



Pharmacology for Nursing Care

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Second Edition

Pharmacology for Nursing Care

Second Edition

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Notice

In preparing this text, the author and publisher have exerted every effort to ensure that the drug dosages and usages presented herein are accurate and in accord with standards set by the United States Food and Drug Administration or considered appropriate by the general medical community. However, because standards for drug therapy are continually evolving, the reader is advised, before administering any drug, to consult the manufacturer's package insert for any changes in recommended dosages or indications, and for any additional warnings and precautions. This is especially important when administering newer drugs or those that are infrequently used. Any discrepancies or errors should be brought to the attention of the publisher.

PHARMACOLOGY FOR NURSING CARE, 2nd edition

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MAJOR DRUG CLASSES AND THEIR PROTOTYPES

The prototypic drugs in this list are classified in two ways: (1) by *pharmacologic family* (e.g., beta-adrenergic blockers), and (2) by *therapeutic family* (e.g., drugs for angina pectoris). Since a single drug may belong to multiple therapeutic families (in addition to its pharmacologic family), a drug may appear in the list more than once. Propranolol, for example, appears four times: first as a prototype for its pharmacologic family (beta-adrenergic blockers), and later as a prototype within three therapeutic families (antidysrhythmic drugs, drugs for angina pectoris, and drugs for hypertension).

PERIPHERAL NERVOUS SYSTEM DRUGS

- Muscarinic Agonists
 - Bethanechol
 - Pilocarpine
- Muscarinic Antagonists
 - Atropine
- Ganglionic Stimulants
 - Nicotine
- Ganglionic Blockers
 - Trimethaphan
- Neuromuscular Blockers
 - Competitive (Nondepolarizing)*
 - Tubocurarine
 - Depolarizing*
 - Succinylcholine
- Cholinesterase Inhibitors
 - Reversible*
 - Neostigmine
 - Irreversible (Organophosphates)*
 - Isoflurophate
- Adrenergic Agonists
 - Epinephrine
- Alpha-Adrenergic Blockers
 - Phentolamine
 - Prazosin
- Beta-Adrenergic Blockers
 - Beta₁ and Beta₂ Blockers*
 - Propranolol
 - Selective Beta₁ Blockers*
 - Metoprolol

CENTRAL NERVOUS SYSTEM DRUGS

- Drugs for Parkinson's Disease
 - Dopaminergic Drugs*
 - Levodopa (increases dopamine [DA] synthesis)
 - Carbidopa (blocks levodopa destruction)
 - Selegiline (inhibits monoamine oxidase-B)
 - Amantadine (promotes DA release)
 - Bromocriptine (DA receptor agonist)
 - Centrally Acting Anticholinergic Drugs*
 - Benztropine
- Drugs for Epilepsy
 - Phenytoin
 - Phenobarbital
 - Carbamazepine
 - Ethosuximide
 - Valproic acid
 - Diazepam (IV)

- Antipsychotic Agents
 - Traditional Antipsychotics*
 - Chlorpromazine (a low-potency agent)
 - Haloperidol (a high-potency agent)
 - Atypical Antipsychotics*
 - Clozapine
- Antidepressants
 - Tricyclic Antidepressants*
 - Imipramine
 - Monoamine Oxidase Inhibitors*
 - Phenelzine
 - Selective Serotonin Reuptake Antagonists*
 - Fluoxetine
- Drugs for Bipolar Disorder (Manic-Depressive Illness)
 - Lithium
- Drugs for Anxiety and Insomnia
 - Benzodiazepines*
 - Diazepam (for anxiety)
 - Triazolam (for insomnia)
 - Barbiturates*
 - Secobarbital
 - Nonbenzodiazepine-Nonbarbiturates*
 - Buspirone
- Opioid (Narcotic) Analgesics and Antagonists
 - Pure Opioid Agonists*
 - Morphine
 - Agonist-Antagonist Opioids*
 - Pentazocine
 - Pure Opioid Antagonist*
 - Naloxone
- General Anesthetics
 - Inhalation Anesthetics*
 - Halothane
 - Isoflurane
 - Nitrous oxide
 - Intravenous Anesthetics*
 - Thiopental
 - Ketamine
 - Droperidol plus fentanyl [Innovar]
- Central Nervous System Stimulants
 - Methylxanthines*
 - Caffeine
 - Amphetamines*
 - Amphetamine sulfate
 - Others*
 - Methylphenidate
 - Cocaine

MAJOR DRUG CLASSES AND THEIR PROTOTYPES

DIURETICS

High-Ceiling (Loop) Diuretics
 Furosemide
 Thiazide Diuretics
 Hydrochlorothiazide
 Potassium-Sparing Diuretics
 Spironolactone
 Triamterene

CARDIOVASCULAR DRUGS

Angiotensin-Converting Enzyme (ACE)
 Inhibitors
 Captopril
 Calcium Channel Blockers
Agents That Affect the Heart and Blood Vessels
 Verapamil
Agents That Affect Blood Vessels Primarily
 Nifedipine
 Drugs for Hypertension
Diuretics
 Hydrochlorothiazide
 Furosemide
 Spironolactone
Beta-Adrenergic Blockers
 Propranolol
 Metoprolol
Alpha-Adrenergic Blockers
 Prazosin
Combined Alpha / Beta Blocker
 Labetalol
Centrally Acting Antiadrenergics
 Clonidine
 Methyldopa
ACE Inhibitors
 Captopril
 Enalapril
Calcium Channel Blockers
 Verapamil
 Nifedipine
 Drugs for Angina Pectoris
Organic Nitrates
 Nitroglycerin
Beta Blockers
 Propranolol
 Metoprolol
Calcium Channel Blockers
 Verapamil
 Nifedipine
 Drugs for Congestive Heart Failure
Diuretics
 Hydrochlorothiazide
 Furosemide
 Spironolactone
Vasodilators
 Captopril (ACE inhibitor)

Inotropic Agents

Digoxin (a cardiac glycoside)
 Dopamine (a sympathomimetic)

Antidysrhythmic Drugs

Class I: Sodium Channel Blockers

Quinidine (Class IA)
 Lidocaine (Class IB)

Class II: Beta Blockers

Propranolol

Class III: Drugs That Delay Repolarization

Bretylium

Class IV: Calcium Channel Blockers

Verapamil

Others

Adenosine
 Digoxin

Drugs Used to Lower Blood Cholesterol

Bile Acid-Binding Resins

Cholestyramine

HMG-CoA Reductase Inhibitors

Lovastatin

Others

Nicotinic acid
 Gemfibrozil

Anticoagulant, Antiplatelet, and

Thrombolytic Drugs

Anticoagulants

Heparin (parenteral)
 Warfarin (oral)

Antiplatelet Drugs

Aspirin

Thrombolytic Drugs

Streptokinase
 Alteplase (tPA)

ENDOCRINE DRUGS

Drugs for Diabetes

Insulin Preparations

Regular insulin (insulin injection)
 Lente insulins

Sulfonylureas (Oral Hypoglycemics)

Tolbutamide

Drugs for Thyroid Disorders

Drugs for Hypothyroidism

Levothyroxine (T_4)

Drugs for Hyperthyroidism

Propylthiouracil

Contraceptive Agents

Combination Oral Contraceptives

Ethinyl estradiol plus norethindrone

Progestin-Only Oral Contraceptives

Norethindrone

Long-Acting Contraceptives

Subdermal progestin implant [Norplant]

Depot medroxyprogesterone acetate

Emergency Postcoital Contraceptives

Ethinyl estradiol plus norgestrel
 Mifepristone (RU 486)

Pharmacology for Nursing Care

Dedicated to the memory of
Betsey Abell
my dear friend

Biographic Information

Richard A. Lehne, PhD, received his BA from Drew University and his doctorate in pharmacology from George Washington University. Over the past fourteen years, he has taught pharmacology to undergraduate and graduate nursing students at the University of Arizona College of Nursing and the University of Virginia School of Nursing, and has been voted best teacher by his students. Dr. Lehne now lives in Charlottesville, VA, where he is occupied with writing, guest lecturing and learning to dance.

Linda A. Moore, EdD, RN, is an Associate Professor at the University of North Carolina at Charlotte. She received her BSN from Duke University and her MSN and EdD from the University of Virginia. She is currently Academic Coordinator of the Nurse Anesthesia program at UNC Charlotte/Carolinas Medical Center. In addition, she is Director of Continuing Education in the College of Nursing. Her major clinical and research interest is cardiovascular nursing, both cardiac risk prevention and care of the critically ill cardiac client. Dr. Moore is a member of the North Carolina Nurses' Association, Sigma Theta Tau, and the American Association of Critical Care Nurses.

Leanna J. Crosby, DNSc, RN, received her diploma in nursing from St. Luke's Hospital School of Nursing, her baccalaureate and master's degrees in nursing from the University of Virginia, and her doctorate in nursing science from Catholic University of America. She is now an Assistant Professor and Director of Research Laboratories at the University of Arizona College of Nursing. Her primary teaching responsibilities are graduate physiology and undergraduate pathophysiology.

Her area of research is chronic rheumatoid disease, and she is a member of the University of Arizona Health Science Arthritis Center. In addition, Dr. Crosby is a member of the Arthritis Health Professions Association, Sigma Xi Scientific Research Society, and Sigma Theta Tau and other nursing organizations.

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 an Assistant Professor at the University of Rochester College of Nursing, 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; she is also an Associate of the Susan B. Anthony Center. 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, and the Golden Apple Teaching Award from the Medical University of South Carolina.

Preface to the Second Edition

OVERVIEW OF THE BOOK

Welcome to the second edition of *Pharmacology for Nursing Care*, the pharmacology text nursing students *like* to read. This edition, like the first, was written to be a true *textbook*—that is, a book that focuses on essentials and downplays secondary details. To give the book its focus, three principal techniques are employed: (1) teaching through prototypes, (2) using 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. To reinforce the relationship of pharmacologic knowledge to nursing practice, nursing implications are integrated into the body of each chapter. In addition, to provide rapid access to nursing information, nursing implications are summarized at the end of most chapters. Like the first edition, the second emphasizes conceptual material, thereby reducing rote memorization and increasing reader friendliness. A detailed description of the book's distinguishing features is given in the preface to the first edition, which is reprinted herein.

NEW IN THIS EDITION

Incorporation of Nursing Process. The objective of drug therapy is to produce maximum benefits with minimum harm. To accomplish this objective, we must individualize treatment. The nursing process is well suited to help us do this. To demonstrate the applications of nursing process in drug therapy, we have (1) added a new chapter discussing the relationship of nursing process to drug therapy, and (2) restructured the summaries of nursing implications employing a modified nursing process format.

New Chapters. In response to developments in pharmacology and to suggestions from students and teachers, we have added nine new chapters:

- Pharmacology and the Nursing Process
- Drug Therapy in Pediatric and Geriatric Patients
- Drugs for Headache
- Angiotensin-Converting Enzyme Inhibitors
- Management of Myocardial Infarction
- Hematopoietic Growth Factors
- Drug Therapy of Urinary Tract Infections
- Drugs for Sexually Transmitted Diseases
- Immunosuppressive Drugs

Updates of Existing Chapters. All chapters have been extensively revised. Revisions include updated guidelines for managing common disorders (e.g., myocardial infarction, hypertension, high blood cholesterol, asthma, diabetes mellitus, peptic ulcer disease). More than 120 new drugs have been added.

TEACHING AIDS FOR INSTRUCTORS

An *Instructor's Manual* and *Transparency Set* are available at no charge to teachers using this text. The *Transparency Set* contains 100 color transparencies of figures (and a few tables) from the text. The *Instructor's Manual* contains (1) suggestions for setting up a pharmacology course, (2) over 70 case studies, including more than 350 short answer questions with answers and rationales, and (3) an exam bank with over 700 questions, most in NCLEX format. To obtain your *Instructor's Manual* and *Transparency Set*, contact your W. B. Saunders educational sales representative. (If you do not know who your sales representative is, you can find out from your school bookstore, or by calling W. B. Saunders sales support at 1-215-238-8406.)

RICHARD A. LEHNE

Preface to the First Edition

Pharmacology pervades all phases of nursing practice and relates directly to patient care and patient 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 takes 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 secondary details can be learned as needed.

This text was written with two major objectives. The first is to help nursing students establish a knowledge base in the basic science of drugs. The second is to demonstrate how that knowledge can be directly applied in providing patient care and patient education. To achieve these goals, several innovative techniques are 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 5 through 10), basic principles of neuropharmacology (Chapter 11), basic principles of antimicrobial chemotherapy (Chapter 73), and basic principles of cancer chemotherapy (Chapter 90).

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. 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 cardiovascular drugs, which includes separate chapters on hypertension, angina pectoris, congestive heart failure, myocardial infarction, and dysrhythmias, 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 best 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], indomethacin [Indocin], and more than twenty 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, it is also 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 the teacher with the difficult question of what to teach and confronts the student with the equally difficult question of what to study. Attempts to answer these questions can

frustrate teacher and student alike. Even 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 information that you may want to learn after mastering the material in large print." 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. By employing this technique, we have been able to incorporate a large body of detail into this book 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. As a result, rather than overwhelming students 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.

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 care for and educate patients. To show students how they can apply pharmacologic knowledge 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 should 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 may 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 superior drugs are developed, they tend to replace older, less desirable agents. 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. 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., *Math for Nurses*, 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 is especially well suited to serve as the primary text for courses dedicated specifically to pharmacology. In addition, the book's focused approach makes it a valuable resource for pharmacologic instruction within integrated curriculums and for self-directed learning by students and practitioners.

RICHARD A. LEHNE

Acknowledgments

In writing this edition, as in the first, I have enjoyed the wise counsel, warm friendship, and good humor of Drs. Linda A. Moore, Diane B. Hamilton, and Leanna J. Crosby. Special appreciation is due Dr. Moore for creating and coordinating the greatly expanded Instructor's Manual that accompanies this edition.

I want to thank Dr. Alfred J. Rémillard for revising and updating the section on Canadian Drug information, which he wrote originally for the first edition of this book.

I am grateful to a small army of extraordinary people at W. B. Saunders Company. Daniel T. Ruth, nursing editor, has given this project unfailing support; applied his considerable diplomatic skills to keep volatile situations from going ballistic (usually); coaxed a reluctant author into making changes that, in retrospect, really *are* improvements; and extended genuine friendship, which can be rare in our professional world. Special acclaim is due Arlene Friday, copy editor, for giving this text its final form, and for making an arduous and potentially contentious process go as smoothly and painlessly as this author could hope for. I am grateful also to Melissa Walter for creating the new artwork for this edition, to Sharon Iwanczuk for creating the artwork transported from the first edition, and to Joan Wendt for giving this edition its elegant design. Of course, I want to thank Susan Bielitsky, editorial assistant, who was always upbeat, sympathetic, and helpful, despite my frequent calls for aid. Finally, I want to thank Peter Faber, production manager, along with the entire production staff, for transmuting this book into tangible form.

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the entire manuscript. The contributors to the Instructor's Manual—Rebecca Kent Bevilacqua, RN,C, SNP; Diane Blanchfield, CRNA, MS; Judy Gias, BSN, RN, CCRN; Sonya Hardin, PhD, RN, CCRN, CS; Frances Rhyne King, MEd, MN, RN; Judith C. Mann, MSN, RN; Rosemary Martines, RN; Ann Mabe Newman, DSN, RN,C; Elaine Nishioka, MSN, RN, PNP; Carol O'Neil, PhD, RN; Sherry Walter, MSN, RN; and Willie Wachowiak, RN,C, FNP—provided insightful feedback within their areas of expertise; thank you all.

I want to thank my friends and colleagues at the University of Arizona College of Pharmacy, Tucson, AZ, who will recognize their influence throughout this book. It was my great pleasure to work with the faculty of the Department of Pharmacology and Toxicology teaching basic pharmacology to BSN students at the College of Nursing, and with Drs. Martin D. Higbee and Marie E. Gardner of the Department of Pharmacy Practice, who shared their considerable expertise in gerontology as we taught pharmacology and therapeutics to graduate students in the Gerontologic Nurse Practitioner program.

Lastly, I want to thank the friends and associates who have provided comfort and encouragement over the past year and a half as this revision took form. Four of you deserve special recognition: Jean Gratz, a steadfast friend with a talent for calling just when she's needed most; Bill Curtis, a longtime friend, who, despite the demands of maintaining the formularies at both the C.S.T. and his new dispensary, somehow found time for our frequent and lengthy commiserations; Sam Adams, always on tap, and never failing to provide solace during the occasional crisis; and, of course, the Muse of Pharmacology—my aging companion, Cat.

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