

Nanocarriers in Circulation: Achievements, Challenges and Perspectives

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Vascular system is the natural route for drug delivery in the body, and also is a target for therapeutic interventions. Most drugs and biotherapeutics have inadequate pharmacokinetic and do not accumulate in the intended sites. To overcome these challenges, diverse drug delivery systems including nanocarriers and targeted nanocarriers are being designed. Their targets include regulatory endothelial cells lining lumen of blood vessels and blood cells including red blood cells (RBC), which can serve as secondary “mother-ship” carriers for nanocarriers. Both affinity and non-affinity features of nanocarrier design, and biological features – systemic and in the target – control and modulate distribution, destination, fate and effects of these drug delivery systems. In particular, selection of optimal binding sites and design of nanocarriers with optimal geometry and flexibility are key controllable factors that can be reiteratively re-engineered based of their performance progressively from in vitro to pre-clinical in vivo experimental models. The challenges are immense and encompass biocompatibility and safety of nanocarrier-based drug delivery systems, as well as permeation of biological barriers and translational issues – production, cost, approval and medical use. The perspectives are, in theory, very bright, but experience of last decades instructs us to pay more attention to mechanistic aspects of the drug delivery systems and systematic approach to analysis of their performance criteria.