

Preface

This volume provides an overview of fundamental principles relating to the science and technology of drug delivery. It approaches the subject from a mechanistic perspective using language that is understandable to those entering the field and who are not familiar with its common phrases or complex terms. It provides a simple encapsulation of concepts and then expands on them as the reader progresses through the book. Once the concepts are laid out, applications to various disease states are described in detail.

Drug delivery is an interdisciplinary field concerned with the proper administration of bioactive compounds to achieve a desired clinical response in humans or animals. Drug delivery is beneficial to billions of people (and animals) worldwide and is achieved by designing and developing technologies that modify the temporal and spatial drug release profile, resulting in enhanced product safety and improved patient convenience and compliance. Rational design of a drug delivery technology requires the convergence of many fields of science and engineering.

Technologies have been developed for delivery of bioactives via many routes of administration including the oral, topical (e.g., skin), transmucosal (nasal, buccal/sublingual, vaginal, ocular, and rectal), and inhalation routes. A broad range of bioactive compounds are incorporated into delivery technologies, from simple molecules to peptides and proteins, antibodies, vaccines, and gene-based drugs. A well-designed drug delivery technology offers the advantages of reduction in dose frequency, a more uniform effect of the drug over time, reduction of drug side effects, reduced unwanted fluctuations in circulating drug levels, and extension of the commercial value of a drug or formulation. Disadvantages of drug delivery systems include their high cost, and sometimes a decreased ability by the clinician or patient to adjust dosages.

The outcomes of recent efforts in the field of drug delivery are rapidly emerging, as is expansion of knowledge of the underlying science. Recent advances include the development of targeted delivery systems in which the drug is only active in a specific area of the body such as cancer tissues, microscopic novel long acting

formulations such as microparticles and nanoparticles in which the drug is released over a period of time in a controlled manner, liposomes, in situ forming implants, and drug polymer conjugates.

This book is divided into six parts. The first part covers the *value of drug delivery*, starting with a chapter written by Wilson on the advantages that drug delivery brings and why drug delivery is needed to treat a specific condition. Terms used in the drug delivery area are defined and controlled release resources are identified. An overview of mechanisms of drug delivery is then provided in a chapter by Siegel and Rathbone. The second part of the book covers *polymeric delivery materials* and includes a description of the synthesis, manufacture, and characterization of polymeric materials used to deliver drugs. Chapters emphasize the need for materials characterization and the need to fully characterize manufacturing processes to avoid process and product failures. Hydrophobic polymers are discussed by Jones et al., hydrogels are reviewed by Omidian and Park, and Burgess and Tsung co-author a chapter on biodegradable polymers. The third part of the book deals with *temporal delivery systems and mechanisms*. Siepmann et al. author two chapters on diffusion and swelling controlled systems, Schwendeman and Wischke provide a summary of degradable polymeric carrier systems, and Siegel presents an overview of porous systems. In the fourth part concerning *spatial delivery systems and mechanisms*, Minko provides a chapter on receptor targeted release, Torchilin reviews liposomes for targeted drug delivery, and Fattal discusses targeted delivery using biodegradable polymeric nanoparticles. The fifth part deals with present and potential future clinical *applications* of controlled drug delivery. This part begins with an extensive review of chronotherapeutics and drug delivery by Smolensky et al., which is followed by chapters on approaches to treatment of cardiovascular disease (Fishbein et al.), cancer (Bardhwaj and Ravi Kumar), and infectious disease (Senel). A final chapter in the fifth part covers controlled release in tissue engineering (Suggs). The sixth, final part is a *future outlook* consisting of a chapter written by Dr. Stephen Perrett surveying the present and future regulatory and commercial landscape for advanced drug delivery systems.

The Editors are indebted to the willingness and expertise of the authoritative contributors who have donated their valuable time to write chapters for this volume. Without them this book would not have become a reality.

Lille, France
Minneapolis, MN, USA
Southport, QLD, Australia

Juergen Siepmann
Ronald A. Siegel
Michael J. Rathbone

Fundamentals and Applications of Controlled Release
Drug Delivery

Siepmann, J.; Siegel, R.A.; Rathbone, M.J. (Eds.)

2012, XIV, 594 p., Hardcover

ISBN: 978-1-4614-0880-2