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Edited by Claus-Michael Lehr, **Cell Culture Models of Biological Barriers**

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Reviewed by Dr S. Deferme, Lilly Development Centre, Leuven, Belgium, where he holds a position in the Investigative ADME Group. Dr Deferme has been involved in the area of drug absorption (Caco-2, intestinal tissues, Ussing chambers) for the past 5 years.

As the pharmaceutical industry strives to implement the 3R principle (Refinement, Reduction and Replacement of in-vivo animal testing), more and more sophisticated cell- and tissue-based test models have been introduced in pharmaceutical research, especially in the field of drug absorption and delivery. Compared with in-vivo studies on animals (or man), cell culture models have a higher throughput capacity and provide a more mechanistical insight into drug transport (e.g. enzymes involved in intestinal metabolism of the drug, efflux mechanisms limiting drug absorption). Besides their ethical and resource advantages, these cell culture models can easily be standardized and validated.

It is stated by the authors that the aim of this book is to provide a practical approach to contemporary cell culture-based in-vitro techniques for drug transport studies at biological absorption barriers, which is indeed reflected by the content of the book. For example, this book offers many detailed protocols on how to culture cells, which materials are required for transport binding and uptake experiments and how to perform these experiments.

The book contains 24 chapters and consists of 3 parts. In the first part, the general aspects of epithelial cell culture systems are described, including the basic aspects of cell growth and cell cycle, selection and standardization of cell culture media, bioelectrical characterization of cultured epithelial cell layers, characterization of drug transport over epithelial barriers, cellular binding, high throughput screening and issues of validation and quality control. In the second part, methods used to model particular epithelial barriers of pharmaceutical interest are reviewed. These epithelial barriers include the intestinal epithelium (Caco-2, Ussing chambers), the alveolar and bronchial epithelium, nasal mucosa, corneal and retinal epithelium, skin, buccal epithelium, the blood–placental barrier and, last but not least, the blood–brain barrier. Besides an overview of the currently existing models to study these epithelial barriers, the practical approach of this book is confirmed in each chapter by providing more detailed protocols on one specific model of choice. Finally, the third part of this book discusses a selection of emerging tools for studying biological barriers and drug transport, including in-silico approaches, confocal and two-photon fluorescence microscopy, fluorescence correlation spectroscopy and scanning force microscopy.

A general comment on this book is that some chapters contain over-detailed information (e.g. the chapter on cellular binding and uptake), while it would be interesting to have some additional and more elaborated details in other chapters, especially for people looking for basic information on cell cultures to study drug transport (the target audience of this book). For example, the chapter on bioelectrical characterization consists of 8 pages of text, while the determination of the bioelectrical parameters can be considered as a very useful tool in understanding the processes contributing to drug transport across the epithelial cell culture, and therefore it might need some further elaboration. A similar comment can be made on the characterization of transport across epithelial barriers, where the different transport routes (passive diffusion, active or carrier-mediated transport and carrier-mediated efflux) are very briefly highlighted. Moreover, this same brief basic information on transport routes is repeated several times throughout the book as an introduction to almost every chapter in the second part, which the reader might evaluate as redundant information.

In this second part of the book, it is a pity that for some important barriers, including the intestinal barrier and the blood–brain barrier, the focus was put too much on one specific cell culture type. For instance, although the Caco-2 cell culture model is a frequently used model to assess drug transport across the intestinal barrier, it is not the only existing cell culture model thus used. In addition, the limitations of this model in relationship to other models and how to overcome these limitations are not sufficiently elaborated.

In general, the chapters are well written and a sufficient amount of illustrations and tables is provided throughout the text. All sections end with a list of the relevant references, which is useful for the meticulous reader. The

Contents and Index pages are adequate for quick cross-referencing.

In summarizing, although some chapters might need some more detailed elaboration, I think this book is a very useful tool for its target audience, namely novices in the field of cell culture, including chemists, physicochemists and pharmacists, in the pharmaceutical industry and at universities. The more experienced users will probably prefer more detailed works on their specific model of interest.