PolyDefine
A Platform for Precision PEG Alternatives for Gene Delivery

In a nutshell

Lipid nanoparticles (LNPs) are the backbone of modern gene therapies, but their performance is constrained by the use of PEG–lipids as key stabilizing components in their formulation. PEG reduces delivery efficiency and triggers immune responses that prevent repeated dosing applications. Critically, over 80% of the population already carries anti-PEG antibodies, leading to rapid clearance and loss of efficacy.
This makes PEG replacement not optional, but a fundamental requirement to unlock the next generation of RNA therapies, especially for chronic diseases, cancer, and protein replacement.
PolyDefine addresses this gap with a new class of chemically defined, monodisperse PEG alternatives. Our platform enables precise control over nanoparticle design, delivering higher performance, improved reproducibility, and a clear path toward safer, repeat-dose gene therapies.

Why is our technology important?

The next generation of RNA therapeutics will depend on delivery systems that can be precisely adapted to different diseases and patient populations. However, current LNP technologies rely on limited, largely static surface chemistries, which restrict optimization and slow down therapeutic development across indications.
PolyDefine addresses this constraint by enabling a tunable, chemically defined material platform for nanoparticle engineering. This shifts LNPs from fixed formulations to programmable delivery systems, where key surface properties can be systematically designed rather than empirically adjusted.
This level of control opens the door to application-specific nanoparticle design, including targeted delivery to defined organs, tissues, or cell types. In practice, it enables faster formulation development, improved translation from research to clinic, and a broader expansion of gene therapies into complex diseases where precision delivery is essential.

The benefits of our solution

- Higher efficacy: Increased gene expression *vs.* standard PEG–lipid systems (proof-of-concept)
- Enables repeated dosing: Avoids anti-PEG immune response and rapid clearance
- Consistent performance: Monodisperse materials eliminate batch variability
- Programmable delivery: Tunable structure enables organ-, tissue-, or cell-specific targeting
- Faster development: Simplified characterization and more predictable optimization
- Scalable integration: Gram-scale synthesis, compatible with existing LNP workflows

Keywords

LNPs, PEG alternatives, Gene delivery, RNA therapeutics, Nanomedicine

Founding Team

Prof. Sandrine Gerber, Dr. Alireza Kavand