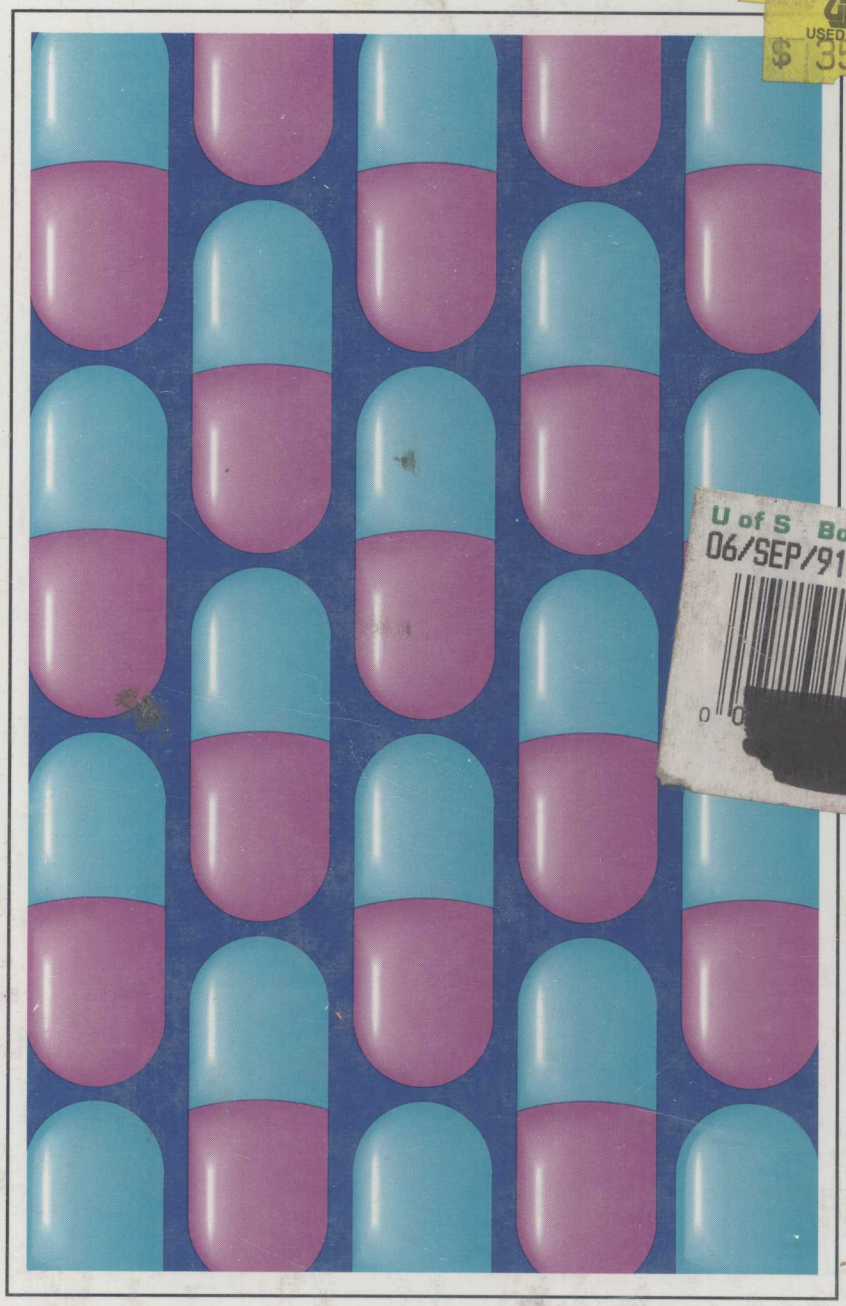
PHARMACOLOGY

for nursing care



Richard A. Lehne

anna Crosby • Diane Hamilton • Linda Moore

PHARMACOLOGY

for nursing care

Richard A. Lehne, PhD
Formerly Lecturer
School of Nursing
University of Virginia
Formerly Research Assistant Professor
Department of Pharmacology
University of Virginia School of Medicine
Charlottesville, Virginia

in collaboration with

Leanna J. Crosby, DNSc, RN
Assistant Professor
Director of Research Laboratories
College of Nursing
University of Arizona
Tucson, Arizona

Diane B. Hamilton, PhD, RN
Assistant Professor of Nursing
Instructor of Medicine
Attending Inpatient Psychiatric Unit
Medical University of South Carolina
Department of Psychiatry and Behavioral Science
Charleston, South Carolina

Linda A. Moore, MSN, EdD, RN
Assistant Professor of Nursing
University of North Carolina at Charlotte
Charlotte, North Carolina

W.B. SAUNDERS COMPANY
Harcourt Brace Jovanovich, Inc.
Philadelphia • London • Toronto • Montreal • Sydney • Tokyo

W. B. SAUNDERS COMPANY
Harcourt Brace Jovanovich, Inc.

The Curtis Center
Independence Square West
Philadelphia, PA 19106-3399

Library of Congress Cataloging-in-Publication Data

Pharmacology for nursing care / Richard Lehne . . . [et al.].
p. cm.
ISBN 0-7216-1766-2
1. Pharmacology. 2. Nursing. I. Lehne, Richard, 1943-
[DNLM: 1. Drug Therapy—nurses' instruction. 2. Pharmacology—nurses' instruction. QV 4 P5364]
RM301.P457 1990
615.1—dc20
DNLM/DLC

89-70017

Editor: Michael Brown
Developmental Editor: Lisa M. Konoplisky
Designer: Joan Owen
Production Manager: Carolyn Naylor
Manuscript Editors: Mary Anne Folcher and Margaret MacKay Eckman
Illustrators: Sharon Iwanczuk, Elizabeth Strausbaugh, and Arlette Ramphal
Illustration Coordinator: Lisa Lambert

Notice

In preparing this text, the authors have made every effort to verify the drug selections and standard dosages presented herein. It is not intended as a source of specific or correct drug use or dosage for any patient. Because of changes in government regulations, research findings, and other information related to drug therapy and drug reactions, it is essential for the reader to check the information and instructions provided by the manufacturer for each drug and therapeutic agent. These may reflect changes in indications or dosage and/or contain relevant warnings and precautions. Attention to these details is particularly important when the recommended agent is a new and/or infrequently employed drug. Any discrepancies or errors should be brought to the attention of the publisher.

PHARMACOLOGY FOR NURSING CARE 0-7216-1766-2

Printed in United States of America

Last digit is the print number: 9 8 7 6 5 4 3 2

For my father

Biographical Information

Richard A. Lehne, PhD, received his BA from Drew University and his doctorate in pharmacology from George Washington University. He did postdoctoral training in pharmacology at the University of Virginia School of Medicine. From 1980 to 1985 he taught undergraduate and graduate pharmacology at the University of Virginia School of Nursing, where his students voted him their best teacher. For the past four years Dr. Lehne has worked full time writing this book.

Leanna J. Crosby, DNSc, RN, received her diploma in nursing from St. Luke's Hospital School of Nursing, Denver, Colorado, her baccalaureate and masters in nursing from the University of Virginia, Charlottesville, Virginia, and a doctorate in nursing science from Catholic University of America, Washington, D.C.. At this time, she is an Assistant Professor and Director of the Research Laboratories, College of Nursing, University of Arizona, Tucson, Arizona. She teaches graduate level physiology within the College of Nursing. Her area of research interest is with patients who have chronic rheumatoid disease and the concepts associated with the disease process such as fatigue, depression, stress, and sleep/rest problems. She is a member of the University of Arizona Health Science Arthritis Center. She is a member of the Arthritis Health Professions Association, Sigma Xi Scientific Research Society, and Sigma Theta Tau, as well as other nursing organizations.

Diane B. Hamilton, PhD, RN, is an Assistant Professor of Nursing and an Instructor of Medicine in the Department of Psychiatry and Behavioral Sciences at the Medical University of South Carolina. She is an attending nurse in the Division of Psychiatric Nursing. Dr. Hamilton teaches psychiatry and behavioral science to medical students and also teaches psychiatric nursing and theoretical frameworks to MSN students at the University. She is responsible for coordinating staff education for the Institute of Psychiatry and, in addition, maintains a private practice specializing in depression in women. She taught psychiatry, gerontology, and community health to undergraduates at Mt. Mercy College and clinical psychology to undergraduates at University of Virginia and Medical University of South Carolina.

Dr. Hamilton is a member of the American Nurses Association, the American Association for the History of Nursing, the American Association for the History of Medicine, and Sigma Theta Tau. Dr. Hamilton received her RN from Northwestern University and her BSN from West Texas State University. She holds an MA from the University of Iowa in Community and Gerontological Nursing and a PhD from the University of Virginia in Psychosocial Nursing and Nursing History.

Linda A. Moore, RN, EdD, has taught undergraduate and graduate students in both clinical and classroom settings at University of Virginia and University of Virginia Medical Center. Her areas of clinical expertise are intensive care and coronary care. She acted as content coordinator of the undergraduate subject areas of adult and pediatric medical-surgical nursing and obstetrics and gynecology with an emphasis in acute care settings at the University of Virginia. Her graduate experience includes coordinating adult health at the master's level in multiple settings with both an acute and

community focus. She received her BSN from Duke University, a MSN from the University of Virginia, and her doctorate in education from the University of Virginia. She is currently Assistant Professor of Nursing at the University of North Carolina at Charlotte.

Preface

Pharmacology pervades all phases of nursing practice and relates directly to patient care and education. Despite its pervasiveness and importance, pharmacology remains an area in which students, practitioners, and teachers are often uneasy. Much of this uneasiness stems from traditional approaches to the subject, in which memorization of details has taken precedence over understanding. In this text, the opposite approach is taken. Here, the guiding principle is to establish a basic understanding of drugs, after which the secondary details can be learned as needed.

This text was written with two major objectives. The first is to help the nurse establish a knowledge base in the basic science of drugs. The second is to demonstrate how that knowledge can be directly applied to provision of patient care and education. To achieve these goals, several innovative techniques have been employed. These 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, 5, 6, 7, and 8); basic principles of neuropharmacology (Chapter 9); basic principles of antimicrobial chemotherapy (Chapter 68); and basic principles of cancer chemotherapy (Chapter 83). Discussion of these subjects is extensive and in depth.

Reviewing Physiology and Pathophysiology. To understand the actions of a drug, we must understand the systems that the drug influences. For all major drug families, relevant physiology and pathophysiology is reviewed. Reviews are presented *at the beginning of each chapter,* rather than in a systems review at the beginning of a unit. For example, in the unit on renal-cardiovascular drugs, which includes separate chapters on diuretics, hypertension, angina pectoris, congestive heart failure, cardiac arrhythmias, atherosclerosis, deficiency anemias, and thrombosis, reviews of relevant physiology and pathophysiology begin each chapter. This juxtaposition of pharmacology, physiology, and pathophysiology is designed to facilitate understanding of the inter-relationships among these subjects.

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

The benefits of teaching through prototypes can be appreciated with the following example. Let's consider the nonsteroidal anti-inflammatory drugs (NSAIDs), a family that includes aspirin, ibuprofen [Motrin], indomethacin, tolmetin, piroxicam, and others. Traditionally, information on these drugs is presented in a series of paragraphs describing each drug in its turn. When attempting to study from such a list, the student is likely to learn many drug names and little else; the important concept of similarity among family members is often 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, it is more effective in that similarities among family members are underscored.

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 the teacher with the difficult question of what to teach and the student with the equally difficult question of what to study. Attempts to answer these questions can frustrate teacher and student alike. Worse, in the presence of myriad details, basic concepts can become obscured.

To help establish a focus on essentials, this text employs two type sizes. Large print is intended to say, "On your first exposure to this topic, this is the core of information that you should learn." Small print is intended to say, "Here is additional important information that you may want to learn after mastering the material in large print." As a rule, large print has been reserved for prototypes, basic principles of pharmacology, and reviews of physiology and pathophysiology. Small print has been used for secondary information about the prototypes and for discussion of drugs that are not prototypes. By employing this technique, it has been possible to incorporate a large body of detail into the book without having that detail cloud the bigger 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, the few adverse effects and interactions that are especially characteristic are highlighted through discussion in large print; the remainder are noted briefly in small print. As a result, rather than overwhelming the student with a long and forbidding list, which can impede comprehension, the approach employed here, by delineating a moderate body of important information, serves to promote comprehension.

Demonstrating the Application of Pharmacology to Nursing Practice. The principal reason for asking a student of nursing to learn pharmacology is to enhance his or her ability to care for and educate patients. To show students how they can apply pharmacologic knowledge to nursing practice, nursing implications have been *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 applications have also been *summarized at the end of most chapters.* These summaries should serve to reinforce the information presented in the main text. In chapters that are especially brief or that address infrequently used drugs, summaries of nursing implications have been omitted. However, even in these chapters, nursing implications are incorporated into the chapter body.

About Dosage Calculations. Unlike many nursing pharmacology texts, this one has no section on dosage calculation. The reasons for this departure from tradition are twofold. First, adequate presentation 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., Kee and Marshall's *Clinical Calculations,* W.B. Saunders Company), the need to include this information in pharmacology texts has been obviated.

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

RICHARD A. LEHNE

Acknowledgments

It has been a privilege and pleasure to collaborate with Drs. Leanna J. Crosby, Diane B. Hamilton, and Linda A. Moore. Their extensive experience as clinicians and teachers has contributed immeasurably to the relevance and timeliness of the clinical and nursing content. Moreover, during the five years required to produce this book, their friendship and good humor have provided welcome and much needed sustenance. I further thank Dr. Moore for the section on techniques of drug administration.

I am grateful to Alfred J. Remillard, Pharm.D., for the section on Canadian drug information and for his composure and geniality under fire.

It has been my good fortune to work with the management and staff of the W.B. Saunders Company on this book. I am indebted to Michael Brown, editor in chief of the nursing book division, for his support of the project, from its inception (when he served as acquisition editor) to its completion; for his patience as the manuscript slowly grew; and for his capacity to preserve harmony at times when discord seemed certain.

Over the course of this marathon, I've worked with two developmental editors, Fran Mues and Lisa Konoplisky. Fran ran the initial leg of the race, passing the baton to Lisa just as the path approached its steepest ascent. Ms. Konoplisky completed the most demanding phase with efficiency, grace, and professionalism. My deep appreciation is also extended to Sharon Iwanczuk for faithful rendering of the figures; to Joan Owen, book designer; and to Carolyn Naylor, production manager.

Special acclaim is due Mary Anne Folcher of WBS, for whom the title copy editor is entirely inadequate. Over an eight-month span she worked with proficiency (not to mention endurance) to transmute a large and often ungainly manuscript into printable form. To the extent that this is a good book, the credit in large portion is hers. Thank you, Mary Anne, for your labors and for your humor, understanding, and encouragement.

Many individuals have reviewed the manuscript, either in part or in its entirety. I would particularly like to acknowledge the nursing educators who served as reviewers, most of whom critiqued the complete text, a truly formidable task. In this group are Rita Behnke, DNS, RN, Ellen Buckner, PhD, RN, Virginia Cassmeyer, PhD, RN, Marion F. Hale, MN, RN, Barbara J. Herlihy, PhD, RN, Barbara Holtzclaw, PhD, RN, Donna D. Ignatavicius, MS, RN, Karen S. Kesten, MSN, RN, CCRN, Janet Lingenfelter, EdD, RN, Martha Mourning, MSN, RN, Susan Stanwyck, MEd, MN, and Katherine Stefos, PhD. In addition, I wish to thank Dr. Joseph D. Schwartzman, who reviewed the units on antimicrobial drugs and antiparasitic drugs. My warmest appreciation is extended to all of the reviewers for enhancing this book with their comments.

I've had no faithful assistant to praise for countless hours spent typing and retyping the manuscript. I do wish, however, to thank the management and staff of SAMNA Corporation — makers of the word processing software employed in writing this book — for offering their expertise freely and frequently.

A new textbook is necessarily a descendant of those that preceded it, and to varying degrees will reflect that lineage. Accordingly, I wish to make explicit my implicit debt to this book's forebears, especially to the matriarch of all modern pharmacology texts: *Goodman and Gilman's The Pharmacological Basis of Therapeutics.*

I wish to thank the many friends, associates, and significant others who, over the years of this writing, have provided solace and encouragement and who, at last, can stop asking "Are you done yet?" I wish to extend special thanks to Dr. Theodore W. Rall, mentor and friend, whose influence on this book is greater than he knows (or might choose to admit); to Dr. Mary Anna Rushia, without whose wise counsel and kind heart this book might never have been conceived, let alone survived its long and difficult gestation; to Dr. Joseph Mooney who attended at the delivery; and, of course, to William C. Curtis, friend and director of the C.S.T., and to his able and accommodating staff.

RAL

Contents

* Dr. Remillard is the Associate Professor of Pharmacy at the College of Pharmacy, University of Saskatchewan, Saskatoon, Saskatchewan.

Expanded Contents