

Preface

Research and development of innovative drug delivery systems are increasing at a rapid pace throughout the world. This trend will intensify in future as public health expenses demand lower costs and increased efficiency for new therapies. In order to meet this demand, many well-known and efficiently applied drugs will be reformulated in new drug delivery systems that can be value-added for optimized therapeutic activity.

One important aspect in the newly developing field of nanomedicine is the use of nanoparticle drug delivery systems allowing innovative therapeutic approaches. Nanotechnology as a delivery platform offers very promising applications in drug delivery. Due to their small size such drug delivery systems are promising tools in therapeutic approaches such as selective or targeted drug delivery towards a specific tissue or organ, enhanced drug transport across biological barriers (leading to an increased bioavailability of the entrapped drug) or intracellular drug delivery which is interesting in gene and cancer therapy.

The nanotechnological approaches in drug delivery include a large variety of forms, mainly systems based on lipid or polymeric nanoparticles (nanocapsules and nanospheres) microemulsions, liposomes, but also polymeric micelles and cyclodextrins. Potentially different from other scientific communities in the field of drug delivery, nanoparticulates are defined as carrier system with a size below one micron.

On behalf of a great team of nano researchers who have been part of this exciting project, I am pleased to introduce to the scientific community a comprehensive work on Nanotechnology applied in the

field of drug delivery, which can be seen as a knowledge base for therapeutic applications of nanotechnologies.

In the past decade, ongoing efforts have been made to develop systems or drug carriers capable of delivering the active molecules specifically to the intended target organ in order to increase the therapeutic efficacy. This approach involves modifying the pharmacokinetic profile of various therapeutic classes of drugs through their incorporation in colloidal nanoparticulate carriers in the submicron size range such as liposomes or nanoparticles. These site-specific delivery systems allow an effective drug concentration to be maintained for a longer interval in the target tissue and result in decreased side effects associated with lower plasma concentrations in the peripheral blood. Thus, the principle of drug targeting is to reduce the total amount of drug administered while optimizing its activity. It should be mentioned that the scientific community is still skeptical that such goals could be achieved since huge investments of funds and promising research studies have in many cases resulted in disappointing results and have also been slow in yielding successfully marketed therapeutic nanocarriers. With the recent approval by health authorities of several effective nanosized products containing antifungal or cytotoxic drugs, interest in small drug carriers has been renewed.

A vast number of studies and reviews as well as several books have been devoted to the development, characterization, and potential applications of specific microparticulate- and nanoparticulate delivery systems. No encapsulation process developed to date has been able to produce the full range of capsules desired by potential capsule users. Few attempts have been made to present and discuss in a single book the entire therapeutic range of nanocarriers covered in this book. The general theme and purpose here are to provide the reader with a current and general overview of the existing nanosized delivery systems and to emphasize the various fields of therapeutic applications. The systematic approach used in presenting the first part introducing to the general therapeutic options followed by disease-focused reviewing the existing drug carriers should facilitate the comprehension of this increasingly complex field and clarify the main considerations involved in designing

manufacturing, characterizing, and evaluating a specific nanosized-delivery system for a given therapeutic application or purpose.

The first part highlights the exceptional properties of nanoparticles involving their sustained drug release and other physicochemical properties, but especially their ability to trigger drug transport across biological barriers. The general mechanisms of drug delivery, particle translocation, interactions with cells are detailed in this part of the book. Besides, the general strategies of nanoparticulate drug targeting and gene therapy will be elucidated here. The first part of the book starts with a chapter describing the physicochemical aspects of nanocarriers, including particulate systems, liposomes, micellar systems, emulsions, their principal properties, the main excipients necessary for their manufacturing and the basics on their preparation techniques. The authors also address major issues such as the stability of these formulations as well as aspects on the final pharmaceutical form to administer these carriers.

The following chapters deal with the general aspects on drug transport across biological barriers, for the moment one of the most important applications of nanocarriers in the field of therapeutics. Drugs with low permeability properties can significantly enhance their value by their use in a nano-formulation which increases its transport.

Another important aspect is the application of small carriers in the area of drug targeting. This chapter elucidates the potential of nanocarriers in order to allow specific drug delivery to inaccessible disease sites.

The last chapter in this first part is presenting the application of nanodevices in the field of the gene therapy. Although still today most of the gene therapy approaches rely on the use of viral systems, more and more studies deal with the use of non-viral gene delivery due to the advances in the development of biomaterials.

The second part will focus specifically on the therapeutic approaches which are possible by the use of nanocarriers dividing the overall context into chapters dealing with diverse diseases and the relevant therapeutic approaches based on the design of nanoparticulate drug delivery systems.

I am very grateful to all the authors who have shared my enthusiasm and vision by contributing high quality manuscripts, on time, keeping in

tune with the original design and theme of this work. You will not be having this book in your hand less their dedication and sacrifice.

Editor

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