Drug Delivery to the Brain-Physiological Concepts, Methodologies and Approaches

Maha Nasr*

Department of Pharmaceutics and Industrial Pharmacy, Faculty of Pharmacy, Ain Shams University, Cairo, Egypt


The process of delivering drugs to the brain is very complex in nature, owing to the unique anatomical properties of the brain and the presence of blood brain barrier (BBB), which restricts the delivery of molecules by virtue of its special junctions. In order to attempt the delivery of a certain drug to the brain, one must have the knowledge of many aspects, starting with the physiology of the brain and BBB, the nature of the disease to be targeted and the current status of drug to brain delivery in comparison with the emerging trends.

In this regard, this book deals with all the aspects of drug delivery to the brain, starting with the basic physiological concepts and the prediction of drug concentrations in the brain. It also addresses the methods of drug delivery to the CNS while taking into consideration the industrial point of view. Therefore, I believe that this book is useful to a wide range of audiences such as students, formulators, academic teachers as well as for the research and development industrial scientists.

The book is very well-structured, composed of five parts subdivided into twenty four chapters. Part one is entitled "Physiology and basic principles for drug handling by the brain". As the name implies, this part provides the basics that a reader must know regarding the brain and BBB. This part; which is subdivided into four chapters, covers in detail, the three main barrier layers separating the blood and the central nervous system, the drug metabolizing enzymes, and the role of transport systems for endogenous and xenobiotic compounds at the BBB and blood-CSF barrier (BCSFB) and their relationship with the CNS drug delivery. A very interesting chapter in this part is chapter three entitled " Blood-brain barrier (BBB) pharmacoproteomics: A new research field opened up by quantitative targeted absolute proteomics (QTAP)" which introduces QTAP methodology to quantitatively obtain the expression profile of proteins simultaneously and determine how it can benefit the BBB research.

Part two of this book is entitled "Pharmacokinetic concepts and methods for studying drug delivery across the blood-brain barrier". This section is subdivided into five chapters, mainly dealing with the pharmacokinetic principles of BBB transport and the intra-brain distribution of drugs, factors affecting the latter, how to predict the success of a drug which is expected to act within the brain and the challenges facing the prediction of human CNS drug effects.
also provides very useful information on the in vitro models of BBB as well as the in situ and in vivo animal models. Furthermore, chapter eight explains how the medical imaging technique (Positron emission tomography PET) can be used to investigate the fate of a candidate drug through radiolabelling.

One of the merits of this book is that it contains a part (three) which addresses the industrial approaches for investigating drugs that have potential applications in brain delivery during the drug discovery and development stage. This section is further divided into four chapters which focus on the techniques for investigating the rate and the extent of BBB transport of new chemical entities, prediction of a drug's level in the brain by virtue of its chemical structure and strategies to optimize or avoid CNS penetration in an attempt to avoid clinical trial failures. Interestingly, the last chapter of this section provides insights into the drug brain delivery approaches from a pharmacoeconomic perspective and suggests solutions on how to translate the lengthy discovery process into a financially rewarding one.

Part four would be very interesting to the readers who are seeking information on drug brain delivery, and how to overcome the challenges facing brain delivery using either novel formulation approaches or techniques. This part is subdivided into seven chapters, introducing the readers to the improved modalities of brain delivery using convection enhanced delivery, alternative routes of administration such as the intranasal route, or alternative formulation strategies such as the use of nanocarriers, protein vectors and intravenously administered viral vectors. The concept of "osmotic opening" of the BBB for drug treatment is highlighted in chapter nineteen.

Finally, the last part focuses on how the disease conditions can affect drug brain delivery. Several diseases are encountered in this section, namely inflammatory disorders, neurodegenerative disorders, brain trauma and stroke and brain tumors.

In my opinion, this book is an encyclopedic one with all illustrations done professionally and all the texts arranged in a readable style. The level of detail provided by this book ranks it among the top references in the context of brain delivery.

CONSENT FOR PUBLICATION
Not applicable.

CONFLICT OF INTEREST
The authors declare no conflict of interest, financial or otherwise.

ACKNOWLEDGEMENTS
Declared none.