

## EDITING OUR GENES

Relevant for: Science & Technology | Topic: Biotechnology, Genetics & Health related developments

American biochemist Jennifer Doudna, one of the pioneers of the gene editing tool Crispr-Cas9, woke up in a cold sweat after she dreamt of Adolf Hitler. He was wearing a pig mask, and wanted to understand the tool's uses and implications. In the book she co-authored, *A Crack in Creation: Gene Editing and the Unthinkable Power to Control Evolution*, Doudna recounts the dream, and acknowledges the "truly incredible power" of the technology, "one that could be devastating if it fell into the wrong hands."

Crispr, an acronym for Clustered Regularly Interspaced Short Palindromic Repeats, harnesses the natural defence mechanisms of bacteria to alter an organism's genetic code. It's likened to a pair of molecular scissors, a cut-and-paste technology, that can snip the two DNA strands at a specific location and modify gene function. The cutting is done by enzymes like Cas9, guided by pre-designed RNA sequences, which ensure that the targeted section of the genome is edited out. The elegance of this editing tool has transformed medical research, and gives rise to the question: can a faulty gene be deleted or corrected at the embryonic stage?

Last month, researchers in China used a variation of Crispr. Instead of snipping strands, they swapped DNA letters to correct Marfan Syndrome, an inherited disorder that affects connective tissue. Huang Xingxu, the lead author of the paper, which was published in *Molecular Therapy*, said it was done on 18 viable human embryos through in-vitro. Two of the embryos, however, exhibited unintended changes. All were destroyed after the experiment.

In 2017, American biologist Shoukhrat Mitalipov used Crispr to repair a genetic mutation that could cause a deadly heart condition. It was done on embryos in such a way that the faulty gene would not be passed down the family tree. The findings are the focus of an ongoing debate, with several scientists sceptical of whether the gene was corrected. Can accuracy be guaranteed in early stage embryos?

Bioethicists expressed concern over the clinical application of such research. Can we — and should we — control or dictate evolution? These are still early days in a new frontier of genome engineering. Researchers are only beginning to understand the power — and fallout — of gene editing.

Studies have shown that edited cells can lack a cancer suppressing protein. As our understanding grows, we will have the potential to edit out genes that cause fatal diseases. We will perhaps one day have the potential to use the very same mechanisms to edit out undesirable traits in human beings. This raises the spectre of eugenics.

Bioethicists fear abuse of gene editing, not just by misguided governments hoping to create a 'superior' race, but also by the private sector preying on a parent's desire to create a perfect child. For now, it remains a distant prospect, but silencing science or hijacking the debate is not the answer. The burden of this knowledge cannot be borne by science alone.

*The writer is with The Hindu's Bengaluru bureau*

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