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REVIEW

Low density lipoprotein bionanoparticles: From cholesterol transport to delivery of anti-cancer drugs

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Abstract In this review article, we highlight the importance of low-density lipoprotein (LDL) and its implications in the field of drug delivery to cancer cells. LDL is naturally occurring bionanoparticles (BNP) with a size of 18–25 nm. These BNPs specifically transport cholesterol to cells expressing the LDL receptors (LDLRs). Several tumors overexpress LDLRs, presumably to provide cholesterol for sustaining a high rate of membrane synthesis. LDL BNPs are biocompatible and biodegradable, favorably bind hydrophobic and amphiphilic drugs, are taken up by a receptor-mediated mechanism, have a half-life of 2–4 days, and can be rerouted. Drugs can be loaded onto LDL BNPs by surface loading, core loading, and apoprotein interaction. LDL may be used as a drug carrier for treatment of atherosclerosis, cancer, and in photodynamic therapies.

Contents

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1. Introduction

Nanoparticulate matter is a collection of particles with at least one dimension that is smaller than 1 μm but larger than atoms and molecules. The size of nanomaterials is similar to that of most biological molecules and structures (Buzea et al., 2007). Fig. 1 represents definition of nano and micro sizes and some biological nanomaterials.

The therapeutic or diagnostic agents of interest are encapsulated within nanoparticles using a polymeric matrix and are adsorbed or conjugated onto the nanoparticle surface (Misra et al., 2010). Nanoparticles may be targeted to specific sites via the receptors on target cells that elicit specific biochemical interactions (Misra et al., 2010). The universal structural topology of nanoparticles consists of a core compartment with terminal surface groups (Misra et al., 2010). Nanosized materials (5–100 nm) are used in various applications. The use of therapeutic nanoparticles as unique drug delivery systems will soon be a significant addition to current cancer therapeutics. This technology has enabled the manipulation of the biological and physicochemical properties of materials to facilitate more efficient drug targeting and delivery (Buzea et al., 2007).

Bionanotechnology, a subdivision of nanotechnology focuses on the development of novel nanoscalematerials from biological building blocks (Lee and Wang, 2006). Natural

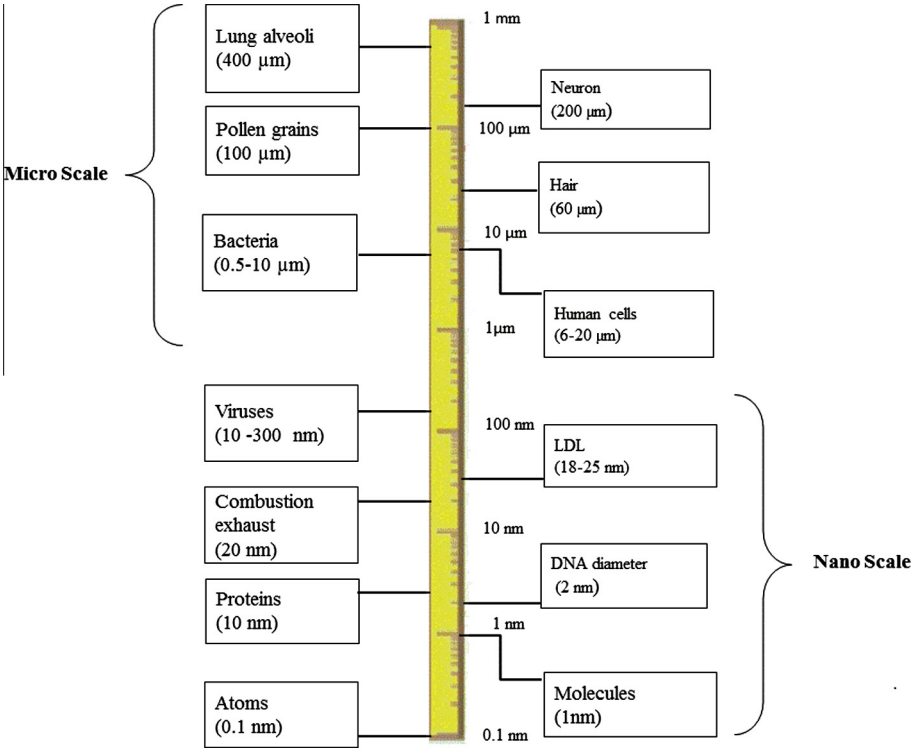

Figure 1 Represents size of nanomaterials compared to biological components and definition of nano and micro sizes.