Enhancement in Drug Delivery

Edited by
Elka Touitou
Brian W. Barry

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Enhancement in Drug Delivery
Preface

Enhancement in drug delivery and absorption via a specific route of administration often becomes essential in the design of novel pharmaceutical products and new therapies. On the one hand, biotechnological therapeutic molecules usually require enhancers for their successful administration by noninjectable modes; alternatively, for the more efficient delivery of conventional drugs, other routes that overcome the disadvantages of traditional administration may also require additional augmentation.

The literature currently available on drug delivery enhancement, including the most recent developments, though extensive, is still fragmented into sources that concentrate on specific administration routes, making it difficult to gain an integrated knowledge in this field.

The concept that guided us while editing this book was that by assembling knowledge on various modes of enhancement for problematic administration routes, we could deliver a multidisciplinary comprehensive review to the readers. Thus, we believe that this volume can be used as a reference book for the research community and pharmaceutical industries as well as an educational tool for senior students and practitioners in the field of pharmaceutics, medicine, and health-related disciplines. More specifically, this book is targeted toward scientists in academia and industry and graduate students in various research-intensive programs in pharmaceutical sciences, biotechnology, and medicine who are dealing with many aspects of drug design, development, and testing.

Within the chapters, the reader may find the same enhancer tested for various administration routes and in diverse experimental models. By understanding the properties and behavior of the accelerants operating within such systems, the scientist may be inspired with new ideas for choosing the ideal promotor for a new application. The contributing authors, in their reviews, discuss not only the achievements, but also the failures and drawbacks of various enhancers that are often mainly related to their toxicities.

Thus, the scheme of this book is to present a comprehensive review of the theory and methods for enhancing drug absorption through various routes of the human body. It is hoped that, by a process of cross-fertilization, investigators primarily involved with one specific route of delivery will find additional stimulation and helpful concepts applicable to their own area of expertise from a reading of the approaches other workers have used within their spheres of activity. Not every enhancement method ever tried, however speculative, for each route of delivery finds a place in the relevant section. We believe that the book presents the most interesting approaches operating at the time the authors prepared their contributions.

The opening chapters deal with the major route of drug delivery, and reflect on gastrointestinal anatomy, physiology, and permeation pathways, together with such considerations as the role of surfactants in accelerating the input of macromolecules, targeted gastrointestinal delivery, inhibition of enzymes and secretory transport, problems with lipophilic drugs, and the use of chitosan and its derivatives. Treatments on permeation pathways in rectal absorption and relevant enhancers provide information for a route whose use varies significantly in different countries. A deliberation on the basic biopharmaceutics of buccal and sublingual absorption precedes a contemplation of the role of chemical enhancers. The problems associated with circumventing the barrier of the skin during transdermal drug delivery bring into sharp focus many problems associated with breaching biological barriers; the stratum corneum has developed an elegant structure with which to limit very significantly
the access of most chemicals, while permitting the controlled loss of water. It is therefore in this area of drug delivery that we find use of the widest range of enhancement methods. After a chapter orientating the reader to the structure and barrier function of the stratum corneum, contributors consider the most widely investigated enhancement approaches. These include the very extensive employment of chemical promotors, at least experimentally, electrically assisted methods such as iontophoresis, electroporation, and ultrasound, the promise offered by vesicular carriers, as well as methods that combine liposomes with electrical potentiation. The final transdermal chapter considers the approach of by-passing or removing the major source of our difficulties, the horny layer of the skin.

In recent years, a considerable interest in nasal delivery has developed and the text on the physiological parameters that affect this process leads once again to the use of chemical enhancers. The problem of peptide delivery, which is a concern with respect to all routes of delivery in light of the as yet unfulfilled promises of the biotechnology revolution, completes this section. Consideration of the nature of the vagina and uterus as absorbing organs sets the scene for a contemplation of strategies for improving the bioavailability of a drug when administered via the vaginal route. Details on the structure and function of the eye help us to understand delivery systems for this route and the relevance of chemical permeation enhancers, together with the promise of iontophoresis. The final section of the book deals with structure and function of the blood–brain barrier and strategies for overcoming it.

We express our appreciation to all the authors for contributing outstanding chapters. We would also like to thank Mrs. Yvonne Western and Mrs. Madelyn Segev for their excellent assistance with respect to the manifold duties involved in the preparation of the manuscript.

Elka Touitou
Brian Barry
Editors

Elka Touitou is Professor of Pharmaceutical Sciences, Head of the Dermal/Transdermal Drug Delivery Group, and Head of the Teaching Committee of the School of Pharmacy, The Hebrew University of Jerusalem, Israel. She is the president of the Israeli chapter of the Controlled Release Society (ICRS) and serves as a member of the Scientific Advisory Board of the CRS. She has been a professor at a number of pharmaceutical companies and universities in Europe and the United States, including Hofmann La Roche, American Cyanamid, and the University of Rome. She has a varied and broad experience in collaborating with the pharmaceutical industry in the design of new formulations. Professor Touitou is an internationally recognized authority in the field of drug delivery. She obtained her PhD in 1980 from The Hebrew University of Jerusalem. Her primary research interest is in the field of enhanced drug absorption from various administration routes (oral, transdermal, nasal) and design of novel carriers for enhanced drug delivery. She is the inventor of “Ethosome” and holds 14 patents, has published over 200 scientific works, including original research papers, reviews, and book chapters. She has also coedited Novel Cosmetic Delivery Systems (Marcel Dekker, 1999). Professor Touitou is the recipient of a number of awards, including the Jorge Heller Outstanding Paper Award and Kaye Innovation Award.

Brian W. Barry is Professor of Pharmaceutical Technology and Head of the Drug Delivery Group of the School of Pharmacy, University of Bradford, UK. His education includes a BSc (pharmacy) and a DSc (both obtained at the University of Manchester) together with a PhD from the Faculty of Medicine of the University of London. He is a Fellow of the Royal Pharmaceutical Society of Great Britain, a Chartered Chemist, a Fellow of the Royal Society of Chemistry, and a Fellow of the American Association of Pharmaceutical Scientists. Professor Barry is an international authority on drug delivery systems, especially via the topical and transdermal routes. He has over 400 publications, including Dermatological Formulations; Percutaneous Absorption (Marcel Dekker, Inc., 1983) to his credit. He served as a member of the UK Chemistry, Pharmacy and Standards Sub-Committee of the Committee on Safety of Medicines and acted as adviser on topical and transdermal delivery of drugs to the Medicines Control Agency of the UK and the Food and Drug Administration in the United States. He has a wide and varied experience of collaborating with and acting as a consultant for some 40 firms in the pharmaceutical industry in the UK, Europe, the United States, and Australia.
Contributors

Muhammad Abdulrazik  
Department of Pharmaceutics  
School of Pharmacy  
The Hebrew University of Jerusalem  
Jerusalem, Israel

Hidetoshi Arima  
Graduate School of Pharmaceutical Sciences  
Kumamoto University  
Kumamoto, Japan

John J. Arnold  
Department of Ophthalmology  
School of Medicine  
Duke University  
Durham, North Carolina

Brian W. Barry  
Drug Delivery Group, School of Pharmacy  
University of Bradford  
Bradford, UK

Priya Batheja  
Ernest Mario School of Pharmacy  
The State University of New Jersey  
Piscataway, New Jersey

Anupam Batra  
University Institute of Pharmaceutical Sciences  
Punjab University  
Chandigarh, India

Elena V. Batrakova  
Department of Pharmaceutical Sciences  
University of Nebraska Medical Center  
Omaha, Nebraska

David J. Begley  
Blood–Brain Barrier group  
Center for Neuroscience Research  
King’s College London  
London, UK

Francine Behar-Cohen  
Physiopathology of Ocular Diseases: Therapeutic Innovations Unit  
INSERM U 598  
Paris, France

Simon Benita  
Department of Pharmaceutics  
School of Pharmacy  
The Hebrew University of Jerusalem  
Jerusalem, Israel

Andreas Bernkop-Schnürch  
Department of Pharmaceutical Technology  
Leopold-Franzens-University  
Innsbruck, Austria

James C. Birchall  
Welsh School of Pharmacy  
Cardiff University  
Cardiff, UK

Maria Cristina Bonferoni  
Department of Pharmaceutical Chemistry  
School of Pharmacy  
University of Pavia  
Pavia, Italy

Michael C. Bonner  
Drug Delivery Group, School of Pharmacy  
University of Bradford  
Bradford, UK

Joke A. Bouwstra  
Department of Drug Delivery Technology  
Leiden/Amsterdam Center for Drug Research  
Leiden University  
Leiden, The Netherlands

Marc B. Brown  
MedPharm, King’s College London  
London, UK
Carla Caramella  
Department of Pharmaceutical Chemistry  
School of Pharmacy  
University of Pavia  
Pavia, Italy

Arik Dahan  
Department of Pharmaceutics  
School of Pharmacy  
The Hebrew University of Jerusalem  
Jerusalem, Israel

Miranda W. de Jager  
Department of Drug Delivery Technology  
Leiden/Amsterdam Center for Drug Research  
Leiden University  
Leiden, The Netherlands

M. Begoña Delgado-Charro  
Department of Pharmacy and Pharmacology  
University of Bath  
Claverton Down  
Bath, UK

Abraham J. Domb  
Department of Medicinal Chemistry and Natural Products  
School of Pharmacy  
Faculty of Medicine  
The Hebrew University of Jerusalem  
Jerusalem, Israel

Esther Eljarrat-Binstock  
Department of Medicinal Chemistry and Natural Products  
School of Pharmacy  
Faculty of Medicine  
The Hebrew University of Jerusalem  
Jerusalem, Israel

Franca Ferrari  
Department of Pharmaceutical Chemistry  
School of Pharmacy  
University of Pavia  
Pavia, Italy

Ben Forbes  
Pharmaceutical Sciences Research Division  
King’s College London  
London, UK

David R. Friend  
Vyteris, Inc.  
Fair Lawn, New Jersey

Joseph Frucht-Pery  
Department of Ophthalmology  
Hadassah University Hospital  
Jerusalem, Israel

Biana Godin  
Department of Pharmaceutics  
School of Pharmacy  
The Hebrew University of Jerusalem  
Jerusalem, Israel

Richard H. Guy  
Department of Pharmacy and Pharmacology  
University of Bath  
Claverton Down  
Bath, UK

Amnon Hoffman  
Department of Pharmaceutics  
School of Pharmacy  
The Hebrew University of Jerusalem  
Jerusalem, Israel

Patrick M. Hughes  
Allergan, Inc.  
Irvine, California

Alexander V. Kabanov  
Department of Pharmaceutical Sciences  
University of Nebraska Medical Center  
Omaha, Nebraska

Indu Pal Kaur  
University Institute of Pharmaceutical Sciences  
Punjab University  
Chandigarh, India

Joseph Kost  
Department of Chemical Engineering  
Ben-Gurion University of Negev  
Beer Sheva, Israel

Sian Tiong Lim  
MedPharm  
King’s College London  
London, UK
Yoshiharu Machida  
Department of Drug Delivery Research  
Hoshi University  
Tokyo, Japan

R. Karl Malcolm  
School of Pharmacy  
Queen’s University of Belfast  
Belfast, UK

Gary P. Martin  
Pharmaceutical Sciences Research Division  
King’s College London,  
London, UK

Stephen D. McCullagh  
School of Pharmacy  
Queen’s University of Belfast  
Belfast, UK

Elias Meezan  
Department of Pharmacology and  
Toxicology  
School of Medicine  
University of Alabama at Birmingham  
Birmingham, Alabama

Bozena Michniak  
Ernest Mario School of Pharmacy  
Rutgers—The State University of New Jersey  
Piscataway, New Jersey

Ryan J. Morrow  
School of Pharmacy  
Queen’s University of Belfast  
Belfast, UK

Blaise Mudry  
School of Pharmaceutical Sciences  
University of Geneva  
Geneva, Switzerland

Orest Olejnik  
Allergan, Inc.  
Irvine, California

Hiraku Onishi  
Department of Drug Delivery Research  
Hoshi University  
Tokyo, Japan

Dennis J. Pillion  
Department of Pharmacology and  
Toxicology  
School of Medicine  
University of Alabama at Birmingham  
Birmingham, Alabama

Maja Ponec  
Department of Drug Delivery Technology  
Leiden/Amsterdam Center for Drug Research  
Leiden University  
Leiden, The Netherlands

Silvia Rossi  
Department of Pharmaceutical Chemistry  
School of Pharmacy  
University of Pavia  
Pavia, Italy

Abraham Rubinstein  
Department of Pharmaceutics  
School of Pharmacy  
The Hebrew University of Jerusalem  
Jerusalem, Israel

Giuseppina Sandri  
Department of Pharmaceutical Chemistry  
School of Pharmacy  
University of Pavia  
Pavia, Italy

Ekaterina M. Semenova  
Jules Stein Eye Institute  
UCLA School of Medicine  
Los Angeles, California

John D. Smart  
School of Pharmacy and Biomolecular Sciences  
University of Brighton  
Brighton, UK

Rashmi Thakur  
Ernest Mario School of Pharmacy  
Rutgers—The State University of New Jersey  
Piscataway, New Jersey
Elka Touitou
Department of Pharmaceutics
School of Pharmacy
The Hebrew University of Jerusalem
Jerusalem, Israel

Kaneto Uekama
Graduate School of Pharmaceutical Sciences
Kumamoto University
Kumamoto, Japan

Yoshiteru Watanabe
Department of Pharmaceutics and Biopharmaceutics
Showa Pharmaceutical University
Tokyo, Japan

Martin Werle
ThioMatrix GmbH, Research Center
Innsbruck, Austria

Adrian C. Williams
School of Pharmacy
University of Reading
Reading, UK

Clive G. Wilson
Department of Pharmaceutical Sciences
Royal College, University of Strathclyde
Glasgow, UK

Lior Wolloch
Department of Biomedical Engineering
Ben-Gurion University of Negev
Beer Sheva, Israel

A. David Woolfson
School of Pharmacy
Queen’s University of Belfast
Belfast, UK
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Promoted Gastrointestinal Drug Absorption
1 Gastrointestinal Anatomy, Physiology and Permeation Pathways

Abraham Rubinstein

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