



Advancing Nonviral Gene Delivery: Lipid- and Surfactant-Based Nanoparticle Design Strategies

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Abstract:

Gene therapy is a technique utilized to treat diseases caused by missing, defective or overexpressing genes. Although viral vectors transfect cells efficiently, risks associated with their use limit their clinical applications. Nonviral delivery systems are safer, easier to manufacture, more versatile and cost effective. However, their transfection efficiency lags behind that of viral vectors. Many groups have dedicated considerable effort to improve the efficiency of nonviral gene delivery systems and are investigating complexes composed of DNA and soft materials such as lipids, polymers, peptides, dendrimers and gemini surfactants. The bottom-up approach in the design of these nanoparticles combines components essential for high levels of transfection, biocompatibility and tissue-targeting ability. This article provides an overview of the strategies employed to improve in vitro and in vivo transfection, focusing on the use of cationic lipids and surfactants as building blocks for nonviral gene delivery systems.

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