

Preface

The concept of focal drug delivery has been applied for treating illnesses that are localized to a certain tissue or organ. These delivery systems are applied directly to the diseased site and deliver a desired dose for an extended time period while minimizing systemic distribution of toxic drug. Overall, this book contains two sections: first section includes fundamental introductory chapters for focal drug delivery, whereas second section includes chapters describing drug delivery to body sites/system.

Biodegradable polymers have been playing a very important role in delivery aspects of therapeutic molecules because of their biocompatibility and biodegradability. Chapter 1 discusses the importance of these polymeric carriers in focal controlled drug delivery and explores a wide range of polymers, including those from natural and synthetic sources. Chapter 2 presents the role of implantable medical devices such as stents in controlled local drug delivery. Various classes and requirements of implantable devices such as mechanical properties, biocompatibility, and sterilization have been listed in this chapter. A detail about focal drug delivery applications of cardiovascular and orthopaedic implantable devices has been provided.

Tumor targeting comes first in discussion in emphasizing the role of systemic targeting. Chapter 3 provides various means of drug targeting like polymeric nanoparticles, liposomes, polymersomes, and solid lipid nanoparticles, the role and endogenous factors making an impact on EPR effect in tumor targeting along with the ligand-based targeting based on carbohydrates, proteins, antibodies, aptamers, and small molecules for various malignancies. Chapter 4 discusses the emerging role of liposomes in focal drug delivery for cancer and noncancer therapies. Chapter 5 emphasizes the expanding role of polymer drug conjugates and suggests their potential in drug delivery platforms. An understanding of in vivo pharmacokinetics and pharmacodynamics of a delivery system is important in determining the clinical effectiveness of these systems in site-specific targeting. Chapter 6 focuses on the anticancer drug delivery systems for treatment of solid tumors and on the quantitative assessment of the analyzed factors/parameters.

Chapter 7 covers various treatment modalities in brain tumor, describing a brief about locally delivered chemotherapy following surgical resection. Strategies like drug delivery microchips, gene-targeted drugs, and nanocarriers have been explored in their role in effective delivery in this aspect. Chapter 8 describes intranasal administration of neuropeptide-loaded nanoparticles as a feasible means to noninvasively deliver neuropeptides for CNS therapeutics. Chapter 9 examines the scope of focal drug delivery in inner ear therapy, comparing advantages and disadvantages of different techniques like intratympanic perfusion, organ-targeted delivery, and direct cochlear drug delivery. Chapters 10 and 11 focus on the emerging role of nanotechnology in ocular drug delivery that presents a big challenge to current therapies because of its complex anatomical and physiological barriers and the major types of nucleic acids and various strategies that have been used to achieve site-specific delivery of nucleic acids to the eye for the treatment of ocular diseases. Chapter 12 gives a brief about basic mechanisms of transport in iontophoretic drug delivery systems in localized delivery of drugs in addition to its growing investigating potential in treatment of various diseases related to eye and skin. A drug designated to act locally in the oral cavity has to remain in the site for a measured period of time and withstand the dynamic conditions in the mouth such as changing pH levels, masticatory abrasion, slippery mucosa, and smooth teeth surfaces. Chapter 13 focuses on potential of polymeric carriers in treating various oral cavity diseases of bacteriological, viral, and fungal origin. The major reason for the resistance of the oral microbes is their inherent organization into characteristic biofilms. Chapter 14 begins with the introduction of these biofilms and advantages of focal drug delivery in this aspect and concludes with the recent development of various novel technologies for the prevention, control, and treatment of oral infections including controlled focal delivery modalities. Chapter 15 discusses focal drug delivery to stomach that includes gastro-retentive drug delivery systems. A brief for gastro-retentive dosage form (GRDF), different GRDF technologies, and their unique application has been discussed. Chapter 16 discusses focal drug delivery to intestine emphasizing variable intestinal conditions like environmental pH values, transporter expression levels, and CYP3A4 expression necessary for a successful targeted drug delivery.

Chapter 17 gives a review of the challenges and opportunities in systemic and local drug delivery to the arterial tissue, advances in systemic (e.g., targeted nanotechnology-based formulations) and local (e.g., drug-eluting stent (DES) implantation) delivery technologies, and their future perspective in the development of multifunctional nano-systems resulting in localized intracellular drug delivery with improved efficacy. Chapters 18 and 19 focus on the role of stents and vascular grafts in localized drug delivery to vascular tissues. The first gives the readers an introduction about bare-metal stents (BMS) that have been used in coronary artery diseases, long-term result problems of in-stent restenosis (ISR), and stent thrombosis resulting in introduction of DES to overcome the problems of ISR along with the advancement to development of a more user-friendly bioabsorbable and polymer-free stents. The second one discusses the advantages of drug-eluting vascular graft compared to coronary artery bypass grafting as well as trends in their development

with a prime focus on electrospinning as a promising platform technology for creating a new generation of vascular grafts. Chapter 20 introduces the importance of and major hurdles for lymphatic targeting as well as the potential of new delivery platforms for nanocarriers such as liposomes, solid lipid nanoparticles, etc. for better penetration into diseased areas. Osteomyelitis, a disease of bone and bone marrow, presents a major challenge in therapy. The challenges along with the potential of newer forms of sustained-release antibiotic delivery systems in delivering antibiotics at constant rates over a prolonged period of time, eliminating the need for multiple dosing, are indicated in Chapter 21. Chapter 22 reviews an up-to-date overview of the acellular biomaterial-based strategies, aimed at simultaneous regeneration of bone and cartilage by the controlled focal delivery of the appropriate factors. Development and clinical testing of various delivery systems (microspheres, hydrogels, and macroporous scaffolds) are also discussed.

Chapter 23 presents locally and systemically delivered polymeric drug carrier systems in treatment of solid tumors. Different types of in situ forming injectable hydrogels, various micro- and nanoparticulate systems, and the role of polymeric drug delivery systems in addressing the multidrug resistance are discussed. Chapter 24 describes the advantages offered by multifaceted nanocarrier systems over current conventional formulations for skin ailments and their research and market potential along with factors vital for selection of appropriate nano delivery system. Chapter 25 deals with anatomy of the nail unit, related diseases, and challenges presented by topical and oral anti-infective. It also explores the potential of focal delivery approaches to nails that are currently being investigated. In Chap. 26, the reader is presented with an overview of different wound management dressings and advanced technologies for achieving improved healing for wounds, burns, and diabetes-related ulcers and related pathogenesis. Also pharmacological agents like gene therapy and cytokine, growth factors, stem cells, etc. are also discussed. Chapter 27 previews the potential of vaginal drug delivery systems focusing on the barriers presented by vaginal mucosa. The various strategies discussed include nanomaterials like nanoparticles, electrospun fibers, and HIV microbicide applications for effective and successful vaginal drug delivery. Lastly, discussed in Chap. 28 are the selected developments in the extensive field of prolonged duration of local anesthesia for the goal of enhanced anesthetic duration following administration.

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