

Lipid nanoparticles for cell and gene therapy

In recent years, lipid nanoparticles (LNPs) have emerged as a leading non-viral vector for nucleic acid delivery. Unlike viral vectors, LNPs face fewer constraints in terms of cargo capacity and immunogenicity. They can also carry diverse therapeutic payloads, such as nucleic acids, small molecules, and proteins. Given the remarkable potential of LNPs for the field of cell and gene therapy, we have dedicated this special issue of *Molecular Therapy Advances* to exploring new innovations in the design, formulation, and application of LNPs.

Since the advent of LNP-mRNA vaccines, LNPs have expanded into a variety of therapeutic applications. Thus, this special issue features original research articles and reviews on LNPs for cancer immunotherapy,¹ autoimmunity,² and gene therapy.³ As refined LNP design and formulation are critical to enable the success of these LNP therapeutics, the special issue also includes reviews focused on LNP composition and formulation,⁴ LNP structure in the context of mRNA encapsulation,⁵ and LNP membrane modification for improved RNA delivery.⁶ Finally, the call for papers for this special issue yielded impactful original research articles that explore barriers to hepatic LNP gene transfer,⁷ the identification of central nervous system-penetrant LNPs that can deliver base editing components for spinal muscular atrophy,⁸ and more.

This collection of comprehensive reviews and original research articles will provide you with a wide-ranging view of the current state of LNPs in the field of cell and gene therapy. At present, LNPs stand poised to revolutionize the *in vivo* delivery of molecular therapeutics. We hope that you gain valuable insights into the past, present, and future of LNPs from the diverse offerings in the "Lipid nanoparticles for cell and gene therapy" special issue.

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