

Special Issue

Impact of Lipid Nanoparticle Physicochemical Properties on mRNA Vaccine

Message from the Guest Editor

As mRNA vaccines extend their applications from infectious diseases to oncology and other therapeutic areas, optimizing lipid nanoparticle (LNP) formulations is critical to enhancing vaccine efficacy, stability, and safety. Key physicochemical properties of LNPs—including lipid structure, particle size, surface charge, lipid composition, and structural characteristics—significantly influence mRNA delivery efficiency and immune response activation. A comprehensive understanding of how these properties affect mRNA delivery, biodistribution, and cellular uptake will facilitate advancements in vaccine design, formulation, and production. This special issue seeks to consolidate leading research and reviews examining the relationship between LNP physicochemical properties and mRNA vaccine performance. We invite original research articles, reviews, and perspectives on a variety of topics, including but not limited to: emerging technologies in LNP design, physicochemical property optimization, structure-function relationships, stability and storage solutions, targeted delivery and biodistribution, and safety and biocompatibility.

Guest Editor

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