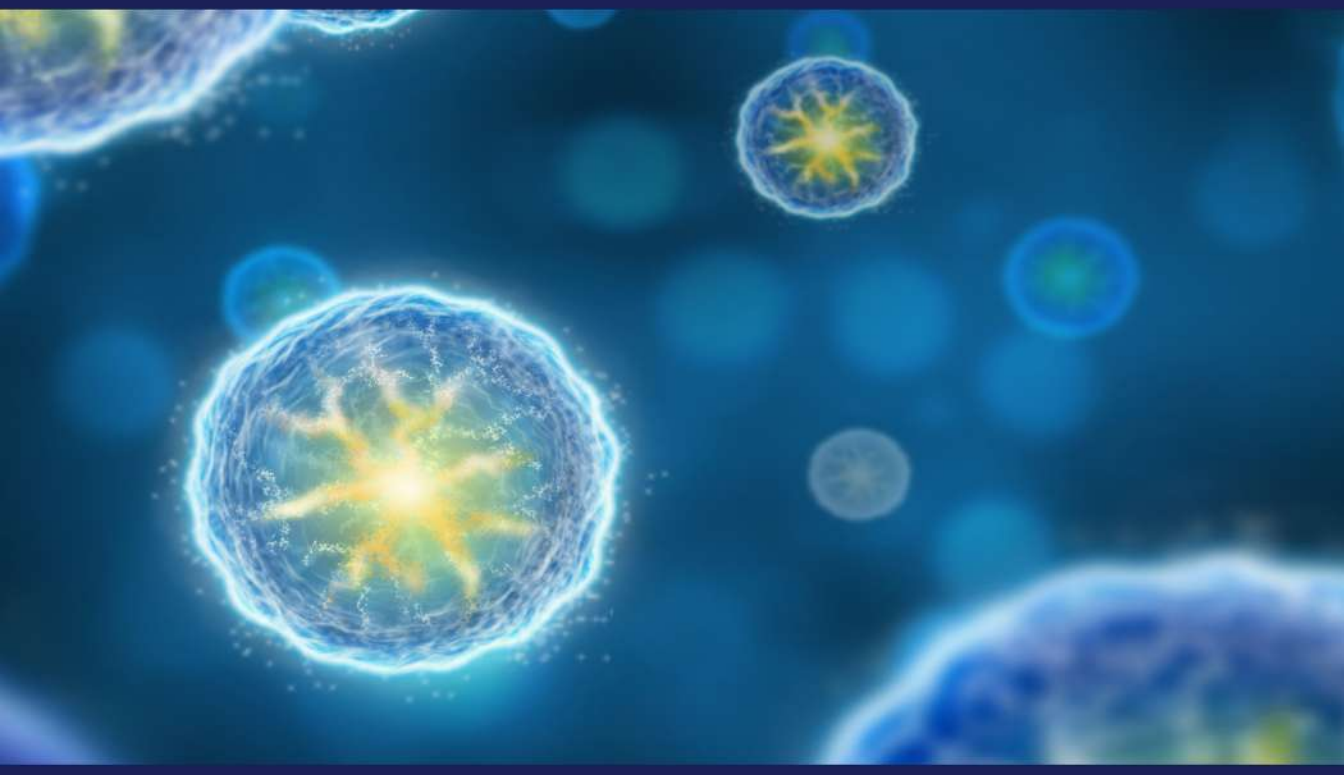
EMERGING TRENDS IN NANOBIOMEDICINE

NanoBioMaterials



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9 Nanocarrier-Mediated Therapeutic Protein Delivery

*Akhlesh Kumar Jain, Teenu Sharma, and Sunil Kumar Jain**

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9.1 INTRODUCTION

Proteins are vital elements involved in all the essential activities of the biological system, such as signal transduction, enzyme catalysis, gene regulation and maintaining the classic balance of cell survival and programmed death (Walsh, 2010; Leader *et al*., 2008). Advances in genetic engineering have led to proliferation in the enormous diversity of proteins with high biological purity. Despite their strength and specificity in physiological activities, most of the therapeutic proteins are tough to deliver clinically. Hence, an efficient means of transporting proteins to cells and organs of interest in an active state is a key aspect in tumor targeting, vaccination, regenerative medicine, treatment of functional loss and genetic disorders. Despite the administration of these peptides and proteins, these have very short biological half-life. The inherent problems to parenteral protein delivery are patient compliance, discomfort and high variability in bioavailability.

Noteworthy efforts in last decade have been carried out to synthesize nanoparticles (NPs) as delivery vehicles, since they provides appropriate ways of delivering low molecular weight therapeutics, as well as large bioactives, i.e. proteins, peptides, vaccines or nucleotides either by restricted or by tissue-specific delivery. Researchers, due to multiple reasons, are fascinated by nanocarriers as formulation vehicles, because the ratio of number of surface atoms or molecules to the total number of atoms or molecules is enhanced phenomenally, leading eventually to exponential augmentation of the effective surface area (Hadjipanayis *et al*., 2010). Furthermore, nanocarriers can become much larger in number and, due to their tiny size, could reach regions of low accessibility such as tumor cells, damaged tissues and inflamed

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