



# Nano Based Drug Delivery Systems

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## Editorial

Nanomedicine and nano delivery systems are a relatively new but rapidly developing science where materials in the nanoscale range are employed to serve as means of diagnostic tools or to deliver therapeutic agents to specific targeted sites in a controlled manner. Nanotechnology offers multiple benefits in treating chronic human diseases by site-specific, and target-oriented delivery of precise medicines. Recently, there are a number of outstanding applications of the nanomedicine (chemotherapeutic agents, biological agents, immunotherapeutic agents etc.) in the treatment of various diseases. The current review, presents an updated summary of recent advances in the field of nanomedicines and nano based drug delivery systems through comprehensive scrutiny of the discovery and application of nanomaterials in improving both the efficacy of novel and old drugs (e.g., natural products) and selective diagnosis through disease marker molecules.

Nanomedicine and nano delivery systems, although relatively recent but fast-developing technology is one where nanoscale materials are used to function as diagnostic tools or to deliver therapeutic agents to specifically targeted sites in a controlled manner. It also provides many advantages in the management of human diseases. Recently, there has been a range of excellent uses of nanomedicine as chemotherapeutic agents, biological agents, immunotherapeutic agents, etc., for treatment of different diseases. In this chapter we discuss the recent developments and insights obtained in the field of nanomedicine.

### Bioavailability – the problem with conventional drug delivery

The bioavailability of a drug within the body depends on several factors like the size of the drug molecules and solubility parameters. Conventional dosage forms therefore face challenges in reaching the target site at appropriate dose.

For example, conventional dosage forms of some of the highly water soluble drugs cause fluctuations in drug concentration in the body due to high disintegration properties and also result in faster clearance of the drug from the blood stream.

Other drugs are fat soluble and when taken in conventional dosage forms may cause bioavailability problems. Similarly, patients suffering from chronic diseases like diabetes need to take painful insulin injections on a regular basis.

Also, cancer patients regularly have to undergo powerful chemotherapy, which involves quite severe side effects as the anticancer drugs target cancer cells and normal cells equally.

Hence proper platforms to deliver the drugs at targeted sites without losing their efficacies while limiting the associated side effects are highly required.

Many novel technologies for developing effective drug delivery systems came into existence among which nanotechnology platforms for achieving targeted drug delivery are gaining prominence these days. Research in this field includes the development of drug nanoparticles, polymeric and inorganic biodegradable nanocarriers for drug delivery, and surface engineering of carrier molecules.

These nanocarriers help in solubilizing the lipophilic drugs, protecting fragile drugs from enzymatic degradation, pH conditions, etc., and targeting specific sites with triggered release of drug contents.

### Nanobots

Nanobots or nanomotors are advanced sub-micron sized, self driven, biodegradable nanodevices made of bio-nano components, which carry cargo to the target sites.

This active motor based drug delivery approach promises an effective and improved drug delivery compared to conventional methods. Gold nanoparticle loaded PEDOT/zinc-based artificial micromotors are tested in mouse models via oral administration. They showed excellent acid-driven, self propulsive properties with high cargo-loading capacities.

Unimolecular submersible nanomachines that are activated by UV light, DNA-origami based nanorobots, light-induced actuating nanotransducers, WiNoBots, magnetic multilink nanoswimmers, etc., are some of the other technological developments that are anticipating the application of nanorobots in drug delivery..

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