the gene engineering for the process of ex vivo manipulation (3). The announcement on the claim by gene specialists to have created first ever gene edited babies shock the world. The DNA pair of the twins was altered to prevent them from being infected by HIV virus.

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## IMPACTS OF GENE-EDITING TECHNIQUE

There are several impacts of gene-editing approach in various technological aspects. Although gene-editing has a number of positive impacts, scientists are worried that the approach gives limited time to address ethical and safety concerns which the procedure could raise. As a result of a number of negative impacts too, are expected to be presented by the technology of gene-editing. Some of the impacts are discussed below.

### Disease Control

Disease resistance is one of the popular applications of gene-editing technology in agriculture. The scientists involved are tinkering across a variety of animals. For instance, Brian Gillis who is a biotechnology entrepreneur hopes that the approach can assist in breaching the dramatic loss of honey bees around the world (4). The loss has been caused by factors which are attributed to disease and parasites.

### Making Drugs

There has been a quest to modify allergens in chicken eggs which requires delicate control. The process demands an adjustment of the genetic sequence in a way that will stop the protein from triggering an immune reaction in people (4) but still perform the normal function in embryonic development. Researchers have plans to produce chicken whose components require integration of CRISPR directly into their genome. This edition will make it easier chicken DNA and create drugs from domesticated animals.

### Vector Control

Genetically modified mosquitoes have been used to prevent the spread of diseases such as dengue and malaria over decades. Gene-editing proves to be another alternative that could be utilized in vector control. Molecular biologist Anthony James explained a line of mosquitoes with gene drive – a synthetic system that passes the malaria resistance gene onto the mosquito's offspring (4). This gene drive ensures that all insects' offspring inherits copies of the edited gene thereby allowing it to spread very fast to over the population.

Researchers reported having edited mosquitoes making them unable to carry the parasite causing malaria (5). Moreover, the ability to reshape other species, scientist, biologists, and biomolecular specialists suggest that application of the technique on animals may bear a looming prospect on fiddling with our own life.

### Better Food Production

There has been a controversial debate over the merits of genetically engineered foods. Retailers have been forced to stop the sale of genetically modified foods even as farmers embrace them and make efforts to seeking legislation for the same. Gene-editing is expected to reduce the need for farmers to cull animals. Culling has been

seen as an expensive and arguably inhumane practice. Using gene-editing approach, Biotechnologist Alison used the technique to ensure that beef cattle could produce only male because female produces less meat and are often culled (4). In the egg industries, adding a gene for a green fluorescent protein to the chicken sex chromosomes will allow the male embryos to grow under UV light. Male eggs could be removed before they hatch and be potentially applied in vaccine production (4).

Technology advocates argue that gene-editing technology can improve farming efficiency. This will boost the ability to feed the growing population with limited negative impacts on the environment. For instance, the approach will significantly make the livestock industry more efficient through conventional breeding within the same period of time (5).

### Fallout in the Food Chain

Criticism has been raised concerning the changes that might affect animals' health such as the composition of meat and milk (6). Gene-editing tools are known to alter genes other than their intended targets. Consumers, therefore, advocates need for caution in the application of techniques which are still new to animals that will be consumed as foods. For example, the Chinese researchers have to produce meatier cashmere goats that grow long hair, miniature pigs that lack growth gene and are set to be sold as novelty pets and bulky beagles. The researchers are also utilizing the CRISPR-Cas9 tool to alter pigs with the hope of making them grow human organs and create gene drives to be spread over the entire population (5). Such gene editing on animals poses a health risk on the human who consume such animals. The food chain will be altered out and the consumers will need to find alternative sources of food.

### THE PANDORA'S BOX

Chinese scientists have mentioned that Pandora's Box has been opened, however, they pointed out that they still have a chance of closing it before it becomes irreparable. The scientists argue that the approach may ruin Chinese science. The removal of the CCR5 using the CRISPR-Cas9 which the scientists claim, will help in immunizing against AIDS, smallpox and consequently cholera (7). On the other hand, if the technique is allowed on babies, the rich may spend money on creating beautiful, healthy and smart baby designers while the

poor remain impoverished with no effort of creating offspring.

### ETHICAL CONCERNS

Southern University of Science and Technology, China, pointed out that the experiment was carried outside the biological school and that it is believed to have violated academic ethics. The university stated that the experiment had been an independent investigation in that the reports were not discussed by the academic committee. The letter from the university stated the investigation ruined the reputation and progress of science in China. They argue that is unfair for scholars and in China who are well known for research and innovation (1). The letter further suggested that it is highly risky to perform a direct transformation of a human embryo in an effort to produce a baby. Worldwide, biomedical scientists have not tried to conduct such a process due to the high risk of making mistakes that will have long-term social impacts on future generations.

A warning has been given on the process of gene-editing. The warning stated that the transformation of genetic material in humans is not certain and the mixing of genes will be unavoidable. Two baby girls were born healthy through the procedure but still, an immeasurable potential risk to humans is expected if the procedure is to be continued into the future.

### SAFETY CONCERNS

Clinical trials which applied different techniques had shown positive results. The introduction of gene editing, however, proved to be simple and more efficient than other techniques used before. The team had plans to treat a total of ten people who will each receive two to four injections. The process is reported to be a safe trial, participants are to be monitored for six months to determine if the injections could cause adverse effects. The treating team will also watch the participants beyond the time they will benefit from the treatment procedure. However, Rizvi has questioned whether the particular trial will succeed in the future. Rizvi argues that the extraction, modification of genes and cell multiplication is a huge process which is not easy to scale (8). The argument is based on the fact that unless the process proves to be highly efficient, it will be hard to conclude on the moving forward. Rizvi doubts that the process will be

more valuable as compared to the use of antibodies which can be used in large quantities in a clinic (8). The response to this question by saying that the trial is being evaluated and it is too early to decide on the approach to take.

Questions have been raised on how genes of embryos will be beneficial to future children. For the case of the twins in the experiment, their mother does not have HIV then their father should be well controlled. Measures should be formulated to prevent the father from passing the virus to his children. Most biologists think that gene-editing is somewhat early to be implemented for the human embryos until it is proven safe (9). The risk involved in gene editing is that it does not take place only until the fertilized egg begins to divide. Another potential risk is that the editing machines cause mutations in the other genes. If the science progresses enough, it may be reasonable to use the technique in embryos with deadly genetic mutations (9).

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## GENE-EDITING IS A TECHNOLOGY THAT WILL SAVE LIVES

American biochemist who is one of the investors of the CRISPR gene editing called for the implementation of the technology in implanted embryos. Scientists claim that editing the embryo will reduce the risks of contracting HIV virus. However, the process may render a person to be more susceptible to West Nile Virus (10). The discussion focused on medical advances such as gene editing and especially those which have impacts on vulnerable population should be tested carefully with caution, discussed with patients, scientists, physicians, and the community members, and implemented with equally (8).

## ARTICLE INFORMATION

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## RELIABILITY

It remains a mystery to prove and ascertain whether the results of the gene-editing experiment could stand up to the rigorous scrutiny. Questions being asked include whether the trial could get ethical approval and whether the babies could indeed resist the HIV virus over their entire life (11, 12). The reliability of the results remains a lingering riddle given that the infecting the participants just to validate the claims is a criminal offense.

The technology has been pointed out to become a tool for maintaining class divisions among the rich and the poor. Stephen Hawking points out that there will be a struggle of self-designing people who will always aim at improving with an increasing rate (13, 14).

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## CONCLUSION

Gene editing through a number of techniques has been a crucial development for the understanding of life processes and how they evolve. Huge progress has been made in editing DNA and RNA with the aim of protecting the newborn from infectious diseases such as HIV virus. Gene editing by the Chinese scientists using CRISPR provide rapid techniques for inserting, modifying and deleting DNA sequences. Chinese scientists have successfully produced gene-edited twins by applying the technology. However, safety and ethical concerns remains to be important questions. Gene editing will continue to advance and to be technically achieved while researchers and the society whether or not the technology should be accepted. ■

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