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# TODAY'S IMPORTANT CURRENT AFFAIRS

# UPSC Mains

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## CRISPR TECHNOLOGY

**Source**: The post is based on the article published in **"The Hindu"** on **06.04.2025**.

**In News**:ACTREC's CRISPR -based test detects a rare blood cancer.

The new test developed using CRISPR technology can quickly and accurately diagnose Acute promyelocytic leukemia (APL) a rare and aggressive form of leukemia ,under 3 hours and costs less than existing tests.

**Syllabus:** ***Mains – GS III (SCIENCE AND TECHNOLOGY -biotechnology)***

### Acute Promyelocytic Leukemia (APL)

Acute Promyelocytic Leukemia (APL) is a rare subtype of acute myeloid leukemia (AML), characterized by the accumulation of immature white blood cells called promyelocytes in the bone marrow and blood. It is caused by a genetic mutation involving chromosomes 15 and 17, resulting in the PML/RARA fusion gene.

### symtoms

✧ Bleeding and Bruising: Easy bruising, bleeding gums, nosebleeds, and heavy menstrual bleeding due to low platelet counts and coagulopathy.

- ✧ Fatigue and Anemia: Tiredness, pale skin, and shortness of breath due to a lack of red blood cells.
- ✧ Infections: Frequent infections due to low white blood cell counts.
- ✧ Weight Loss: Unintended weight loss and loss of appetite.
- ✧ Blood Clots (Thrombosis): Formation of blood clots in various parts of the body, such as legs or lungs.
- ✧ Fever and Other Symptoms: Fever, chills, night sweats, and petechiae (small red spots on the skin)

## CRISPR technology

CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats) is a revolutionary gene-editing technology derived from the natural immune system of bacteria. It allows us to precisely modify DNA by adding, removing, or altering genetic material at specific locations in the genome.

## Working of CRISPR

CRISPR works by utilizing two main components:

- ✧ Guide RNA (gRNA): A synthetic RNA molecule designed to target a specific DNA sequence.
- ✧ Cas9 Protein: An enzyme that acts as molecular scissors to cut the DNA at the targeted site.

## Steps of Function:

- ✧ The gRNA directs Cas9 to the desired DNA sequence.
- ✧ Cas9 creates a double-stranded break in the DNA.
- ✧ The cell repairs the break using one of two mechanisms:
- ✧ Non-Homologous End Joining (NHEJ): Often results in random insertions or deletions, disrupting gene function.
- ✧ Homology-Directed Repair (HDR): Allows precise insertion of new DNA using a repair template.

## Principles Behind CRISPR

CRISPR exploits a bacterial defense mechanism where bacteria store fragments of viral DNA in their genome as "memory" of past infections. When attacked again, they produce RNA from these stored sequences to guide Cas enzymes to destroy the virus's DNA.

## CRISPR Uses

CRISPR is used because it is:

- ✧ Precise: Targets specific DNA sequences.
- ✧ Efficient: Works faster than older methods.
- ✧ Cost-effective: Requires fewer resources.

CRISPR technology, particularly the **RAPID-CRISPR system,** is **emerging** as a promising tool in the diagnosis and treatment of Acute Promyelocytic Leukemia (APL).

## How RAPID-CRISPR Helps in APL or its merits compared to Other traditional methods.

- ✧ Rapid Diagnosis

The RAPID-CRISPR system can detect the PML::RARA fusion transcript, a hallmark of APL, in under three hours. This rapid identification is crucial as APL is a medical emergency with a high early mortality rate if not diagnosed promptly.

- ✧ Effective method.

The method employs a sensitive assay that can identify very low levels of PML::RARA, making it more effective than traditional diagnostic techniques, which can take longer and require sophisticated equipment.

- ✧ High Sensitivity and Specificity.

## Conclusion

The integration of CRISPR technology into the diagnosis and treatment of Acute Promyelocytic Leukemia represents a significant advancement in oncology. With its ability to provide rapid diagnostics and target cancer-causing genes precisely, CRISPR holds promise for improving patient outcomes and potentially curing this aggressive form of leukemia. However, further research is essential to confirm long-term safety and efficacy before widespread clinical application