Editorial

Shivanand P. Puthli

Research Pharmaceuticals Scientist,
Mumbai, India
E-mail: drugdel@rediffmail.com

Biographical notes: Shivanand P. Puthli is a Research Scientist in the field of drug delivery science. He completed his graduation and PhD from Bombay University, India in Pharmaceutical Sciences. Further, he did his Post-doctoral Research in Japan in the area of drug delivery and pharmacokinetics. He has number of patents to his credit. He has won several merit awards for academic and professional excellence and is an invited speaker at conferences and seminars. He has published original research papers/abstracts in a number of national and international peer-reviewed scientific journals/conferences. He is an expert reviewer for over 30 international scientific journals and serves on the Editorial advisory board of more than five international journals. He has been in organising and scientific committees of various international seminars and conferences. His research interests primarily include drug delivery science, biopharmaceutics, pharmacokinetics, pharmaceutics and pharmaceutical technology.

Emerging frontiers in nanopharmaceuticals

Controlled drug delivery system has experienced various phases of evolution. It originated with macroscopic delivery systems including oral dosage forms, implantable delivery, and transdermal patches. This changing paradigm was followed by the microscopic line extension delivery systems like injectable depot preparations. In 1959, Nobel Laureate Richard Feynman delivered the "plenty of room at the bottom" lecture and predicted the surfacing of a new era of nanotechnology. Last few decades have seen unprecedented advancements in this proliferating research field. Polymeric micelles and liposomes were initially introduced in the 1960s and a decade later nanoparticles and dendrimers emerged as promising delivery systems. This list has since then increased and we now have a variety of architectures including nanocrystals, nanotube, quantum dots, nanoshells, lipoplexes, nanocochleates, fullerenes, nano electro-mechanical systems etc., for diverse applications. Nanotechnology has been explored as an effective tool for diagnostic imaging, gene and drug delivery applications. Theragnostics is yet another imminent field where a bioresponsive system is employed for diagnosis and therapy using the same nano archetype. One can look forward to 'individualised medicine' with the advent of genomic sequencing coupled with nanopharmaceuticals. The success of commercialised/clinically advanced nanoproducts can be attributed to the principles of improved solubilisation and bioavailability, PEGylation, passive targeting making use of the Enhanced Permeability Retention

effect and active tumour targeting by ligand decorated delivery vehicles (including functionalised 'Trojan horse') amongst others.

Nanotechnology has an enormous impact on modern medicine and the demand in healthcare industry is expected to touch $53 billion mark (with pharmaceuticals alone capturing about $40 billion share) by the year 2011. Many pharmaceutical and biotechnology companies are considering nanotechnology as a valuable instrument for product life cycle management by restricting generic entry. The major drawbacks encountered in the manufacture of nanosystems are low drug loading and the difficulty in controlling particle size distribution. Nanopharmaceuticals can still be considered to be at nascent stage as there are critical challenges like product scaleability, improvement in production rate, batch-to-batch consistency, implementation of regulatory framework for product approvals, and environmental issues that need to be entirely resolved. Although this technology has great opportunities, its safety aspects cannot be disregarded. The large surface area of the tiny particles poses health safety risk of cytotoxicity or genotoxicity. Nonetheless, akin to the miniaturised submarine Proteus in the famous science fiction film *Fantastic Voyage* which succeeded in repairing the blood clot in brain, the scientific community is eagerly waiting for the dawn of an era when such 'nano-submarines' would be intricately designed using nanotechnology that would be a boon to cure unmet medical needs, realising the vision of Paul Ehrlich's 'magic bullet' becoming a reality.

For this special issue, galaxies of eminent and upcoming dedicated scientists working in the field of nanopharmaceuticals have contributed interesting articles. The objective here is to give a flavour of most significant arenas of nanopharmaceuticals in one platter and to critically examine the potential of nanoscience as the next generation panacea to human diseases. Dynamic areas of nanopharmaceuticals which capture the emerging core research aspects are presented to the ardent readers. The following interesting articles have been included in this special issue.

1 Kevin P. O'Donnell and Robert O. (Bill) Williams, Nanoparticulate systems for oral drug delivery to the colon.

2 Erik N. Taylor and Thomas J. Webster, Multifunctional magnetic nanoparticles for orthopedic and biofilm infections.

3 Oleh Taratula, Ronak Savla, Huixin He and Tamara Minko, Poly(propyleneimine) dendrimers as potential siRNA delivery nanocarrier: from structure to function.

4 Dennis Samuel, Dhruba Bharali and Shaker A. Mousa, The role of nanotechnology in diabetes treatment: current and future perspectives.

5 T. Andreani, S. Doktorovová, C.M. Lopes and E.B. Souto, Nanobio-techology approaches for targeted delivery of pharmaceutics and cosmetics ingredients.

6 Yun-Seok Rhee and Heidi M. Mansour, Nanopharmaceuticals I: nanocarrier systems in drug delivery.

7 Xiao Wu and Heidi M. Mansour, Nanopharmaceuticals II: application of nanoparticles and nanocarrier systems in pharmaceutics and nanomedicine.

As the guest editor, I wish to extend my sincere gratitude to all the authors who eagerly contributed high quality manuscripts in this special theme issue and wish the readers an enjoyable reading.