

MARTIN'S PHYSICAL PHARMACY AND PHARMACEUTICAL SCIENCES

Physical Chemical and Biopharmaceutical Principles in the Pharmaceutical Sciences

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SIXTH EDITION

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*Dedicated to my parents Patricia and Patrick Sinko,
my wife Renee, and my children Pat, Katie (and Maggie)*

ALFRED N. MARTIN (1919–2003)

This fiftieth anniversary edition of *Martin's Physical Pharmacy and Pharmaceutical Sciences* is dedicated to the memory of Professor Alfred N. Martin, whose vision, creativity, dedication, and untiring effort and attention to detail led to the publication of the first edition in 1960. Because of his national reputation as a leader and pioneer in the then emerging specialty of physical pharmacy, I made the decision to join Professor Martin's group of graduate students at Purdue University in 1960 and had the opportunity to witness the excitement and the many accolades of colleagues from far and near that accompanied the publication of the first edition of *Physical Pharmacy*. The completion of that work represented the culmination of countless hours of painstaking study, research, documentation, and revision on the part of Dr. Martin, many of his graduate students, and his wife, Mary, who typed the original manuscript. It also represented the fruition of Professor Martin's dream of a textbook that would revolutionize pharmaceutical education and research. *Physical Pharmacy* was for Professor Martin truly a labor of love, and it remained so throughout his lifetime, as he worked unceasingly and with steadfast dedication on the subsequent revisions of the book.

The publication of the first edition of *Physical Pharmacy* generated broad excitement throughout the national and international academic and industrial research communities in pharmacy and the pharmaceutical sciences. It was the world's first textbook in the emerging discipline of physical pharmacy and has remained the "gold standard" textbook on the application of physical chemical principles in pharmacy and the pharmaceutical sciences. *Physical Pharmacy*, upon its publication in 1960, provided great clarity and definition to a discipline that had been widely discussed throughout the 1950s but not fully understood or adopted. Alfred Martin's *Physical Pharmacy* had a profound effect in shaping the direction of research and education throughout the world of pharmaceutical education and research in the pharmaceutical industry and academia. The publication of this book transformed pharmacy and pharmaceutical research from an essentially empirical mix of art and descriptive science to a quantitative application of fundamental physical and chemical scientific principles to pharmaceutical systems and dosage forms. *Physical Pharmacy* literally changed the direction, scope,

focus, and philosophy of pharmaceutical education during the 1960s and the 1970s and paved the way for the specialty disciplines of biopharmaceutics and pharmacokinetics which, along with physical pharmacy, were necessary underpinnings of a scientifically based clinical emphasis in the teaching of pharmacy students, which is now pervasive throughout pharmaceutical education.

From the time of the initial publication of *Physical Pharmacy* to the present, this pivotal and classic book has been widely used both as a teaching textbook and as an indispensable reference for academic and industrial researchers in the pharmaceutical sciences throughout the world. This sixth edition of *Martin's Physical Pharmacy and Pharmaceutical Sciences* serves as a most fitting tribute to the extraordinary, heroic, and inspired vision and dedication of Professor Martin. That this book continues to be a valuable and widely used textbook in schools and colleges of pharmacy throughout the world, and a valuable reference to pharmaceutical scientists and researchers, is a most appropriate recognition of the life's work of Alfred Martin. All who have contributed to the thorough revision that has resulted in the publication of the current edition have retained the original format and fundamental organization of basic principles and topics that were the hallmarks of Professor Martin's classic first edition of this seminal book.

Professor Martin always demanded the best of himself, his students, and his colleagues. The fact that the subsequent and current editions of *Martin's Physical Pharmacy and Pharmaceutical Sciences* have remained faithful to his vision of scientific excellence as applied to understanding and applying the principles underlying the pharmaceutical sciences is indeed a most appropriate tribute to Professor Martin's memory. It is in that spirit that this fiftieth anniversary edition is formally dedicated to the memory of that visionary and creative pioneer in the discipline of physical pharmacy, Alfred N. Martin.

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November 2009

Ever since the First Edition of *Martin's Physical Pharmacy* was published in 1960, Dr. Alfred Martin's vision was to provide a text that introduced pharmacy students to the application of physical chemical principles to the pharmaceutical sciences. This remains a primary objective of the Sixth Edition. *Martin's Physical Pharmacy* has been used by generations of pharmacy and pharmaceutical science graduate students for 50 years and, while some topics change from time to time, the basic principles remain constant, and it is my hope that each edition reflects the pharmaceutical sciences at that point in time.

ORGANIZATION

As with prior editions, this edition represents an updating of most chapters, a significant expansion of others, and the addition of new chapters in order to reflect the applications of the physical chemical principles that are important to the Pharmaceutical Sciences today. As was true when Dr. Martin was at the helm, this edition is a work in progress that reflects the many suggestions made by students and colleagues in academia and industry. There are 23 chapters in the Sixth Edition, as compared with 22 in the Fifth Edition. All chapters have been reformatted and updated in order to make the material more accessible to students. Efforts were made to shorten chapters in order to focus on the most important subjects taught in Pharmacy education today. Care has been taken to present the information in “layers” from the basic to more in-depth discussions of topics. This approach allows the instructor to customize their course needs and focus their course and the students' attention on the appropriate topics and subtopics.

With the publication of the Sixth Edition, a Web-based resource is also available for students and faculty members (see the “Additional Resources” section later in this preface).

FEATURES

Each chapter begins with a listing of **Chapter Objectives** that introduce information to be learned in the chapter. **Key Concept Boxes** highlight important concepts, and each **Chapter Summary** reinforces chapter content. In addition, illustrative **Examples** have been retained, updated, and expanded. **Recommended Readings** point out instructive additional sources for possible reference. **Practice Problems** have been

moved to the Web (see the “Additional Resources” section later in this preface).

SIGNIFICANT CHANGES FROM THE FIFTH EDITION

Important changes include new chapters on Pharmaceutical Biotechnology and Oral Solid Dosage Forms. Three chapters were rewritten de novo on the basis of the valuable feedback received since the publication of the Fifth Edition. These include Chapter 1 (“Introduction”), which is now called Interpretive Tools; Chapter 20 (“Biomaterials”), which is now called Pharmaceutical Polymers; and Chapter 23 (“Drug Delivery Systems”), which is now called Drug Delivery and Targeting.

ADDITIONAL RESOURCES

Martin's Physical Pharmacy and Pharmaceutical Sciences, Sixth Edition, includes additional resources for both instructors and students that are available on the book's companion Web site at thepoint.lww.com/Sinko6e.

Instructors

Approved adopting instructors will be given access to the following additional resources:

- Practice problems and answers to ascertain student understanding.

Students

Students who have purchased *Martin's Physical Pharmacy and Pharmaceutical Sciences*, Sixth Edition, have access to the following additional resources:

- A separate set of practice problems and answers to reinforce concepts learned in the text.

In addition, purchasers of the text can access the searchable Full Text Online by going to the *Martin's Physical Pharmacy and Pharmaceutical Sciences*, Sixth Edition, Web site at thePoint.lww.com/Sinko6e. See the inside front cover of this text for more details, including the passcode you will need to gain access to the Web site.

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And to my wonderful wife, Renee, who deserves enormous credit for juggling her hectic professional life as a pharmacist and her expert skill as the family organizer while maintaining a sense of calmness in what is an otherwise chaotic life.

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