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## Genetic Modification Goes Beyond Ethics

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(The editorial is based on the article “Genetic Modification Goes Beyond Ethics” which appears in Livemint for 29th November 2018.)

**Globalization and ever-increasing scientific advancements in the health industry have made the upgradation and adoption of ethics within the regulatory framework even more significant.**

**In news:** [World's First Gene Edited Babies](#)

Ever since researchers at the University of Alicante in Spain came up with the revolutionary new gene-editing tool CRISPR, the chance to play a vital role and the temptation to do it have been beckoning scientists. Recently a Chinese researcher He Jiankui claimed, that he had created the world’s first genetically edited babies by altering their DNA using CRISPR. He claimed the genes of the twins had been edited to resist the HIV virus, which is what makes the framing of the argument against genetic editing much more complex. Though his claim is still unverified, it triggered the debate whether gene editing violates academic ethics and standards or not.

This announcement caused predictable alarm with many wondering if these experiments have gone too far. The argument that tinkering with the variability of a gene pool can have disastrous consequences, given that genes are connected and for one single character many of them have to work in unison, now stand challenged.

### Background

- In 1996, when Dolly the sheep became the first mammal ever to be cloned from another individual’s body cell, fears were raised that human cloning was inevitable.
- Since then horses, cats, dogs, and livestock have been cloned across the world without creating much of a stir through the announcement of two genetically identical macaques, Zhong Zhong and Hua Hua, at a laboratory in China did stoke fears of human cloning is the inevitable next step.

- Although, when scientists in the 1970s discovered how to fertilize human eggs in test tubes there was the apprehension that this might lead to people cherry-picking only high-quality parents for their children, it didn't happen. Now it is helping childless parents to bear a child.

## Applications of Gene Editing

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- CRISPR/Cas9 is one of the newest genome editing tools. It can alter sections of DNA in cells by cutting at specific points and introducing changes at that location. Already extensively used in scientific research, CRISPR/Cas9 has also been seen as a promising way to create potential genome editing treatments for diseases such as HIV, cancer or sickle cell disease. Such therapeutics could inactivate a disease-causing gene, or correct a genetic mutation.
- CRISPR gene editing provides for the ultimate toolbox for genetic manipulation. CRISPR systems are already delivering superior genetic models for fundamental disease research, drug screening, and therapy development, rapid diagnostics, in-vivo editing and correction of heritable conditions. Scientists are working on the theory that CRISPR might be used to boost the function of the body's T-cells so that the immune system is better at recognizing and killing cancer. Disorders of the blood and immune system are other potential targets.
- Around 80 patients with HIV had immune cells in their blood removed in the world's first gene-editing trials that took place in California and involved a different technique called (Zinc-finger nucleases) ZFNs.
- Researchers in China edited human embryos to try to correct a faulty gene that caused an inherited blood disorder.
- Scientists said they had used gene editing to create a mosquito that can resist malaria.
- Plant breeders are using CRISPR to create disease-resistant strains of crops.
- In medicine, gene editing could potentially cure inherited diseases, such as some forms of heart disease and cancer, and a rare disorder that causes vision loss.
- In agriculture, this technique can create plants that not only produce higher yields, like Lippman's tomatoes but also ones that are more nutritious and more impervious to drought and pests, traits that may help crops endure more extreme weather patterns predicted in the coming years.

## Ethical Concerns

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- Wealthy parents buying the latest offspring upgrades for their children. There will be the **emergence of genetic haves and have-nots**, leading to even greater inequality than we already live with.
- Also, human embryo editing research may not be adequately controlled, leaving it open to a lab somewhere to create gene-edited babies.
- Some of the key scientists in this field have **concerns about the potential misuse of**

- a **technology** that could be used for eugenics, to create genetic discrimination.
- But **even in agriculture, genetic modification is a subject of major debate**, especially in developing countries, including India.
- Most of the ethical discussions related to genome editing center around human germline editing. This is because **changes made in the germline would be passed down to future generations**.

**Germline:** is the cellular lineage of a sexually reproducing organism from which eggs and sperm are derived, also: the genetic material contained in this cellular lineage which can be passed to the next generation.

**Germline Editing** means deliberately changing the genes passed on to children and future generations – in other words, creating genetically modified people. Human germline modification has for many years been widely considered off-limits, for both safety and social reasons. It is formally prohibited in more than 40 countries.

- There is also debate that, ecological disequilibrium can be caused by gene editing.
- Due to the possibility of off-target effects (edits in the wrong place) and mosaicism (when some cells carry the edit but others do not), safety is of primary concern.

## Way Forward

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- Human civilization has always progressed by interfering with the natural evolutionary process. In this process, the application of Gene Editing is inevitable. However, to prevent it from being a disruptive force, it is better to regulate it.
  - **India does not have a comprehensive gene editing policy in place, though germline gene editing is banned in line with international norms.** Yet, in the face of persisting diseases and crippling human conditions, divine intervention may sometimes need to be supplemented with genetic ones in a carefully regulated environment.
  - **There is also an international effort led by the US, UK, and China to harmonize regulation of the application of genome editing technologies. This effort officially launched in December 2015 with the International Summit on Human Gene Editing in Washington, DC.**
  - **A UNESCO panel of scientists, philosophers, lawyers, and government ministers has called for a temporary ban on genetic “editing” of the human germline,** calling for a wide public debate on genetic modification of human DNA. It is important to have **continuing public deliberation and debate** to allow the public to decide whether or not germline editing should be permissible.
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