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Minicircle DNA in Cellular Therapies: Advancing CAR-T Cell Engineering

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The oncology landscape has been transformed by the rise of CAR (chimeric antigen receptor) T-cell therapies, which enable engineered T-cells to recognize and eliminate tumor cells with high precision.



However, conventional manufacturing approaches face significant hurdles: plasmid-based transfection is often inefficient due to DNA-induced toxicity, while viral vectors carry inherent safety concerns and regulatory complexity. These limitations frequently necessitate multiple expansion cycles, making the process labor-intensive, costly, and prone to T-cell exhaustion.

Minicircle DNA offers a powerful alternative. With its minimal size and lack of bacterial backbone, minicircle DNA dramatically reduces DNA toxicity and immunogenicity—resulting in more efficient gene transfer and enhanced T-cell viability. When paired with transposon systems such as Sleeping Beauty or PiggyBac, it enables non-viral gene integration with near-random insertion profiles, significantly improving the safety profile of engineered CAR-T cells. These advantages also extend to the reprogramming of sensitive cell types, including stem cells.

Key Advantages of Minicircle DNA for CAR-T Cell Applications:

- Lacks bacterial backbone – no unnecessary sequences
- Low DNA toxicity – greater T-cell viability
- Improved safety – aligns with evolving regulatory standards
- Clinically validated – success in multiple CAR-T studies

Accelerate your CAR-T cell development with minicircle DNA.
We're here to support your innovation.

https://www.plasmidfactory.com/custom-dna/minicircle-dna/

Find out more about successful Minicircle applications at our ESGCT Lunchtime Symposium *October 08 | 01:30 pm - 02:30pm | more info to follow*

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