Rethink cell therapy with LNPs



What are LNPs?

Lipid nanoparticles (LNPs) are innovative non-viral delivery systems that encapsulate and safeguard nucleic acids, such as mRNA or gene editing cargo, for safe delivery into cells.

These advanced delivery systems have already proven their value in high-impact settings like COVID mRNA vaccines and CRISPR applications. Now, they're being adapted for non-viral delivery in engineered cell therapy workflows such as CAR T and hematopoietic stem cell (HSC) modification—opening new avenues for next-generation cell therapies.

Imagine them as precise, protective couriers for your payloads that are gentler, more consistent, and ready-to-scale.

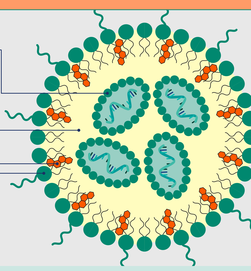


Fig 1. Schematic illustration of a lipid nanoparticle

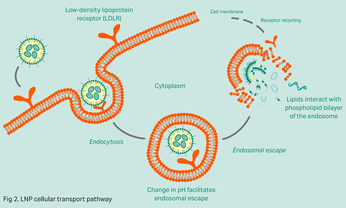


Fig 2. LNP cellular transport pathway

Where do LNPs fit in your cell therapy workflow?

LNPs streamline cell therapy without complex workflows.

Whether you're developing CAR T or editing hematopoietic stem cells (HSC), LNPs offer a gentler, more consistent path from formulation to transfection to scale-up—an effective alternative to electroporation.

It begins with selecting the right payload, such as mRNA, siRNA, or gene-editing tools like Cas9. This cargo is encapsulated in LNPs using a controlled formulation process to protect it and promote efficient delivery. Whether sourced externally or formulated in-house using Cytiva's scalable **NanoAssemblr™ platform**, LNPs are designed to fuse with the cell membrane and release their cargo directly into the cytoplasm, minimizing cellular stress and preserving viability.

LNPs: Simplifying complexity in cell therapy workflow

Once the LNPs are ready, they step into the cell therapy process to deliver their cargo—gently and effectively, replacing harsher methods like electroporation.

Apheresis

Begin with patient- or donor-derived cells.

If cryopreserved, the **VIA Thaw™ system** ensures a controlled, closed, and consistent thawing process, helping preserve cell viability and integrity for downstream processing.

Plug-and-play, lower batch-to-batch variability

Gene transfer

Introduce LNPs into your culture — no pores, no pulses.

These nanoparticles fuse with cell membrane and release cargo. With the **Xuri™ cell expansion system W25**, maintain optimal condition for transfection to support efficient and gentle gene transfer in a controlled, sterile environment.

Harvest and formulation

Recover and formulate cells using the Sefia Select™ system — a closed, automated platform designed to gently harvest cells while preserving viability and phenotype.

The Sefia Select™ system also supports the formulation step, ensuring consistent product quality and minimizing contamination risk.

Our workflow solutions, connected and enabled by **Chronicle™ automation software**, allow you to access and store instrument data, receive alerts, and create batch records

Fewer cell handling steps

Isolation

Isolate your target cells — with **Sefia Select™ system**.

Automated, functionally closed processing helps maintain cell phenotype and purity, while reducing manual variability and minimizing contamination risks.

Protocol-driven, no instrumentation calibration

Expansion

Scale cell growth while maintaining quality using the Xuri™ cell expansion system W25 or transition to our next-generation platform, **Sefia™ expansion system**, designed specifically for T cell processes.

Both platforms offer precisely controlled conditions to ensure high cell yields, consistent product quality, and reduced operator intervention.

Streamlined quality control and documentation

Cryopreservation

Cryopreserve cell therapies using the **VIA Freeze™ controlled-rate freezers**, which provide a liquid nitrogen-free solution. This ensures consistent sample quality while maintaining cell viability and function. With customizable freezing profiles and conduction cooling, VIA Freeze™ supports GMP-compliant cryopreservation, regardless of the volume. This capability allows for the cryopreservation of large quantities of cells and facilitates seamless integration into manufacturing workflows.

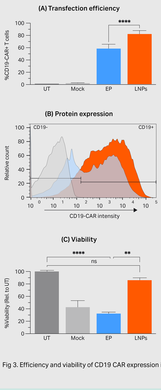
Key benefits of LNPs in cell therapy over electroporation

Non-viral delivery is gaining traction, but how do LNPs compare to traditional methods like electroporation?

This side-by-side view helps you compare key factors so you can make informed decisions for your non-viral workflow.

Attribute	Electroporation (EP)	LNP delivery
Transfection efficiency	Moderate and variable	Higher and more consistent
Cell viability	Lower and often reduced post-treatment with EP	Higher, and better maintained or minimally affected
Workflow complexity	More labor-intensive, variable	Streamlined, automation-ready
Cytotoxicity	Higher-membrane damage	Gentler, lower cytotoxicity
Allogenic compatibility	Challenging due to viability loss	Better suited for allogenic platforms

We have the data: LNPs are gentler and more efficient compared to electroporation



(A) Quantification of CD19 CAR+ T cells shows significantly higher transfection efficiency with LNPs compared to electroporation (EP), mock, or untreated (UT) controls (****p < 0.0001).

(B) Representative histogram of CD19 CAR surface expression, illustrating greater intensity in LNP-transfected cells versus EP and mock groups.

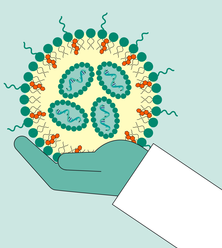
(C) Cell viability analysis reveals a significant reduction in viability following EP, while LNPs maintain higher viability relative to EP (**p < 0.01), though lower than UT and mock controls (****p < 0.0001).

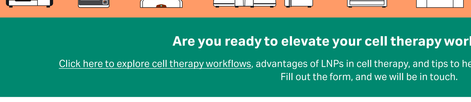
Fig 3. Efficiency and viability of CD19 CAR expression in T cells using LNP delivery.

End-to-end support for scalable success with a helping hand beside you

Scaling non-viral cell therapy delivery is a journey — and Cytiva is here with a helping hand every step of the way. We offer:

- **Off-the-shelf formulations** – optimized to your process
- **Hands-on training** - build confidence with proven protocols
- **Research use only (RUO) to GMP support** - smooth transition with process development
- **Integrated platforms** - From NanoAssemblr™ formulation systems to the Sefia™ cell therapy manufacturing platform — and to Xuri™ systems for allogeneic scale





Are you ready to elevate your cell therapy workflow process?

Click here to explore cell therapy workflows, advantages of LNPs in cell therapy, and tips to help you rethink the delivery of high-quality cells.
Fill out the form, and we will be in touch.

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