

Preface

Despite the fact that many people skip prefaces of books, this page may be the first that you read in this book on the science and applications of skin delivery systems. Honestly, this book has come about as a slow-release preparation. After the highly successful Skin Delivery Advanced Technology Conference organized by Allured Publishing on the day prior to the In-cosmetics exhibition in 2004 in Milan, Italy, Nancy Allured and I discussed the possibility of composing a book based on the presentations of the Conference. But, I wanted a few more novel developments to be added, which led to a completely new book on the science and applications of skin delivery systems for the cosmetic and pharmaceutical industries.

The name “Science and Applications of Skin Delivery Systems” reflects how this book is different from others on skin delivery science. While there are many books available that describe the science of skin delivery, few describe the delivery systems themselves and even fewer describe the science of those systems. Most skin delivery books discuss topics like skin physiology and skin lipid organization, which are important subjects, if you want to understand the scientific background of skin delivery. The examples in such books are derived from simple systems, underscoring the author’s points, but these examples aren’t particularly useful to today’s formulators who deal with complex formulations that may contain as many as 50 ingredients. Other books discuss the various delivery systems available to the formulator of topical products. Often, these books are written by the suppliers of these systems who, of course, claim that their system can be used in every application. Cosmetic and pharmaceutical formulators are helped by the information but left wondering whether that particular system is the right delivery system for their formulation.

This book bridges the gap between the two extremes of all-science and all-systems books, although some skin physiology is covered when it is necessary to understand the discussion. The emphasis is mainly on the various systems and is written by experts who know the potentials as well as the limitations of the skin delivery systems. This *scientific* information allows the cosmetic or pharmaceutical formulator to select the right skin delivery system for his or her *application*. Let’s take a quick look at the six sections of the book.

The first section deals with ways to measure skin delivery, and contains chapters that introduce the principles and terminology that will come back continuously throughout the book. Chapters 1, “Skin Delivery: What it is and

Why We Need It,” and 2, “Measuring Skin Delivery,” are good reading material for those unfamiliar with skin delivery and ways to measure it, whereas those familiar with this science field may immediately jump to Chapter 3, “Methods for Studying Percutaneous Absorption,” which describes the latest findings and remaining issues within this field. Chapter 4, “The Application of Infrared Spectroscopic Imaging to Skin Delivery: Visualizing Molecular Localization in Formulations and in Skin,” is an example of how novel techniques keep emerging in this or adjacent fields that can also be used to measure skin penetration. It is also a good example of today’s attempts to visualize skin delivery—which certainly within the cosmetic industry—will have great applications.

The second section deals with skin delivery from emulsions. Emulsions are described as the forgotten skin delivery system. Though, they have been used since the days of Queen Cleopatra, until recently no serious attempts were made to understand skin delivery from emulsions. This section also reveals that many of the scientific observations made by skin delivery scientists in the 60s and 70s also hold true in much more complex formulations. Unfortunately, most cosmetic formulators do not know these scientific principles and therefore attempts are made in the various chapters to explain and apply them in specific examples, illustrating the benefit of using these scientific principles to one’s advantage. The chapters deal specifically with the influence of formulation type (Chapter 5, “The Influence of Formulation Type on Skin Delivery”), the influence of formulation polarity via the choice of emollients (Chapter 6, “The Influence of Emollients on Skin Penetration from Emulsions”), the influence of stratum corneum polarity via the use of adjuvants (Chapter 7, “The Effect of Changing the Polarity of the Stratum Corneum on the Dermal and Transdermal Delivery of Cosmetically Active Ingredients”), the influence on skin lipid organization via the choice of emulsifiers (Chapter 8, “The Influence of Emulsifiers on Skin Penetration from Emulsions”), the influence of liquid crystalline emulsion structure (Chapter 9, “Liquid Crystalline Emulsions as Cosmetic Delivery Systems”) and finally, the influence of droplet size on skin delivery (Chapter 10, “The Influence of Emulsion Droplet Size on Cosmetic Delivery”). Chapter 11, “Acoustic Attenuation Spectroscopy: A New Technique to Characterize the Stability and Structure of Semi-solid Topical Delivery Systems for Cosmetic and Pharmaceutical Applications,” is a stand-alone chapter that describes how to measure and control many additional aspects of formulation science such as stability.

The third section of this book deals with both soft and hard encapsulation techniques, though it is obvious that the boundary between these two techniques is rapidly disappearing. On the one hand, we have very flex-

ible systems like the elastosomes (Chapter 12, “Vesicles as Skin Delivery Vehicles”) and transfersomes (Chapter 15, “Flexible Liposomes for Topical Applications in Cosmetics”), on the other hand we have hard shelled systems like the solid lipid nanoparticles and the nanostructured lipid carriers (Chapter 13, “Challenging Cosmetics—Solid Lipid Nanoparticles (SLN[®]) and Nanostructured Lipid Carriers (NLC[®])”) but also soft encapsulation systems that encapsulate droplets (Chapter 14, “Soft Encapsulation”). Some systems function more on the molecular level than at a droplet or particle scale. An example is provided in Chapter 19, “Delivering Chemically Labile Molecules into the Stratum Corneum: An Example of Stabilizing Linoleic Acid with α -Cyclodextrin,” when discussing α -cyclodextrins as encapsulating systems. Chapter 16, “The Design of a Skin-friendly Carrier for Cosmetic Compounds Using Pheroid Technology,” describes a radically novel technology, showing that though this Pheroid technology works much more effort is needed before we fully understand why it works. Finally, attention is paid to the synthesis and production of these systems in Chapter 17, “Micro- and Nano-encapsulation of Water- and Oil-soluble Actives for Cosmetic and Pharmaceutical Applications,” and Chapter 18, “Encapsulation and Other Topical Delivery Systems”. In this section, it will become apparent that many different encapsulation systems exist but that they serve different purposes, such as stabilization of a chemically labile active ingredient, enhanced skin penetration, etc., or a combination of these. Authors have all provided extensive literature reference lists to allow those that need to know more to start their own additional research into these subjects.

The fourth section differs in that it discusses alternative ways to enhance skin delivery. This time, the innovation is not necessarily in the formulation itself but in the way it is applied or the techniques that are used during application. Examples involve the use of sonophoresis (Chapter 20, “Topical Delivery of Cosmetic Ingredients by Sonophoresis and Iontophoresis”), iontophoresis (Chapter 21, “Principles of Iontophoresis and its Applications in Cosmetics”) and electroporation (Chapter 22, “Skin Electroporation”). These methods will not be an automatic first choice—as they require the involvement of experts to operate equipment—but in specific cases, the results can be spectacular. Moreover, it will also become apparent that methodologies like iontophoresis are gradually being miniaturized and therefore now become available to the consumer without the use of these experts.

Special delivery routes such as the hair follicle are the focus of the fifth section. In Chapter 23, “Delivery from Rinse-off Products: Mission Impossible or a Reality for Cosmetic Science?,” the skin delivery from rinse-off

products is discussed, a technique that either requires very fast penetrating molecules or deposition technology to effectively change the rinse-off situation into a leave-on situation. The next two chapters are on novel techniques to measure transfollicular delivery. Chapter 24, “Novel Ways of Measuring the Transfollicular Transport of Active Ingredients Across the Skin,” describes, among other things, a novel on-line time and depth resolved visualization technique for transfollicular penetration. Although such techniques are unlikely to be used in the cosmetic or pharmaceutical industry as a test system to screen the clinical efficacy of formulations, they provide a wealth of information on the basic principles of transfollicular delivery. Chapter 25, “Significance of Follicular Delivery and Ways to Measure It,” describes the importance of transfollicular delivery and other (simpler) methods of measuring transfollicular delivery. As each method has its specific use, cosmetic and pharmaceutical formulators may want to use the more complicated techniques that can visualize skin delivery for, for instance, marketing purposes, and the other methods for quantifying transfollicular delivery on a more routine basis.

The book closes with a rather unusual section, future perspectives on skin delivery systems. This is discussed from a legal perspective (Chapter 26, “Legal Perspective on Cosmetic and Drug Skin Delivery Systems”), a marketing perspective (Chapter 27, “Marketing Skin Delivery Systems: Despite So Many Questions, Here Are Some Answers”) and a dermatological perspective (Chapter 28, “Clinical Relevance of Topical Delivery Systems for Active Cosmetic Ingredients (Cosmeceuticals)”). It is always difficult to describe what has not yet happened and what you think may happen. However, this section is intended to help R&D management of cosmetic and pharmaceutical companies identify issues that might appear when introducing such systems in the market place. Its true value can only be decided in a couple of years’ time.

And with that, we’ve come to the last sentence of this Preface: the shell is broken; it is time to deliver the precious content.

Johann Wiechers
Gouda, The Netherlands