

CRISPR

Gene-editing technology as a new frontier

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Clustered Regularly Interspaced Short Palindromic Repeats, CRISPR for short, also known as CRISPR/Cas9. Now that's quite a mouthful. In layman's terms, CRISPR is the technology that allows us to edit the genes of living organisms. CRISPR/Cas9 equals the potential if not outweighs that of the computer as an emerging technology back in the 1980s. It's not an overstatement to say that this technology holds the key to change our species forever.

HOW IT WORKS

All living things, including human beings, are the result of the information they carry within their genes. DNA is the building block of genes. DNA holds the data according to which cells produce different proteins. These proteins carry out all our physiological functions and even determine how we look. Sometimes there are mutated or sick genes that cause genetic diseases. CRISPR is a programmable technology that can be used with extreme

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precision to cut out a particular bit of DNA out of a genome sequence or insert a particular bit from outside. It can be thought of as a pair of genetic scissors. It allows us to get rid of genetic diseases by cutting out the faulty genes that cause them. It also lets new characteristics—such as increased growth, resistance to pest attack etc. form in an organism by inserting certain DNA information in a genome.

APPLICATIONS

Gene-editing technology has been around since the 1970s. What makes the appearance of CRISPR on the scene so revolutionary is its simplicity and cost-effectiveness. CRISPR's potential applications are extraordinary, unprecedented, and sometimes fearful because of its power to cause irreversible changes to the human race.

At this point, agriculture stands to benefit the most from CRISPR/Cas9. With the global population rapidly rising, this technology can meet the challenges of the global food supply. CRISPR is already being experimented with by scientists and Agritech industries all over the world. It has produced hundreds of crop variants with a higher yield. By tampering with the DNAs that make crops susceptible to pests, drought, and a whole array of diseases, CRISPR aims to improve plant life significantly. It can also be applied to boost the nutrition value of foods and increase shelf-life.

Pairwise, a food company, promises to make fruits and vegetables more appealing to consumers so that they are chosen as snack items instead of harmful junk food with the help of CRISPR.

The application of CRISPR is not just limited to crops but extends to livestock too. In China, police dogs with increased muscles have been successfully bred. Currently, the experiment is being conducted to increase meat yield from industrially farmed animals such as goats and cows. There is research in place to harvest a breed of pigs to cultivate organs. The American company Genesis is currently working on this project.

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An American woman named Victoria Gray has already been treated successfully for Sickle Cell Disease. Therapies, diagnostics and treatment methods are being devised and studied every day. This technology isn't even a decade old, and it's already very prominently in the race to eradicate cancer and HIV. In its theoretical simplicity of cutting out the sick DNA and possibly replacing it with a healthy one, CRISPR has opened up a gate for swift and wondrous medical advancement.

IN BANGLADESH

It may come as a surprise that such a sophisticated and brand-new technology is already being studied and practised in our

country. Professor Shah Faruque of ICDDR and his team, comprised of all Bangladeshi scientists, have been published in the reputed Nature Publishing Group Journal *Scientific Reports* for their work on CRISPR on a group of viruses that attack the Cholera bacteria. This work can help create viruses that prevent and eliminate cholera. Professor Faruque is currently working on life sciences at the Department of Mathematics and Natural Sciences of BRAC University.

The Department of Biochemistry and Molecular Biology at Dhaka University, Krishi Gobeshona Foundation, National Institute of Biotechnology, and other institutions are actively studying the CRISPR/Cas9 system. Experiments aim to eradicate wheat-blast and other crop diseases, increase produce, develop resistance to harsh natural conditions, etc.

GRAINS OF SALT

Like all other major technological breakthroughs, the CRISPR/Cas9 comes with the potential of causing disruptions in society and the world. Several ethical concerns stand at the forefront of the use of this technology. Chinese scientist He Jiankui currently faces three years in jail because of his 2018 experiment of creating two designer babies. He used CRISPR to eliminate the genes responsible for HIV in the children while still in an embryonic state. While this may sound like a marvellous use of the technology, this is still uncharted territory.

This kind of premature application may affect the complex interplay of genes and result in unwanted genetic mutation. Tampering the embryo state with CRISPR creates heritable mutations which go down the generations and has the potential of messing up the entire human gene pool, effectively changing the blueprint of life. Also, the matter of consent is clearly out of the question regarding the application on embryos.

Providing the wealthy with the means to engineer their babies genetically will rip open social inequality to an unforeseen extent. In the wrong hands, there are the looming threats of creating biological weapons and super-soldiers.

Gene editing will affect our lives whether we're for it or against it. Prudent research under the framework of cautious regulations is the only way to move forward with this technology into the future.