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Lipid Nanocarriers for Neurotherapeutics: Introduction, Challenges, Blood-brain Barrier, and Promises of Delivery Approaches

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Abstract:

Significant efforts have been made in research to discover newer neurotherapeutics, however, the rate of reported neurological disorders has been increasing at an alarming speed. Neurotherapeutics delivery in the brain is still posing a significant challenge, owing to the blood-brain barrier and blood-cerebrospinal fluid barrier. These physiological barriers restrict the passage of systemically available fractions of neurotherapeutics into the brain, owing to low permeability and drug localization factors. Neurotherapeutics encapsulating lipid carriers favor a significant increase in bioavailability of poorly water-soluble drugs by enhancing solubility in the gastrointestinal tract and favoring stability. Due to their small size and lipid-based composition, these carriers offer enhanced permeability across the semi-permeable blood-brain barrier to effectively transport encapsulated loads, such as synthetic drugs, nutraceuticals, phytoconstituents, herbal extracts, and peptides, thereby reducing incidences of off-target mediated adverse impacts and toxicity. The most significant advantage of such lipid-based delivery systems is non–invasive nature and targeting of neurotherapeutics to the central nervous system. Critical attributes of lipid-based carriers modulate release rates in rate-controlled manners, enable higher penetration through the blood-brain barrier, and bypass the hepatic first-pass metabolism leading to higher CNS bioavailability neurotherapeutics. The current review discusses a brief and introductory account of the limitations of neurotherapeutics, pharmacological barriers, challenges in brain-targeted delivery, and the potential of nanotechnology-processed lipid-based carriers in the clinical management of neuronal disorders. Keywords: Nanotechnology, drug delivery, nutraceuticals, nanoparticles, CNS, BBB, nanoemulsion, challenges, toxicity, regu

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