PREFACE

This volume of *Methods in Enzymology* introduces the applications and methods of nanomedicine, a field that has been emerging in the past decade, in conjunction with advances in nanotechnology and bionanoscience.

In Chapter 1, Rita E. Serda and colleagues describe the fabrication of porous silicon-based logic-embedded vectors and their optimization to reach nonendosomal targets. Samuel A. Wickline and collaborators, in Chapter 2, describe methods for the postformulation insertion of peptide drugs into lipidic nanostructures and the evaluation of their therapeutic effectiveness both *in vitro* and *in vivo*. The synthesis of several different mesoporous silica nanoparticle materials used for the transport of drug molecules, neurotransmitters, and macromolecules across cell membranes, and the cell wall of plant cells, are outlined by I.-Ju. Fang and Brian G. Trewyn in Chapter 3.

The next set of chapters describes cancer nanomedicines. José L. Arias et al., in Chapter 4, describe the formulation of magnetically responsive nanopolymers that may be used for efficient multifunctional anticancer therapy. Integration of C_6-ceramide into sterically stabilized nanoliposomes has led to the development of a promising therapeutic either on its own or in combination with other agents for the treatment of cancer in preclinical studies. The methods used for these studies are described by Xin Liu and colleagues in Chapter 5. Dai Fukumura and colleagues, in Chapter 6, have developed a multistage nanoparticle delivery system as a potential means to improve the efficacy of anticancer therapy and describe a formulation that shrinks in size once it enters the tumor interstitial space to optimize the delivery to tumors and within tumors. Mitochondria play a key role in apoptosis and several drugs are known to trigger apoptosis by interacting with mitochondria. The methods for the preparation of mitochondria-targeted nanocarriers and protocols for their *in vitro* and *in vivo* assessment are provided in Chapter 7 by Volkmar Weissig. Arginine–glycine–aspartate-grafted nanoparticles can target $\alpha_v\beta_3$ integrin overexpressed by the tumor endothelium, and extravasate more efficiently and enter the tumor via the enhanced permeability and retention effect. In Chapter 8, Véronique Préat and collaborators delineate the methods used for the preparation of the nanoparticles, for the validation of their potential to target tumor endothelium *in vitro* and *vivo*, and for tumor delivery of poorly soluble and/or highly cytotoxic drugs.

Wutian Wu and colleagues, in Chapter 9, describe the use of a self-assembling peptide nanofiber scaffold for the reconstruction of injured brain tissue in a rodent model of surgical brain injury.

The section on cardiac nanomedicines includes contributions by Jason R. McCarthy and Willem J.M. Mulder and colleagues (Chapters 10 and 11, respectively). In the first, the methodology associated with the synthesis of a novel thrombus-targeted fibrinolytic nanoagent and the effect of the conjugation of tissue plasminogen activator to the nanoparticle surface on the activity of nanoagents are described. In the second, the authors illustrate the methods for inducing atherosclerosis in a rabbit model, the preparation of anti-inflammatory liposomes, and monitoring the therapeutic efficacy of experimental therapeutics with noninvasive imaging techniques.

Maria Luisa Bondì and Turgay Dalkara and collaborators (Chapters 12 and 13, respectively) have contributed chapters on the application of nanomedicines to central nervous system diseases. Bondì et al., in Chapter 12, outline the main production methods of lipid nanostructures such as solid lipid nanoparticles and nanostructured lipid carriers, particularly for overcoming the blood–brain barrier for the treatment of several brain diseases. In Chapter 13, Dalkara and colleagues introduce a nanomedicine made of pegylated chitosan nanoparticles with conjugated anti-transferrin receptor antibodies that can transport a blood–brain-barrier-impermeable caspase inhibitor to the brain.

In the section on diabetes nanomedicines, Catarina Pinto Reis and Christiane Damgé review alternative and more convenient methods for insulin delivery using nanotechnology (Chapter 14). Bruno Sarmento and colleagues describe, in Chapter 15, the preparation of solid lipid nanoparticles coated with the mucoadhesive polymer chitosan for intestinal absorption of insulin. They also describe methods to determine the *in vitro* intestinal permeability of insulin by means of these nanoparticles and *in vivo* models to evaluate their hypoglycemic effect in diabetic animals.

In Chapter 16, Ruxana T. Sadikot addresses the targeted delivery of drugs for the treatment of acute lung injury and acute respiratory distress syndrome, using long-acting biocompatible and biodegradable phospholipid micelles. Chapter 17, by Andreas Zimmer and colleagues, describes the use of nanocrystalline solid dispersions, PEG-PLGA nanoparticles, proticles, nanoparticle precipitates, and liposomes for the treatment of pulmonary arterial hypertension.

In the section on nanomedicines for inflammatory diseases, Hayat Önyüksel and colleagues discuss lipid-based and polymeric nanomedicines for the treatment of rheumatoid arthritis, ocular inflammation, and inflammatory bowel disease, including the animal models for these diseases (Chapter 18). In the final chapter of the volume, Philip Wachsmann and Alf Lamprecht describe the preparation, characterization, and use of polymeric nanoparticles in the therapy of murine experimental colitis (Chapter 19).

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I dedicate this volume to the memories of my aunt, Sevim Uygurer, who always supported me since my childhood, and my cousin, Dr. Ferruh Emürk, a professor of environmental engineering at Yıldız University in Istanbul, with whom I used to spend hours playing as a child.

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