PREFACE

Nanotechnology includes the engineering of different functional systems at molecular scale. Such systems are characterized by their unique attributes that can be attractive for a number of disciplines ranging from materials science to nanomedicine. Drug delivery via nanoparticle systems has already become a major pillar of nanomedicine. In that field, the technological innovations in the diagnostics and therapy refer to the development of useful nanovehicles or nanodevices carrying specific load (drug, imaging agent, biomolecule, etc.) to be delivered to the target site in the organism at relevant times and doses. Various nanoscale architectures have been designed—solid nanospheres or porous nanoparticles, nanotubes, nanocapsules, nanoassemblies (liposomes, micelles, and aggregates), branched macromolecules, etc. The engineered nanoparticles are smaller in size than human cells. Having dimensions less than 100 nm, they can circulate through the body, enter the cells, and interact with the therapeutic targets. The strategic rationale for application of drug delivery nanoconstructs arises from the findings made in genomics and proteomics providing the society with powerful tools in the combat against cancer, cardiovascular and neurodegenerative diseases, viral infectious diseases, etc. (Donev, Koseva, Petrov, Kowalczuk, & Thome, 2011; Koseva, Rydz, Stoyanova, & Mitova, 2015). Considering the importance of the above research field and the great interest in its practical application in biomedicine, we have focused this volume of the *Advances in Protein Chemistry and Structural Biology* on Protein and Peptide Nanoparticles for Drug Delivery.

The review in Chapter 1 "Protein– and Peptide–Drug Conjugates: An Emerging Drug Delivery Technology" by Vhora et al. focuses on various protein– and peptide–drug conjugates along with their physicochemical and pharmacological properties. Additionally, emphasis has been given to the conjugation techniques along with different linkers available for construction of conjugation and challenges involved. In Chapter 2 "Modifications of Natural Peptides for Nanoparticle and Drug Design" by Jallouk et al., authors thoroughly review the role of natural peptides in the design and creation of nanomedicines, with a particular focus on cell-penetrating peptides, antimicrobial peptides, and peptide toxins. They discuss in details the great promise of the application of natural peptides in conjunction with nanoparticle delivery systems for the development of

new therapeutic formulations as well as novel platforms for the delivery of various cargoes.

The combination of polymers of biological and synthetic origin is an appealing modern strategy for the production of novel nanocarriers with unprecedented properties. Proteins' interface can play an important role in determining bioactivity and toxicity and gives perspective for future development of the polymer-based nanoparticles. The design of hybrid constructs composed of synthetic polymer and biological molecules such as proteins can be considered as a straightforward tool to integrate a broad spectrum of properties and biofunctions into a single device. All this is presented in Chapter 3 "Hybrid Protein–Synthetic Polymer Nanoparticles for Drug Delivery" by Koseva et al. which provides a detailed discussion on hybrid protein–synthetic polymer nanoparticles with different structure and level in complexity and functionality, in view of their applications as drug delivery systems.

Chapter 4 "Efficient Delivery of Therapeutic Agents by Using Targeted Albumin Nanoparticles" by Kouchakzadeh et al. explores thoroughly the current targeted and nontargeted albumin-based nanoparticles that are in various stages of development for the delivery of therapeutic agents in order to enhance the efficacy of cancer treatment.

Chapter 5 "Vasoactive Intestinal Peptide (VIP) Nanoparticles for Diagnostics and for Controlled and Targeted Drug Delivery" by Klippstein and Pozo focuses on recent developments in the use of nanotechnology-based approaches as a tool for VIP-controlled drug delivery, an excellent example on how nano-enabled methods can fill the gap between current knowledge on the biological role of neuropeptides and their translational potential to health-care solutions. Authors present recent studies aimed at developing nanostructured organic and inorganic systems either for the appropriate delivery of VIP or for VIP targeting. These technologies stand as an alternative starting point for chemical manipulations of the neuropeptides in order to improve potency, selectivity, or pharmacokinetic parameters.

Chapter 6 "Implications of Protein- and Peptide-Based Nanoparticles as Potential Vehicles for Anticancer Drugs" by Elzoghby et al. highlights the applications of protein nanoparticles for delivery of anticancer drugs. Various techniques that have been utilized for preparation of anticancer drug-loaded protein nanoparticles are examined. The major outcomes of some *in vitro* and *in vivo* investigations of surface-modified tumor-targeted protein nanoparticles are discussed here.

Last three chapters are focusing on specific subgroups of materials for preparation of nanoparticles used for drug delivery. In Chapter 7 "Polysaccharide Nanoparticles for Protein and Peptide Delivery: Exploring Less-Known Materials" by dos Santos et al., polysaccharide nanoparticles developed for protein and peptide delivery are described. The emphasis is placed on materials that in general are less explored or that are not so well-known regarding the development of nanoparticulate systems, thus excluding polymers like chitosan, alginate, cyclodextrins, and hyaluronic acid. A detailed report on the main properties and their applications in the production of nanoparticles aimed at protein delivery is presented. Chapter 8 "Bioconjugation of Silk Fibroin Nanoparticles with Enzyme and Peptide and Their Characterization" by Wang et al. explores in great details the bioconjugation of silk fibroin nanoparticles with glucose oxidase, superoxidase, β-glucosidase, L-asparaginase, neutral protease, and insulin, as well as their characterization. Finally, Chapter 9 "Food-Grade Protein-Based Nanoparticles and Microparticles for Bioactive Delivery: Fabrication, Characterization, and Utilization" by Davidov-Pardo et al. provides an overview of the functional properties of food proteins that can be used to assemble nanoparticles and microparticles, the fabrication techniques available to create those particles, the factors that influence their stability, and their potential applications within the food industry.

The aim of this volume is to promote further basic studies and clinical trials in diverse groups of protein and peptide nanoparticles as a promising tool for targeted delivery of therapeutics for treatment of various diseases and disorders.

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