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Short Communication

# Nanomedicines: Considerations and Functional Applications

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The field of nanomedicine is rapidly evolving towards the design of novel diagnostic tools and drug delivery systems, which enable the directed treatment of human diseases. Nanotechnology has revolutionised our perspectives in medicine, by combining biological and physical sciences towards the invention of novel biosensors, microfluidic systems, drug delivery agents, microarray tests and tissue engineering applications. These inventions have resulted in medical breakthroughs in the treatment of diseases such as cancer and many other emerging therapeutic applications. It is therefore critical that medical research & development, corporate and academic institutions, incorporate nanotechnology into their scientific discovery strategies. However, caution should be exercised as the risks and uncertainties of emerging nanomedicines remain unclear, it is for this reason, that the FDA employs very stringent and rigorous review processes in order to ensure transparent and predictable regulatory pathways, which are grounded to the best available scientific practices. Therefore, scientists embarking on nanomedical research and development should seek to collaboratively understand biological interactions of nanoscale materials, including, as appropriate the development of data to assess likelihood of long-term health effects from exposure to specific nanoscale materials.

The first generation of nanomedicines to be FDA approved are lipid-based systems such as liposomes and micelles. These liposomes can be manipulated in the laboratory to encapsulate specific nano-molecular components such as antibodies, miRNA, siRNA, metallic and magnetic nanoparticles and organic drug compounds with the aim of targeting specific diseases. Although liposomes have been the most successful nanoparticle drug-delivery systems, there are numerous limitations, which pertain to the instability, polydispersity, toxicity at repeated administration and capability of inducing immunostimulation and complement activation. It is therefore essential that we explore alternative methods which focus purely on nanomedicines since they have been proven to have more favourable pharmokientic, efficacy and safety benefits in comparison to liposomes.

Nanomedicines are of emerging interest for diagnosis and delivery of therapeutic agents as they are able to overcome (1) poor solubility and instability of certain drugs, (2) the transport of non-resistant therapeutic biomaterials, (3) the lack of controllable release and selective enrichment of drugs, (4) the crossing of biological barriers such as the blood brain barrier. Therefore, nanomedicines will contribute to the future advancements in medicine in ways never imagined. Apart from the known applications of nanomedicines further developments in the field will lead to breakthroughs, from nano robotic systems to nanobiosensors. Although many scientific problems associated to nanomedicines are yet to be resolved, its clinical application offers a promising perspective in therapy and diagnosis of various diseases.

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