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Preface☆

This issue of *Advanced Drug Delivery Reviews* covers state of the art topics in delivery to the central nervous system using nanoparticles, delivery via inhalation or intravenous routes, strategies for therapy of inflammatory bowel disease, systems for capsule endoscopy, nanoprecipitation and physical methods of delivery, and prospects and challenges of using baculoviruses as therapeutics using micro and nanotechnologies.

Jörg Kreuter reviews the advancements made in the utility of polymeric nanoparticles for drug delivery to the brain. Over the years such systems have been used to treat a variety of diseases including cancer, cardiovascular complications and Alzheimer's. In this review influence of size, composition, surface properties and mechanisms of nanoparticle transport across the blood brain barrier are discussed, followed by studies focused on their biocompatibility, biodegradability, in vitro–in vivo correlation as well as utility of such systems in delivery of biologics. The author concludes by expressing that the pharmaceutical industry would need to do more to take advantage of such systems for effective treatment of severe CNS diseases.

With a sharp focus on induced alveolar macrophage responses, Forbes et al., discuss the challenges for inhaled drug discovery and development. The authors argue that discriminating between adaptive alveolar macrophage responses and adverse effects is a major challenge pointing to the key need for the understanding of macrophage biology. Emerging assay techniques, use of toxicokinetics, the need for new biomarkers, risk assessment for nonclinical toxicology and their translation to humans are discussed.

Reddy and Bazile's review focuses on the important role that formulation plays in pharmacokinetics and pharmacodynamics of drugs by delivery via the intravenous route. Various formulations of taxanes are used to illustrate this point. The relationship between the physical chemistry of these formulations and biological effect is discussed. The authors have used this data to propose a classification system for such formulations, i.e., surfactant based, surfactant-free and modulated pharmacokinetics drug delivery. Such classification can aid the formulation scientist for development of safer and more effective intravenous drug delivery systems.

Given the spatial and temporal requirements for drug delivery in the treatment of inflammatory bowel disease, this subject has been intensively studied. Lautenschläger et al. provide a background on the disease, discuss the benefits of targeted delivery in its treatment, and review the various dosage forms and routes of delivery in great detail. Specific emphasis is placed on prodrug strategies for peroral delivery, polymeric systems and role of mucoadhesion, endothelial targeting, liposomal systems, siRNA delivery and bacterial carriers. The review concludes by comparison of the delivery strategies and outlining regulatory considerations.

While the above review focuses on chemical strategies to deliver drugs to the gastrointestinal tract, other electro-mechanical strategies focus on the design of robotic and wireless systems to deliver bioactives to the GI. One method is to develop controllable drug delivery systems for capsule endoscopy. In a review of drug delivery systems for capsule endoscopy Alici and coworkers postulate the key factors that determine the requirements of such systems in an endoscopic capsule. In this review the capsule endoscope, operational environment for its function, comparison of existing systems for capsule endoscopy, and the detailed design of these unique delivery systems are discussed.

A method that is gaining popularity for formulation of hydrophobic compounds is nanoprecipitation. In such method precipitation of the hydrophobic drug in a non-solvent generates nanoparticles. Lepeltier, Bourgaux, and Couvreur discuss the “Ouzo effect”. Parameters controlling the nucleation and growth of aggregates and how they influence the characteristics of the nanoparticles are discussed. Kinetics of mixing and examples of polymeric nanoparticles developed by this method are reported.

Over the years physical means such as light, temperature, electricity, sound and magnetic field have been used to design controlled drug delivery systems. Such strategies have shown success while they have their own challenges. Advantages of such systems can include control over delivery by an external trigger and precise control over delivery rate while a key challenge is limited penetration in target organs. Hamblin and coworkers review a number of physical energy modalities for delivery and discuss techniques such as magnetoporation, electroporation, iontophoresis, among others. Photodynamic therapy, delivery of nucleic acids and development of theranostics with such methods are discussed. The concepts behind these techniques as well as challenges for delivery by physical methods and possible alternative solutions are reviewed.

Besides chemical and physical methods, increasingly advanced drug delivery systems take advantage of biological carriers such as bacteria and viruses. In the final article of this issue Prakash et al. discuss the principles, prospects and challenges of bioengineered baculoviruses for therapeutic delivery. The authors argue that bioengineered insect-cell-originated baculoviruses can overcome some of the challenges with limited efficiency of nonviral gene delivery systems while maintaining safety. This can be accomplished by surface functionalization of such viruses. The review focuses on development of baculovirus hybrids for gene therapy and discusses the challenges for clinical translation of these systems.

I hope the wide array of the review articles in this issue provides ideas for design of new drug delivery systems and enables solving some of the existing problems.

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