

What is DANGER (Deleterious and ANTicipatable Guides Evaluated by RNA-sequencing)?

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Why in News?

- For about a decade, researchers have used the CRISPR technology for genome editing. However, there are some challenges in the use of CRISPR.
- The first challenge is that the phenotypic, or observable, effects caused by unexpected CRISPR dynamics are not quantitatively monitored.
- A second challenge is that the CRISPR technology generally depends on basic genomic data, including the reference genome. The reference genome is like a template that provides researchers with general information on the genome. Unexpected sequence editing with mismatches can occur. These off-target sites are always unexpected.
- The DANGER analysis overcomes these challenges and allows researchers to perform safer on- and off-target assessments without a reference genome.
- The discovery holds the potential for applications in medicine, agriculture, and biological research.

About DANGER (Deleterious and ANTicipatable Guides Evaluated by RNA-sequencing)

- DANGER analysis is a new software tool that makes genome editing safer by overcoming limitations in current CRISPR technology.
- Unlike traditional methods that rely on a reference genome, DANGER works by conducting risk-averse on- and off-target assessments using RNA-sequencing data.
- It evaluates phenotypic effects based on gene expression changes caused by deleterious off-target sites.
- The software quantifies the phenotypic risk at the gene ontology level without the need for a reference genome.
- The tool successfully evaluated the phenotypic effects of gene editing in human cells and zebrafish brains.
- It can be performed on various organisms, personal human genomes, and atypical genomes created by diseases and viruses.
- The open-source nature of the software allows for its adaptation to different genome editing systems beyond CRISPR-Cas9.

What is Genome Editing?

- It is a method that lets scientists change the DNA of many organisms, including plants, bacteria, and animals.
- Editing DNA can lead to changes in physical traits, like eye color, and disease risk.
- Scientists use different technologies to do this.
- These technologies act like scissors, cutting the DNA at a specific spot. Then scientists can remove, add, or replace the DNA where it was cut.

Key Facts about CRISPR-Cas9

- CRISPR is short for Clustered Regularly Interspaced Short Palindromic Repeats, which is a reference to the clustered and repetitive sequences of DNA found in bacteria, whose natural mechanism to fight some viral diseases is replicated in this gene-editing tool.
- Its mechanism is often compared to the 'cut-copy-paste', or 'find-replace' functionalities in common computer programmes.
- A bad stretch in the DNA sequence, which is the cause of disease or disorder, is located, cut, and removed — and then replaced with a 'correct' sequence. And the tools used to achieve this are not mechanical, but biochemical — specific protein and RNA molecules.
- The technology replicates a natural defence mechanism in some bacteria that uses a similar method to protect itself from virus attacks.

Q1) What is DNA?

DNA, or deoxyribonucleic acid, is the hereditary material in humans and almost all other organisms. Nearly every cell in a person's body has the same DNA. Most DNA is located in the cell nucleus (where it is called nuclear DNA), but a small amount of DNA can also be found in the mitochondria (where it is called mitochondrial DNA or mtDNA).

Source: [Researchers develop DANGER analysis tool for the safer design of gene editing](#)

Source: <https://vajiramandravi.com/current-affairs/danger/>

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