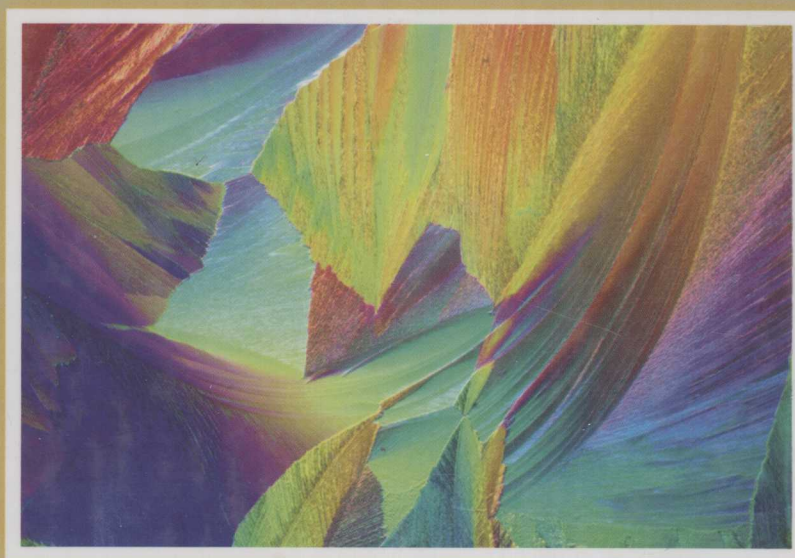


RICHARD A. LEHNE

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Pharmacology

FOR NURSING CARE



FIFTH EDITION

evolve

Pharmacology

FOR NURSING CARE



FIFTH EDITION

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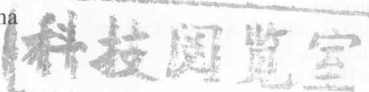
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NOTICE

Pharmacology is an ever-changing field. Standard safety precautions must be followed, but as new research and clinical experience broaden our knowledge, changes in treatment and drug therapy may become necessary or appropriate. Readers are advised to check the most current product information provided by the manufacturer of each drug to be administered to verify the recommended dose, the method and duration of administration, and contraindications. It is the responsibility of the licensed prescriber, relying on experience and knowledge of the patient, to determine dosages and the best treatment for each individual patient. Neither the publisher nor the editor assumes any liability for any injury and/or damage to persons or property arising from this publication.

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*Dedicated
to*

Nancy

Who has enriched my life in
ways I could not have imagined

Thank you, Nance,

for

bringing flowers to the yard,
top-notch pots to the kitchen,
and the concept of fashion to my outdated wardrobe;

and for

teaching me about horses and ponies,
and tractors and Bush Hogs,
and barn dogs and Jack Russell terriers;

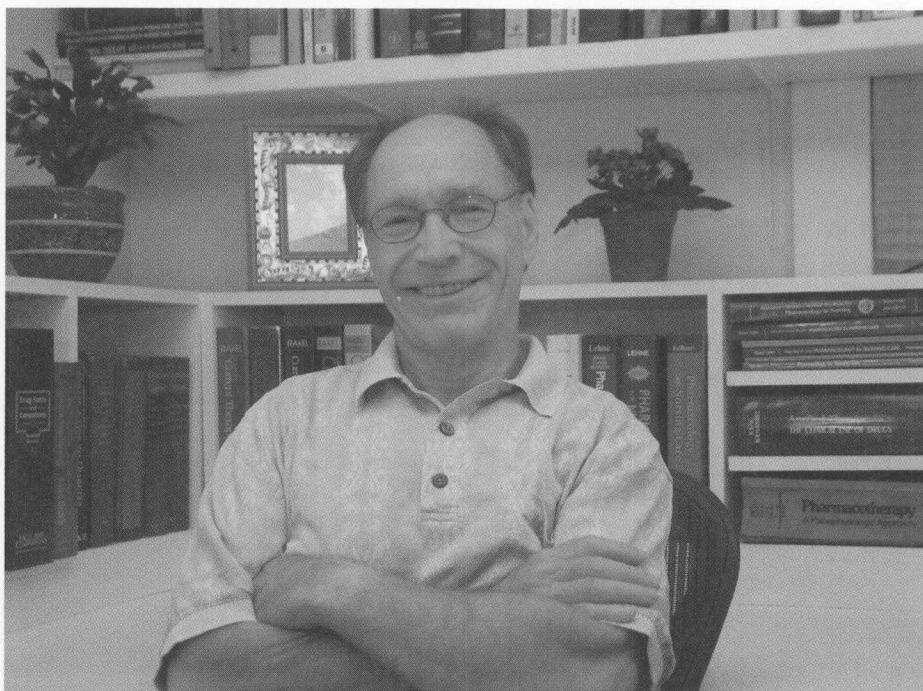
and for

introducing me to Ashley and Gentry,
and Gordon and Helen,
and everyone else in your close-knit and welcoming family;

and, most especially, for

sharing your warmth at night,
your dreams in the morning,
and your trust and love all day long.

About the Author



Richard A. Lehne, PhD, received his BA from Drew University and his PhD in pharmacology from George Washington University. His involvement in nursing education began 24 years ago at the University of Virginia School of Nursing, where he taught undergraduate and graduate pharmacology courses and was voted best teacher by his students. He has also taught at the University of Arizona in both the School of Nursing and School of Pharmacy. For the past 18 years, most of his time has been devoted to creating and revising

this book. Dr. Lehne (rhymes with zany or rainy) lives in Charlottesville, VA, where he likes to bike (as age, weather, and editors permit), practice cooking (it's like being back in the lab, but more fun), and help Nancy (his SO) conduct equestrian shows at her farm (he now knows the difference between a horse and a pony, sort of). Oh yes, and he's still waiting (wistfully) for the neighbor's roosters to discover migration.

Consultants

Linda A. Moore, EdD, RN, APRN, BC (GNP/ANP), MSCN, is an Associate Professor of Nursing at the University of North Carolina at Charlotte and a Nurse Practitioner in the Multiple Sclerosis Center of Carolinas HealthCare Systems. She received her BSN from Duke University and her MSN and EdD from the University of Virginia. Her teaching responsibilities encompass courses for undergraduate (RN to BSN) and graduate students. Her major clinical and research interests are multiple sclerosis, cardiovascular nursing, and gerontologic nursing. Dr. Moore is a member of the North Carolina Nurses' Association, Sigma Theta Tau, and the International Organization of Multiple Sclerosis Nurses.

Leanna J. Crosby, DNSc, G/ANP-C, received her diploma in nursing from St. Luke's Hospital School of Nursing, her baccalaureate and master's degrees from the University of Virginia, and her doctorate in nursing science from Catholic University of America. Also, she completed the adult nurse practitioner program at the University of Virginia and the gerontologic nurse practitioner program at the University of Arizona. Dr. Crosby has done extensive research in chronic rheumatoid disease, and has taught physiology and pathophysiology to a generation of appreciative graduate and undergraduate students. Currently, she is working as a nurse practitioner within the Department of Veteran Affairs, Southern Arizona Veterans Administration Healthcare System, and is an Adjunct Associate Professor at the University of Arizona College of Nursing. Dr. Crosby is a member of the American Nurses Association, Sigma Theta Tau, and the Arizona Nurses' Association, and serves on the Arizona State Board of Nursing Advanced Practice Committee. In addition, she serves as the VISN

18 (Arizona, Texas, and New Mexico) coordinator for the Advanced Practice Nursing Network. At the local level, she is Membership Chair for the Southern Arizona Nurse Practitioner Association, a member of the Professional Standards Board for Nursing at the Southern Arizona VA Medical Center, and Chair of the Tucson VA IACUC Animal Research Committee.

Diane B. Hamilton, PhD, RN, received her BA from Northwestern University, her BSN from West Texas State University, her MA in Community Mental Health and Gerontologic Nursing from the University of Iowa, and her PhD in Psychosocial Nursing and Nursing History from the University of Virginia. She has extensive experience in psychiatric nursing, including serving as Attending Nurse at the Institute of Psychiatry of the Medical University of South Carolina. She has taught psychiatry and behavioral science to medical students, and gerontology, community health, psychiatric nursing, and nursing history to nursing students. Currently, she is a Professor in the School of Nursing at Western Michigan University, where she teaches psychiatric nursing and nursing history and does nursing history research. Dr. Hamilton is a member of the American Nurses Association, the American Association of the History of Nursing, the American Association for the History of Medicine, the American Association of University Women, and Sigma Theta Tau. In addition, Dr. Hamilton is a recipient of the Best of *Image* Award in nursing history, the Lavinia Dock Award for historical scholarship, the Best Investigator Award from the University of Rochester, the Golden Apple Teaching Award from the Medical University of South Carolina and the Distinguished Scholar Award from Western Michigan University.

Preface to the Fifth Edition

OVERVIEW OF THE BOOK

Welcome to the fifth edition of *Pharmacology for Nursing Care*, the pharmacology text that students like to read, really. This edition, like the first four, was written to be a true textbook—that is, a book that focuses on essentials and downplays secondary details. To give the book focus, three primary techniques are employed: (1) teaching through prototypes, (2) use of large print for essential information and small print for secondary information, and (3) limiting discussion of adverse effects and drug interactions to ones that are of particular clinical significance. Also, key points are summarized at the end of each chapter. To reinforce the relationship between pharmacologic knowledge and nursing practice, nursing implications are integrated into the body of each chapter. In addition, to provide rapid access to nursing content, nursing implications are summarized at the end of most chapters, using a nursing process format. As in prior editions, this edition emphasizes conceptual material, thereby reducing rote memorization, promoting comprehension, and increasing reader friendliness. For a description of the book's classic distinguishing features, please refer to the Preface to the First Edition, which follows on page XI.

NEW IN THIS EDITION

Pharmacology for Nursing Care has been revised cover to cover. All chapters have been updated and two new chapters and one new appendix have been added. Topics with significantly expanded coverage include medication errors, adverse drug reactions, Parkinson's disease, pain management, diabetes, hypertension, cholesterol-lowering drugs, hormone replacement therapy, and therapy of viral infections. This edition introduces a host of new drugs and six new Special Interest Topics. In addition, new treatment guidelines have been added, and older guidelines have been updated.

New Drugs

More than 100 new drugs and formulations have been added. Important among these are atomoxetine [Strattera], the first nonstimulant for attention deficit-hyperactivity disorder; aripiprazole [Abilify], the first dopamine system stabilizer for psychosis; ezetimibe [Zetia], the first drug to block cholesterol absorption; teriparatide [Forteo], the first drug to significantly increase bone formation; and enfuvirtide [Fuzeon], the first fusion inhibitor for HIV infection.

New Chapters

This edition has two new chapters. Chapter 102 (Drugs for the Ear) focuses primarily on otitis media, one of the most common disorders of childhood. Otitis externa is also discussed.

Chapter 106 (Potential Weapons of Biologic, Radiologic, and Chemical Terrorism) focuses primarily on potential bacterial and viral weapons (e.g., anthrax, small pox). Biotoxins, chemicals (nerve agents, mustard gas), and radiologic weapons are discussed as well.

Restructured Content

Our coverage of neurodegenerative disorders now appears in a subsection of its own in Unit V, entitled "Drugs for Neurodegenerative Disorders." This subsection includes separate chapters on drugs for Parkinson's disease (Chapter 21) and drugs for Alzheimer's disease (Chapter 22). Likewise, the coverage of anticancer drugs has now been split into two chapters: Chapter 98, Anticancer Drugs I: Cytotoxic Agents and Chapter 99, Anticancer Drugs II: Hormones, Hormone Antagonists, Biologic Response Modifiers, and Other Anticancer Drugs.

New Special Interest Topics

This edition has 25 boxes on Special Interest Topics, which address issues that I find especially engaging and hope you will too. Some boxes discuss cutting-edge therapies, some discuss ongoing controversies, some discuss topics of general interest, and some discuss issues featured in the popular press. Titles of the six new boxes are:

- *Has the Placebo Lost Its Effect?*
- *Postpartum Depression*
- *Isolated Systolic Hypertension: The Real Killer of Aging Americans*
- *And the Best Drug Is . . . The Cheap One!*
- *Attention Ladies: Digoxin May Be Hazardous to Your Health*
- *Face Time with Botox*

A complete list of Special Interest Topics appears on the inside back cover of the book.

New Appendix

Because drug names are often hard to pronounce, we've added a pronunciation guide—Appendix B—for the 200 most widely prescribed drugs in 2002. Sound files to accompany Appendix B are available online at evolve.elsevier.com/Lehne/.

New Feature: Full-Color Printing

For the first time, *Pharmacology for Nursing Care* is printed in full color. The most obvious impact is on the figures: All new figures were drawn in full color, and full color was added to all existing figures. Color has also been used to enhance headings and other design elements. Why did we switch to full color? Primarily to facilitate learning. Of course, we also think the extra color makes the book look better.

ONLINE RESOURCES FOR STUDENTS

To accompany this edition, we have four online resources: Content Updates, an Audio Drug Glossary, WebLinks, and a list of important Canadian drug names. All of these resources are available at evolve.elsevier.com/Lehne/.

Content Updates

Pharmacology undergoes steady and sometimes rapid evolution. Important new drugs are introduced each year, uses for older drugs change, and previously unknown toxicities of available drugs may be revealed. As a result, a pharmacology text can quickly become dated. To keep this text current, we are providing “*Pharmacology for Nursing Care* UPDATES” online. Each update will focus on new drugs, drug alerts, and important advances in therapeutics. Content is keyed to chapters in the book. Issues can be searched by chapter number and by drug name. All content can be downloaded and printed.

Audio Drug Glossary

The Audio Drug Glossary contains sound files that pronounce the generic names of the 200 most commonly prescribed drugs. As discussed in Chapter 3, if drugs were assigned generic names whose pronunciation was obvious, a glossary such as this would be unnecessary. I look forward to the day when that’s the case.

WebLinks

The WebLinks provided on the Evolve website represent a large and dynamic library of links to drug-related web sites, keyed to the table of contents of this edition. The links are reviewed and edited frequently to ensure being current.

ANCILLARIES

Instructor’s Resource (CD-ROM, Online)

The Instructor’s Resource for the fifth edition is available on CD-ROM (ISBN 0-7216-0257-6) and online. It has four components: Instructor’s Manual, Test Bank, Image Collection, and PowerPoint Collection.

- The Instructor’s Manual is completely new, and emphasizes creative learning strategies to help students apply knowledge of pharmacology to nursing practice. The manual includes Teaching Strategies, Web Research Activities, Critical Thinking Case Studies, and an Open-Book Quiz for each chapter. Answers to the Open-Book Quizzes and Answer Guidelines for the Critical Thinking Case Studies are also provided.
- The Test Bank provides 750 NCLEX-style questions presented in versatile ExamView software, which allows faculty to customize paper-based or online exams through an easy-to-use, intuitive interface. For each question, we indicate the correct answer, nursing process step, NCLEX client-needs category, and cognitive type.
- The Image Collection contains every illustration from the book—about 150 all told, most in full color. The images

are presented in electronic format to facilitate classroom projection or online teaching.

- The PowerPoint Collection consists of nearly 600 text slides, which have been revised and updated for this edition. The slides may be used as-is, or adapted for classroom use or online presentation.

To obtain these resources, contact your Saunders-Elsevier Educational Sales Representative. If you don’t know who your rep is, you can find out by checking the Sales Rep Locator at us.elsevierhealth.com/relocator.jsp or by calling Saunders-Elsevier Faculty Support at 1-800-222-9570.

Pharmacology Instruction Online

Our new online learning tool—*Pharmacology Online to Accompany Lehne: Pharmacology for Nursing Care*, fifth edition (ISBN 0-7216-0250-9)—consists of ready-to-use modules that work hand-in-hand with the textbook. The package features nine in-depth, case-based modules that promote “learning by doing,” and cover such major topics as pharmacokinetics, pharmacodynamics, basic principles of neuropharmacology, and hypertension. In addition, the package has additional modules that address key topics through a variety of engaging, interactive learning activities. All modules can be customized to meet unique teaching needs. For more information, contact your Saunders-Elsevier sales representative, who can be identified by calling 1-800-222-9570 or logging on to us.elsevierhealth.com/relocator.jsp.

Study Guide

The *Study Guide* (ISBN 0-7216-0128-6) is completely new. It was created by Marshal Shlafer, PhD, a gifted teacher and writer from the University of Michigan. The *Study Guide* features innovative learning activities for each chapter of the text, delivered in a clever and engaging style that will help students learn essential content and prepare for licensure exams.

Mosby’s Drug Consult

All faculty and students using *Pharmacology for Nursing Care*, fifth edition, are entitled to free basic-level access to *Mosby’s Drug Consult Internet Edition*, a resource with information on new drug approvals, new indications for existing drugs, and drug safety notices. To access this resource, log on to mosbysdrugconsult.com.

YOUR COMMENTS ARE WELCOME

I’d like to hear from you. All feedback is welcome. Suggestions for improving the book are especially helpful, as are reports of mistakes (small or large) that you may spot. Of course, I’d also like to hear from readers who simply have something nice to say. You can reach me by e-mail at lehne@adelphia.net or by U.S. postal service care of Saunders-Elsevier.

Richard A. Lehne

Preface to the First Edition

Pharmacology pervades all phases of nursing practice and relates directly to patient care and patient education. Yet, despite its importance, pharmacology remains an area with which students, practicing nurses, and teachers are often uneasy. Much of this ill ease stems from traditional approaches to the subject, in which memorizing details takes precedence over understanding. In this text, the opposite approach is used. Here, the guiding principle is to establish a basic understanding of drugs, after which secondary details can be learned as needed.

I wrote this text with two major objectives. First, I want to help nursing students establish a knowledge base in the basic science of drugs. Second, I want to demonstrate how that knowledge can be directly applied in providing patient care and patient education. To achieve these goals, I have used several innovative techniques, which are described below.

Laying Foundations in Basic Principles. Understanding drugs requires a strong foundation in basic pharmacologic principles. To establish this foundation, major chapters are dedicated to the following topics: basic principles that apply to all drugs (Chapters 4 through 8), basic principles of drug therapy across the life-span (Chapters 9 through 11), basic principles of neuropharmacology (Chapter 12), basic principles of antimicrobial chemotherapy (Chapter 79), and basic principles of cancer chemotherapy (Chapter 97).

Reviewing Physiology and Pathophysiology. To understand the actions of a drug, we must first understand the biologic systems that the drug influences. For all major drug families, relevant physiology and pathophysiology are reviewed. In almost all cases, reviews are presented at the beginning of each chapter, rather than in a systems review at the beginning of a unit. This juxtaposition of pharmacology, physiology, and pathophysiology is designed to facilitate understanding of the relationships among these subjects.

Teaching Through Prototypes. Within each drug family, we can usually identify one agent whose features characterize all members of the group. Such a drug can be viewed as a prototype. Because other family members are very similar to the prototype, to know the prototype is to know the basic properties of all family members.

The benefits of teaching through prototypes can be appreciated with an example. Let's consider the nonsteroidal anti-inflammatory drugs (NSAIDs), a family that includes aspirin, ibuprofen [Motrin, others], naproxen [Naprosyn, Anaprox], celecoxib [Celebrex], and more than 20 other drugs. Traditionally, information on these drugs is presented in a series of paragraphs describing each drug in turn. When attempting to study from such a list, students are likely to learn many drug names and little else; the important concept of similarity among family members is easily lost. In this text, the family prototype—*aspirin*—is discussed first and in depth. After this,

instruction is completed by pointing out the relatively minor ways in which individual NSAIDs differ from aspirin. Not only is this approach more efficient than the traditional approach, but also is more effective, in that similarities among family members are emphasized.

Large Print and Small Print: A Way to Focus on Essentials. Pharmacology is exceptionally rich in detail. There are many drug families, each with multiple members and each member with its own catalogue of indications, contraindications, adverse effects, and drug interactions. This abundance of detail confronts teachers with the difficult question of what to teach, and confronts students with the equally difficult question of what to study. Attempts to answer these questions can frustrate teachers and students alike. Even worse, in the presence of myriad details, basic concepts can be obscured.

To help focus on essentials, this text employs two sizes of type. Large type is intended to say, "On your first exposure to this topic, this is the core of information you should learn." Small type is intended to say, "Here is additional information that you may want to learn after mastering the material in large type." As a rule, large print is reserved for prototypes, basic principles of pharmacology, and reviews of physiology and pathophysiology. Small print is used for secondary information about the prototypes and for discussion of drugs that are not prototypes. This technique allows the book to contain a large body of detail without having that detail cloud the big picture. Furthermore, because the technique highlights essentials, it minimizes questions about what to teach and what to study.

The use of large and small print is especially valuable for discussing adverse effects and drug interactions. Most drugs are associated with many adverse effects and interactions. As a rule, however, only a few of these are noteworthy. In traditional texts, practically all adverse effects and interactions are presented, creating long and tedious lists. In this text, those few adverse effects and interactions that are especially characteristic are highlighted through presentation in large print; the remainder are noted briefly in small print. The net result? Rather than overwhelming students with a long and forbidding list, this text delineates a moderate body of information that's truly important, and thereby greatly facilitates comprehension.

Nursing Implications: Demonstrating the Application of Pharmacology to Nursing Practice. The principal reason for asking a nursing student to learn pharmacology is to enhance his or her ability to provide patient care and education. To show students how pharmacologic knowledge can be applied to nursing practice, nursing implications are *integrated into the body of each chapter*. That is, as specific drugs and drug families are discussed, the nursing implications inherent in the pharmacologic information are discussed side-by-side

with the basic science. To facilitate access to nursing information, nursing implications are also *summarized at the end of most chapters*. These summaries serve to reinforce the information presented in the main text.

In chapters that are especially brief or that address drugs that are infrequently used, summaries of nursing implications have been omitted. However, even in these chapters, nursing implications are incorporated into the chapter body.

A Note About Drug Therapy. Throughout this text, as we discuss specific drug families (e.g., beta-adrenergic blockers), we discuss the clinical applications of those drugs. Similarly, in chapters that focus on specific diseases (e.g., Parkinson's disease, hypertension), we indicate which drugs are generally considered most appropriate for treatment. However, it is important to note that clinical applications of individual drugs often change over time: A drug may acquire new indications that are not discussed here, or it may cease to be used for indications that *are* discussed here. Likewise, drug therapy of specific diseases is continually evolving: As clinical experience expands and superior drugs are developed, the list of preferred drugs can change. Accordingly, although the drug therapies presented in this text reflect a general consensus on what

is considered best *today*, these therapies may not be considered best a few years from now—and, in therapeutic areas where there is controversy or where change is especially rapid, the treatments discussed here may be considered inappropriate by some clinicians right now.

About Dosage Calculations. Unlike many nursing pharmacology texts, this one has no section on dosage calculation. Why this departure from tradition? First, adequate discussion of this important subject simply isn't feasible in a text dedicated to the basic science of drugs; the amount of space that can be allotted is too small. Second, thanks to the availability of several excellent publications on the subject (e.g., *Drug Calculations, 7th Edition: Process & Problems for Clinical Practice*), there is no need to include this information in a pharmacology text.

Ways to Use This Textbook. Because of its focus on essentials, this text is especially well suited to serve as the primary text for a course dedicated specifically to pharmacology. In addition, the book's focused approach makes it a valuable resource for pharmacologic instruction within an integrated curriculum and for self-directed learning by students, teachers, and practitioners.

Richard A. Lehne

Acknowledgments

I want to begin by thanking everyone involved at my extended publishing family, which now encompasses W.B. Saunders, Mosby, and Elsevier Health Sciences. Since 1985, these good people have given me support, encouragement, and guidance, along with the latitude to write the book I wanted to. For this edition, five individuals deserve special mention:

- Robin Carter, now executive publisher (formerly my acquisitions editor), embodies a refreshing blend of strength, warmth, and humor. In addition, she has conflict resolution skills to rival those of Jimmy Carter. Her only fault? Owning to a lamentable instability, at times she's been downright hard to find (over the past few years, publishing's gift to realtors has lived in no fewer than four locations: Philadelphia, Tucson, Phoenix, and, [now permanently?] St. Louis).
- Lee Henderson, the project's managing editor, did more than I'll likely ever know. He lined up reviewers, kept track of my progress, provided support as needed, and attended to the myriad details that precede and follow production. However, perhaps his greatest contribution was to ensure that my stress level never dropped to the tolerable range (by calling at least twice a day to remind me that being even a teeny bit more on schedule would be highly appreciated). Oh, did I mention that Lee's not only good at his job, but also a very likable guy with whom I've enjoyed working for two editions?
- Marie Thomas, Lee's editorial assistant, had the unglamorous (but nonetheless essential) job of receiving, logging, and photocopying nearly 2000 pages of manuscript, so that other members of the team would have grist for their mills. She also filled in for Lee whenever duty called. More importantly, Marie shared her compassion, insight, and keen wit, thereby making the few dark hours of this project considerably brighter.
- Celeste Clingan coordinated production and Catherine Jackson (Celeste's boss) kept a watchful eye on the process. More about them in a moment.

When the manuscript was nearly done (or so I thought), the book went into production, a painstaking process that carries a high risk of frayed nerves, strained relationships, and perforated ulcers—but not this time! Everyone involved contributed superb work, for which I am warmly and hugely grateful. How good was their work? So good that I hope the entire team will reconvene for the next edition (a sentiment I've never expressed before). And why was this team so good? Credit and apprecia-

tion go entirely to Catherine Jackson—publishing services manager—who used her considerable influence and experience to secure the best people available. Also, whenever *big* problems arose, Catherine brokered a solution. I want to extend special thanks to Celeste Clingan, our project manager. Throughout production, she remained cheerful, enthusiastic, surprisingly calm, and remarkably accommodating (we even conspired to make design changes on the fly, but don't tell anyone). Of greatest importance, she did everything necessary to ensure that the book in your hand would meet her high standards of quality. Of course, Celeste could not have accomplished all this without the hard work of other team members—especially the incomparable Diane Wilson, who typeset the *entire* book, including tables, flawlessly. Amazing. (If you've never been an author protecting your book from typesetters, you cannot fully appreciate just how grateful I am to Diane.) Finally, I want to thank Cindy Geiss, who colorized the artwork that was carried over from the fourth edition, and created most of the new art for this edition.

And then there's Jeanne Allison. It was Jeanne's job to make sure the artwork actually got done (you know those artists). Also, it seemed that whenever Lee failed to make his daily phone calls, Jeanne would take up the slack, making deft but gentle thrusts with a poke-the-author stick of her own.

I want to thank two contributors, Alfred J. Rémillard, PhD and Alan P. Agins, PhD. Fred Rémillard created the appendix on Canadian drug information for the first edition of this book, and has revised it for each subsequent edition. For the fourth edition of this book, Alan Agins (along with yours truly) created the chapter on herbal supplements, which served as the foundation for the updated version that appears in this edition.

I am grateful for the helpful suggestions offered by five reviewers: Betty Ferrell, PhD, FAAN, who reviewed Chapter 28 (Pain Management in Patients with Cancer); Eugenia Fulcher, RN, BSN, EdD, CMA, Robert Fulcher, RPh, BSPL, and Natasha Leskovsek, RN, MBA, MPM, JD, who reviewed Chapter 57 (Drugs Related to Hypothalamic and Pituitary Function) and Chapter 62 (Drug Therapy of Infertility); and Joseph Schwartzman, MD, who reviewed *all* of the chapters on antimicrobial drugs.

Last, but surely not least, I want to thank all members of the Saunders/Mosby educational sales force, whose professionalism and determination have contributed immeasurably to the book's success.

Rich Lehne

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