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Lipid nanoparticles for systemic gene delivery: Challenges and future perspective

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Started with viral systems, gene delivery research is now taking steps towards development of non-viral gene delivery systems. The major focus has been on the lipid nanoparticle-based systems, especially liposomes, due to their demonstrated biocompatibility over other systems and widespread use for drug delivery. However, these systems are still challenged by toxicity issues, instability in blood, non-specific distribution and low transfection efficiency after intravenous administration. Therefore, methodical understanding of various physicochemical and biological factors affecting the efficiency of such gene delivery systems becomes essential. Moreover, challenges facing the continuous manufacturing to meet quality specifications and regulatory guidelines also need to be addressed. The presentation will cover challenges faced by lipid nanoparticle-based gene delivery and potential solutions available in literature so far for overcoming them. Current clinical status of lipid nanoparticles for gene delivery, particularly for therapeutic RNAs, and increasing interest of biopharma industries and their collaborations for development of lipid nanoparticle-based deliver systems will surely turn out to be several marketed lipid formulations for gene delivery in near future.

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