CRISPR Technology

This article is based on **"Gene editing, the good first and then the worries"** which was published in The Hindu on 13/10/2020. It talks about the opportunity and issues related to CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats) technology.

Recently, the **Nobel Prize in Chemistry for 2020** was given to two women scientists namely Emmanuelle Charpentier (France) & Jennifer A. Doudna (Germany). The nobel prize was given to them for the development of a method for genome editing.

The two scientists have pioneered the use of **CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats)** – Cas9 (CRISPR-associated protein 9) system as a gene-editing tool.

Using components of the CRISPR system, researchers can add, remove, or even alter specific DNA. This has led to a significant impact in biology, medicine, and agriculture.

However, there is growing fear that the promising **gene-editing system** can cause many social and anthropogenic issues.

Application of Gene-Editing

- **Agriculture:** It is being tried out in agriculture primarily to increase plant yield, quality, disease resistance, herbicide resistance and domestication of wild species.
    - The huge potential to edit genes using this tool has been used to create a large number of crop varieties with improved agronomic performance; it has also brought in sweeping changes to breeding technologies.
- **Genetic-Research:** 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.
- **Medical Treatment:** 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.
    - Researchers in China edited human embryos to try to correct a faulty gene that caused an inherited blood disorder.
- **Therapeutic Cloning:** It is a process whereby embryonic cells are cloned to obtain biological organs for transplantation.

Issues Involved

- **Debate in Agriculture Genetic Modification:** There are concerns over the inadvertent effects, such as the creation of food that can cause an allergic reaction.
    - Two studies, one from the Karolinska Institute, Sweden, and the other from the

biopharmaceutical company Novartis, have highlighted that CRISPR-Cas9-edited cells might trigger cancer.

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

Note:

- Germline is the cellular lineage of a sexually reproducing organism from which eggs and sperm are derived.

- **Genetic Inequality:** Through Gene-editing, wealthy parents can buy the latest offspring upgrades for their children.
    - This will lead to the emergence of genetic haves and have-nots and even greater inequality than the present world already lives with.
    - 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.
- **Illegal Experimentation:** Last year, a Chinese researcher used the tool to modify a particular gene in the embryo to make babies immune to HIV infection, which led to international furore.
    - Though no guidelines have been drawn up so far, there is a general consensus in the scientific and ethics communities that the gene-editing technique should not be used clinically on embryos.

Status In India

- In India, several rules, guidelines, and policies backed by the “Rules for the Manufacture, Use, Import, Export and Storage of Hazardous Microorganisms/Genetically Engineered Organisms or Cells, 1989” notified under the **Environment Protection Act, 1986**, regulate genetically modified organisms.
- Apart from it, the **National Ethical Guidelines for Biomedical and Health Research involving human participants, 2017,** by the Indian Council of Medical Research (ICMR), and the Biomedical and Health Research Regulation Bill implies regulation of the gene-editing process.
    - This is especially so in the usage of its language “modification, deletion or removal of parts of heritable material”.
    - However, there is no explicit mention of the term gene editing.

Conclusion

The gene-editing tool has indeed taken “life sciences into a new epoch”. However, like other scientific development it can turn out to be both as a boon or a bane. Therefore, it all depends how well the gene-editing science is regulated for the welfare of humankind.

Thus, it is time that India came up with a specific law to ban germline editing and put out guidelines for conducting gene-editing research giving rise to modified organisms.

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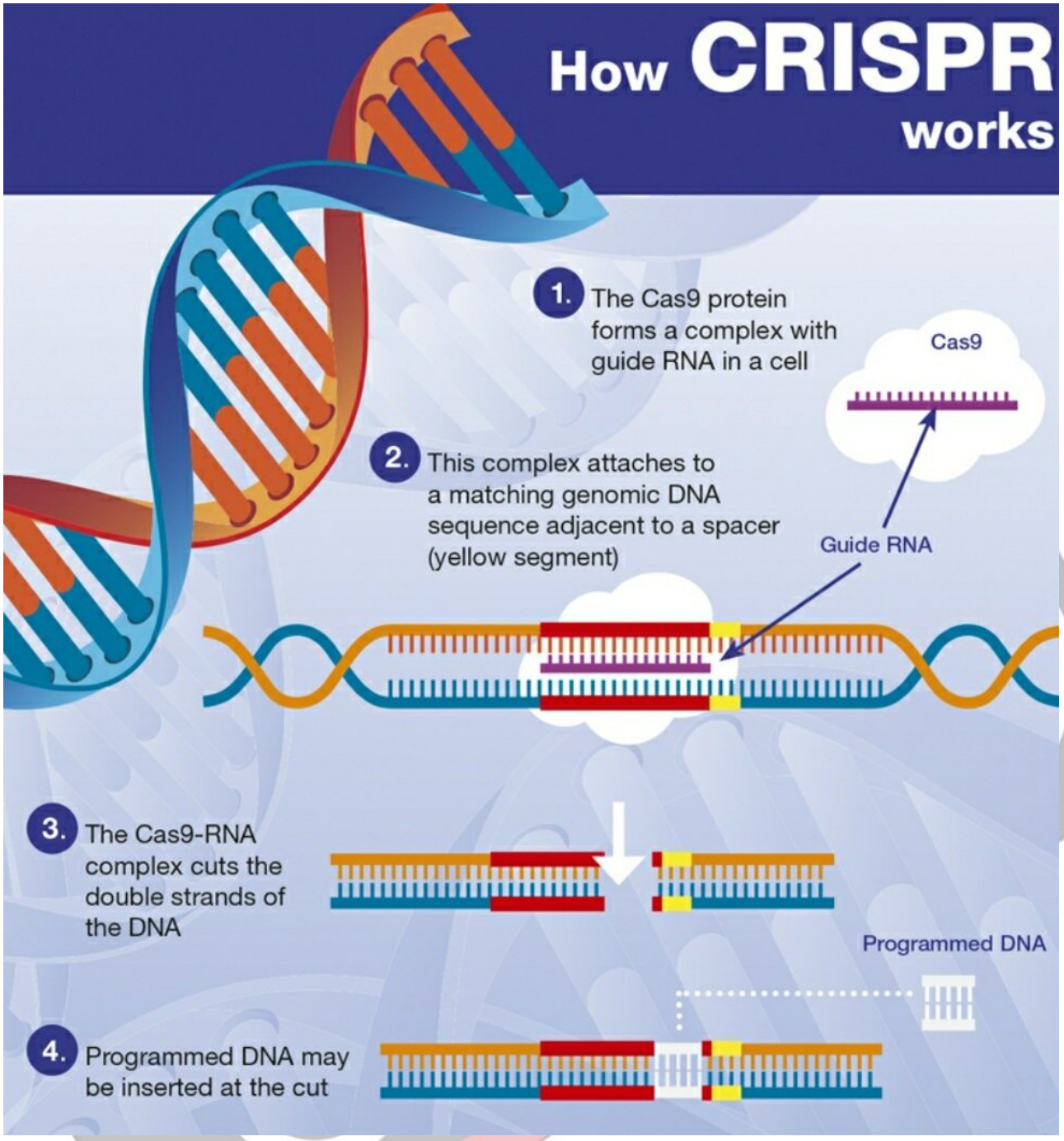

Drishti Mains Question

The gene-editing tool has indeed taken “life sciences into a new epoch”. However, like other scientific development it can turn out to be both as a boon or a bane. Discuss.

This editorial is based on **“Award for auctions”** which was published in The Business Standard on October 12th, 2020. Now watch this on our Youtube channel.