Birsa 101 CRISPR Gene Therapy

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Why in News?

Recently, The Ministry of Tribal Affairs, along with CSIR and CSIR-IGIB, held a workshop on Birsa-101, during the Janjatiya Gaurav Utsav 2026.

- **Birsa-101 –** India's first indigenous *CRISPR* (Clustered Regularly Interspaced Short Palindromic Repeats) based gene therapy for ***Sickle Cell Disease (SCD).***
- **Nomenclature –** Named after ***Bhagwan Birsa Munda***, marking his 150th birth anniversary.
- **Developed by –** CSIR-IGIB (Council of Scientific and Industrial Research – Institute of Genomics and Integrative Biology), with support from the ***Ministry of Tribal Affairs.***
- **Technological framework –** Transferred to *Serum Institute of India* for manufacturing.
- **Key Features -** It works like a *precise genetic surgery*, capable not only of curing Sickle Cell Disease but also transforming treatment pathways for several hereditary disorders.
- Uses engineered *enFnCas9*, a sharper and safer molecular tool than SpCas9 used in Casgevy.

  enFnCas9 *– (enhanced Francisella novicida Cas9) is a next-generation CRISPR gene-editing platform engineered for ultra-high specificity and efficiency.*

  SpCas9 *(Streptococcus pyogenes Cas9) is the most widely used CRISPR-Cas9 genome editing enzyme.*

- *Genome-wide assays* showed up to 1,000-fold fewer off-target events

compared to conventional CRISPR tools.

Genome-wide assays scan an organism's entire DNA sequence at once. This allows scientists to identify genetic mutations, measure gene activity, and map molecular interactions across the whole genome.

- **Mechanism of Action**
  - **Direct Root Correction –** Birsa 101 corrects the single genetic misprint causing sickle cell disease.
  - **Stem Cell Editing –** The therapy extracts and edits blood-forming stem cells from the patient's bone marrow to fix the defect.
  - **Permanent Cure –** Engrafted cells produce healthy blood for patient's lifetime subject to long-term clinical follow-up.
- **Affordability** - It is designed to be more affordable than expensive foreign gene therapies like Casgevy and Lyfgenia.
- **National Mission** – India aims to eliminate sickle cell disease by **2047,** heavily focusing on tribal welfare across critical belts like *Jharkhand, Chhattisgarh, Madhya Pradesh, and Odisha.*

Quick Facts

Sickle Cell Disease • A hereditary blood disorder caused by a *single typo in the genetic code.* • Red blood cells twist into a *crescent or sickle shape, clogging blood vessels.* • Leads to *oxygen starvation of organs*, painful crises, and long-term damage to heart, lungs, and kidneys.
CRISPR • It is a revolutionary gene-editing technology, works like molecular scissors (Cas9 protein) guided by RNA to cut defective DNA. • The cell repairs itself using a corrected DNA sequence. • Enables scientists to locate and fix errors in DNA with extraordinary precision.

References

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