

KEE

---

HAYES

---

McCUISTION

---

6<sup>TH</sup> EDITION

# Pharmacology

*A Nursing  
Process Approach*

---



SAUNDERS  
ELSEVIER

**evolve**

<http://evolve.elsevier.com>



# Pharmacology

6TH EDITION

## A Nursing Process Approach

**Joyce LeFever Kee, MS, RN**

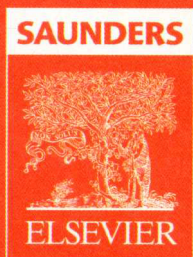
Associate Professor Emerita  
School of Nursing  
College of Health Sciences  
University of Delaware  
Newark, Delaware

**Evelyn R. Hayes, PhD, MPH, FNP-BC**

Professor  
School of Nursing  
College of Health Sciences  
University of Delaware  
Newark, Delaware

**Linda E. McCuiston, PhD, RN, ANP, CNS**

Professor  
Division of Nursing  
Our Lady of Holy Cross College  
New Orleans, Louisiana





**SAUNDERS**  
ELSEVIER

11830 Westline Industrial Drive  
St. Louis, Missouri 63146

PHARMACOLOGY: A NURSING PROCESS APPROACH  
Copyright © 2009 by Saunders, an imprint of Elsevier Inc.

ISBN: 978-1-4160-4663-9

**All rights reserved.** No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or any information storage and retrieval system, without permission in writing from the publisher. Permissions may be sought directly from Elsevier's Rights Department: phone: (11) 215 239 3804 (US) or (144) 1865 843830 (UK); fax: (144) 1865 853333; e-mail: [healthpermissions@elsevier.com](mailto:healthpermissions@elsevier.com). You may also complete your request on-line via the Elsevier website at <http://www.elsevier.com/permissions>.

**Notice**

Knowledge and best practice in this field are constantly changing. As new research and experience broaden our knowledge, changes in practice, treatment and drug therapy may become necessary or appropriate. Readers are advised to check the most current information provided (i) on procedures featured or (ii) by the manufacturer of each product to be administered, to verify the recommended dose or formula, the method and duration of administration, and contraindications. It is the responsibility of the practitioner, relying on their own experience and knowledge of the patient, to make diagnoses, to determine dosages and the best treatment for each individual patient, and to take all appropriate safety precautions. To the fullest extent of the law, neither the Publisher nor the Authors assumes any liability for any injury and/or damage to persons or property arising out of or related to any use of the material contained in this book.

The Publisher

Previous editions copyrighted 1993, 1997, 2000, 2003, and 2006.

**Library of Congress Cataloging-in-Publication Data**

Kee, Joyce LeFever.

Pharmacology : a nursing process approach / Joyce LeFever Kee, Evelyn R. Hayes, Linda E. McCuiston. -- 6th ed.  
p. ; cm.

Includes bibliographical references and index.

ISBN 978-1-4160-4663-9 (pbk. : alk. paper)

1. Pharmacology. 2. Nursing. I. Hayes, Evelyn R. II. McCuiston, Linda E. III. Title.

[DNLM: 1. Pharmacology--Nurses' Instruction. 2. Drug Therapy--Nurses' Instruction. QV 4 K26p 2009]

RM301.K44 2009

615'.1--dc22

2008035237

*Senior Acquisitions Editor:* Kristin Geen  
*Developmental Editor:* Jamie Horn  
*Editorial Assistant:* Jennifer Stoces  
*Publishing Services Manager:* Jeff Patterson  
*Senior Project Manager:* Clay S. Broeker  
*Design Direction:* Teresa McBryan

Printed in Canada

Last digit is the print number: 9 8 7 6 5 4 3 2 1

**Working together to grow  
libraries in developing countries**

[www.elsevier.com](http://www.elsevier.com) | [www.bookaid.org](http://www.bookaid.org) | [www.sabre.org](http://www.sabre.org)

**ELSEVIER**

**BOOK AID**  
International

**Sabre Foundation**



# Contents

## Unit One

### *A Nurse's Perspective of Pharmacology, 1*

- 1 Drug Action: Pharmaceutic, Pharmacokinetic, and Pharmacodynamic Phases, 2
- 2 Nursing Process and Client Teaching, 13
- 3 Principles of Drug Administration, 22

## Unit Two

### *Medications and Calculations, 45*

- 4 Medications and Calculations, 46

## Unit Three

### *Contemporary Issues in Pharmacology, 119*

- 5 The Drug Approval Process, 120
- 6 Transcultural and Genetic Considerations, 128
- 7 Drug Interactions and Over-the-Counter Drugs, 137
- 8 Drugs of Abuse, 149
- 9 Herbal Therapy with Nursing Implications, 169
- 10 Pediatric Pharmacology, 187
- 11 Geriatric Pharmacology, 197
- 12 Medication Administration in Community Settings, 207
- 13 The Role of the Nurse in Drug Research, 216

## Unit Four

### *Nutrition and Electrolytes, 223*

- 14 Vitamin and Mineral Replacement, 224
- 15 Fluid and Electrolyte Replacement, 238
- 16 Nutritional Support, 254

## Unit Five

### *Autonomic Nervous System Agents, 263*

- 17 Adrenergics and Adrenergic Blockers, 267
- 18 Cholinergics and Anticholinergics, 281

## Unit Six

### *Neurologic and Neuromuscular Agents, 295*

- 19 Central Nervous System Stimulants, 298
- 20 Central Nervous System Depressants, 307
- 21 Anticonvulsants, 321
- 22 Drugs for Neurologic Disorders: Parkinsonism and Alzheimer's Disease, 331
- 23 Drugs for Neuromuscular Disorders: Myasthenia Gravis, Multiple Sclerosis, and Muscle Spasms, 344

## Unit Seven

### *Pain and Inflammation Management Agents, 353*

- 24 Antiinflammatory Drugs, 355
- 25 Nonopioid and Opioid Analgesics, 373

## Unit Eight

### *Psychiatric Agents, 391*

- 26 Antipsychotics and Anxiolytics, 393
- 27 Antidepressants and Mood Stabilizers, 408

## Unit Nine

### *Antibacterial Agents, 421*

- 28 Penicillins and Cephalosporins, 422
- 29 Macrolides, Tetracyclines, Aminoglycosides, and Fluoroquinolones, 437
- 30 Sulfonamides, 453

## Unit Ten

### *Antimicrobial Agents, 459*

- 31 Antituberculars, Antifungals, Peptides, and Metronidazole, 460
- 32 Antivirals, Antimalarials, and Anthelmintics, 473
- 33 Drugs for Urinary Tract Disorders, 485

## Unit Eleven

### *Immunologic Agents, 493*

- 34 HIV- and AIDS-Related Drugs, 496
- 35 Vaccines, 515

## Unit Twelve

### *Antineoplastic Agents, 525*

- 36 Anticancer Drugs, 526
- 37 Targeted Therapies to Treat Cancer, 556
- 38 Biologic Response Modifiers, 570

## Unit Thirteen

### *Respiratory Agents, 589*

- 39 Drugs for Upper Respiratory Disorders, 591
- 40 Drugs for Lower Respiratory Disorders, 601

## Unit Fourteen

### *Cardiovascular Agents, 619*

- 41 Cardiac Glycosides, Antianginals, and Antidysrhythmics, 622
- 42 Diuretics, 642
- 43 Antihypertensives, 656
- 44 Anticoagulants, Antiplatelets, and Thrombolytics, 676
- 45 Antilipidemics and Peripheral Vasodilators, 690

## Unit Fifteen

### *Gastrointestinal Agents, 701*

- 46 Drugs for Gastrointestinal Tract Disorders, 703
- 47 Antiulcer Drugs, 722

## Unit Sixteen

### *Eye, Ear, and Skin Agents, 737*

- 48 Drugs for Disorders of the Eye and Ear, 740
- 49 Drugs for Dermatologic Disorders, 756

## Unit Seventeen

### *Endocrine Agents, 769*

- 50 Endocrine Drugs: Pituitary, Thyroid, Parathyroid, and Adrenal Disorders, 772
- 51 Antidiabetics, 789

## Unit Eighteen

### *Reproductive and Gender-Related Agents, 805*

- 52 Female Reproductive Cycle I: Pregnancy and Preterm Labor Drugs, 809
- 53 Female Reproductive Cycle II: Labor, Delivery, and Preterm Neonatal Drugs, 830
- 54 Postpartum and Newborn Drugs, 856
- 55 Drugs for Women's Health and Reproductive Disorders, 876
- 56 Drugs for Men's Health and Reproductive Disorders, 898
- 57 Drugs for Infertility and Sexually Transmitted Diseases, 909

## Unit Nineteen

### *Emergency Agents, 923*

- 58 Adult and Pediatric Emergency Drugs, 924



# Companion CD Contents\*

## NCLEX® Examination Review Questions

- Drug Action: Pharmacologic, Pharmacokinetic, and Pharmacodynamic Phases
- Nursing Process and Client Teaching
- Principles of Drug Administration
- Medications and Calculations
- The Drug Approval Process
- Transcultural and Genetic Considerations
- Drug Interaction and Over-the-Counter Drugs
- Drugs of Abuse
- Herbal Therapy with Nursing Implications
- Pediatric Pharmacology
- Geriatric Pharmacology
- Medication Administration in Community Settings
- The Role of the Nurse in Drug Research
- Vitamin and Mineral Replacement
- Fluid and Electrolyte Replacement
- Nutritional Support
- Adrenergics and Adrenergic Blockers
- Cholinergics and Anticholinergics
- Central Nervous System Stimulants
- Central Nervous System Depressants
- Anticonvulsants
- Drugs for Neurologic Disorders: Parkinsonism and Alzheimer's Disease
- Drugs for Neuromuscular Disorders: Myasthenia Gravis, Multiple Sclerosis, and Muscle Spasms
- Nonopioid and Opioid Analgesics
- Antiinflammatory Drugs
- Antipsychotics and Anxiolytics
- Antidepressants and Mood Stabilizers
- Penicillins and Cephalosporins
- Macrolides, Tetracyclines, Aminoglycosides, and Fluoroquinolones
- Sulfonamides
- Antituberculars, Antifungals, Peptides, and Metronidazole
- Antivirals, Antimalarials, and Anthelmintics
- Drugs for Urinary Tract Disorders
- HIV- and AIDS-Related Drugs
- Vaccines
- Anticancer Drugs
- Targeted Therapies
- Biologic Response Modifiers
- Drugs for Upper Respiratory Disorders
- Drugs for Lower Respiratory Disorders
- Cardiac Glycosides, Antianginals, and Antidysrhythmics
- Diuretics
- Antihypertensives
- Anticoagulants, Antiplatelets, and Thrombolytics
- Antilipids and Peripheral Vasodilators
- Drugs for Gastrointestinal Tract Disorders
- Antiulcer Drugs
- Drugs for Eye and Ear Disorders
- Drugs for Dermatologic Disorders
- Endocrine Drugs: Pituitary, Thyroid, Parathyroid, and Adrenal Disorders
- Antidiabetics
- Female Reproductive Cycle I: Pregnancy and Preterm Labor Drugs
- Female Reproductive Cycle II: Labor, Delivery, and Preterm Neonatal Drugs
- Postpartum and Newborn Drugs
- Drugs for Women's Health and Reproductive Disorders
- Drugs for Men's Health and Reproductive Disorders
- Drugs for Infertility and Sexually Transmitted Diseases
- Adult and Pediatric Emergency Drugs

## Pharmacology Animations

- Nursing, Medical, and Pharmacology Domains
- Client Noncompliance
- Agonists/Antagonists
- Receptor Interaction
- Passive Diffusion
- Impact of Surface Area
- Overview of Pharmacokinetics: Oral Administration
- Distribution: Fat- vs. Water-Soluble Drugs
- Cytochrome P-450 Drug Metabolism
- Half-Life of Intravenously Administered Ampicillin
- Drug Movement Through the Body
- Normal Electrophysiology
- Renin-Angiotensin in Control of Blood Pressure
- Time to Steady State
- Time to Steady State: Starting and Stopping Drug
- Adenosine Infusion, Cardiac Effects
- Atropine Therapy for Sinus Bradycardia
- Diltiazem Injection, Cardiac Effects
- Epinephrine and CPR
- Amiodarone Treatment for Ventricular Tachycardia
- Amiodarone, Antiarrhythmic Drug; Treatment of Ventricular Fibrillation
- Heparin for Acute Coronary Syndrome
- Heparin for Atrial Fibrillation

- Thrombolytic Drugs; Clot Dissolving Drugs
- Acute Myocardial Infarction

## IV Therapy Checklists

- Administration of Bolus Medication Through Continuous IV
- Adding Medication to a Secondary Intravenous Set (Volume Control Set)
- Intermittent Intravenous Medication Administration via a Piggyback or Secondary Set
- Changing Container of an Existing Intravenous Solution

## Medication Errors Checklists

- Interpreting Medication Orders
- Transcribing Medication Orders
- Reviewing Medication Orders
- Preparing Medications
- Administering Medications
- Assessing Client Response
- Appropriate Documentation of Medication Administration
- Procedural Safeguards
- Reporting Medication Errors

## Drug Calculation Problems

- Oral Medication Administration: Solid
- Oral Medication Administration: Liquid
- Injectable Medication (IM) Administration
- Intravenous Medication Administration
- Intermittent IV Administration
- IV Infusion Pump Administration
- Direct IV Injection Administration
- Pediatric Medication Administration
- Pediatric Intramuscular Administration
- Pediatric Intravenous Administration
- Pediatric IV Infusion Pump Rate

## Electronic Calculators

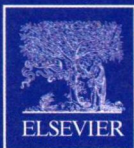
- Absolute Neutrophil Count (ANC)
- Body Mass Index (BMI)
- Body Surface Area (BSA)—Adults
- Body Surface Area (BSA)—Pediatric
- Fluid Deficit
- Sodium Deficit
- IV Infusion Rate
- Calculated Serum Osmolality
- Predicted Peak Flow (PPF) Females
- Predicted Peak Flow (PPF) Males
- Glomerular Filtration Rate (MDRD)

## Top 200 Drugs with Pronunciations

## References from the Textbook

\*Companion CD content prepared by Marilyn Herbert-Ashton, MS, RN, BC. Selected animations provided by Ed Tessier, PharmD, MPH, BCPS.





# evolve

• To access your Student Resources, visit:

**<http://evolve.elsevier.com/KeeHayes/pharmacology/>**

Evolve® Student Resources for Kee/Hayes/McCuistion: *Pharmacology: A Nursing Process Approach*, sixth edition, offer the following features:

■ **Case Studies**

20 case studies with answer guidelines test your ability to think critically.

■ **Content Updates**

Check back often for information updates on new drugs and changing pharmacology information.

■ **Frequently Asked Questions**

Find answers to frequently asked questions and submit questions of your own.

■ **Student Review Activities**

Utilize flash cards for terminology review and memory match puzzles, crossword puzzles, and figure labeling activities for review of key terms and concepts.

■ **WebLinks**

Link to hundreds of websites carefully chosen to supplement the content of the text-book. WebLinks are regularly updated, with new ones added as they develop.

■ **Additional Reference Material**

Find information on FDA approved, recalled, and high-risk drugs; online sources for smoking cessation; caffeine content in beverages; selected sugar-free and alcohol-free products; and more!



*In Loving Memory of my Parents  
Esther B. and Samuel H. LeFever*

**Joyce LeFever Kee**

*To my Parents  
Margaret and Justin Hayes  
for their ever-present love and confidence*

**Evelyn R. Hayes**

*To Robert D. Ekas  
For love and support*

*To Dr. Gerald DeLuca  
For expert guidance*

*and in Memory of my Parents  
Otto and Pauline Schmidt*

**Linda E. McCuistion**



# Meet the Authors

Joyce LeFever Kee



Joyce LeFever Kee received her Bachelor of Science and Master of Science degree in Nursing from the University of Maryland and earned 36 postgraduate credits from the University of Delaware. She was a distinguished faculty educator at the University of Maryland for 4 years and at the University of Delaware for 27 years. The subjects she taught included pharmacology, pathophysiology, fluid and electrolyte imbalances, and medical-surgical nursing in the classroom and clinical areas. She had taught in the undergraduate and graduate programs at the University of Delaware. She retired as Associate Professor Emerita from the University of Delaware.

Joyce is a member of the Sigma Theta Tau Nursing Honor Society and Phi Kappa Phi Honor Society. She received the Excellence in Teaching Award from and was inducted into the Mentor's Circle at the University of Delaware.

Joyce gave numerous lectures and presentations throughout the United States from 1970 to 1990. She has written various articles, particularly on fluid and electrolytes, laboratory and diagnostic tests, and research projects, in the *American Journal of Nursing*, *Nursing Clinics of North America*, *Nursing Journal*, and *Critical Care Quarterly*. She has participated in several research studies on "Identification of Hypertensive Young Adults."

Joyce has authored and coauthored several text and reference books, including *Fluids and Electrolytes with Clinical Applications* (2004), seventh edition; *Handbook of Fluid, Electrolyte, and Acid-Base Imbalances* (2004), second edition; *Pharmacology: A Nursing Process Approach* (2006), fifth edition, with ancillaries including Companion CD for students, Instructor's Resource CD-ROM, and Study Guide; *Clinical Calculations in General and Specialty Areas* (2008) sixth edition, with Instructor's Manual, Testbank, and CD; *Laboratory and Diagnostic Tests with Nursing Implications* (2005), seventh edition; and *Handbook of Laboratory and Diagnostic Tests with Nursing Implications* (2008), sixth edition.

Joyce and her husband enjoy traveling, including trips to Australia, New Zealand, China, Japan, Great Britain, Russia, Greece, Italy, France, Turkey, Egypt, Spain, South America, Scandinavian countries, Mexico, the Caribbean islands, and others. They enjoy snorkeling, swimming, and playing golf.

Evelyn R. Hayes



Evelyn (Lyn) R. Hayes received her Bachelor of Science in Nursing from Cornell University—New York Hospital School of Nursing; an MPH in Public Health Nursing from the University of North Carolina, School of Public Health in Chapel Hill, North Carolina; and a PhD in Higher Education from Boston College. In addition, she completed a Post Master's Certificate as Family Nurse Practitioner at the University of Massachusetts at Amherst and is a certified family nurse practitioner. She has valuable practice experience in acute care institutions and in the community. Currently she is Professor in the School of Nursing, College of Health Sciences, at the University of Delaware. In this role, she has had teaching responsibilities at both the undergraduate and graduate levels and experience with distance learning. She also serves as Director, UD Nursing Center, and Co-Coordinator of Nurse Practitioner Program. Lyn has consulted with faculty in Taiwan and Panama.

A strong advocate of health promotion, Lyn served as Project Director and co-investigator of a U.S. Public Health Service grant Promoting Health Lifestyles in Delaware.

As author, coauthor, and collaborative team member, she has published in multiple journals. General areas of interest include smoking cessation in teens and young adults, comprehensive geriatric assessments, and preparing students for perceived threats in the community with recent publications in *MCN: The American Journal of Maternal/Child Nursing*, *Public Health Nursing*, *Journal of Nursing Education*, and *Nurse Educator*; the use of research based protocols in nursing practice in *Clinical Nurse Specialist*; and issues related to prenatal care in *Journal of Perinatal Education* and *Applied Nursing Research*.

Throughout her career, Lyn has held member and leadership positions at various levels within the University of Delaware as well as professional and community organizations. She has ably provided long-term service and leadership to Sigma Theta Tau International, American Nurses Association, National League for Nursing Accrediting Commission (NLNAC), and the Delaware Nurses Association.

Now a retired colonel in the United States Army Reserve, Lyn's last two assignments were as Principal Reservist to Deputy Commander for Nursing, Walter Reed Army Medical Center, Washington, DC, and Moncrief Army Community Hospital, Fort Jackson, South Carolina. She also is a frequent traveler, both for pleasure and business. When at her home base, she enjoys being creative with crafts and spending time with friends.



## Linda E. McCuistion



Dr. Linda E. McCuistion received a Diploma of Nursing from the Lutheran Hospital School of Nursing in Fort Wayne, Indiana; Bachelor of Science in Nursing from William Carey College in Hattiesburg, Mississippi; Masters in Nursing from Louisiana State University Medical Center; and a PhD in Curriculum and Instruction from the University of New Orleans. She is licensed as an Advanced Practice Nurse and has 35 years of nursing experience, including acute care and home health nursing. Currently, Linda is a Professor in the Division of Nursing at Our Lady of Holy Cross College in New Orleans, Louisiana. She received an Endowed Professorship Award in 2000 and 2003.

Linda has served as a past president, vice president, and faculty advisor of the Sigma Theta Tau International Honor Society in Nursing, Xi Psi chapter-at-large. She is a past associate editor of the *NODNA Times*, which is the New Orleans District Nurses' Association newsletter. She is a member of Phi Delta Kappa and The American Society of Hypertension.

To ease the transition of new nursing graduates into the workforce, Linda has held the role as coordinator for the Graduate Plus Internship Program, a preceptorship program for new nursing graduates in the state of Louisiana. She has served as a legal nurse consultant and as a member

of a medical review panel. Linda is a past Advisory Board Member, Consultant, and Reviewer of a software preparation company for the state licensure examination. She has served as an Advisory Board member for a School for Surgical Technicians. Linda has also served as a consultant to improve the quality of nursing care and to assist acute care facilities in preparation for accreditation.

Linda was chosen as a "Great One Hundred Nurse" by the New Orleans District Nurses' Association in 1993. She is also listed in the 2005/2006 Edition of the Empire Who's Who Executive and Professional Registry.

Linda has given numerous lectures and presentations regionally and nationally on a variety of nursing topics, particularly hypertension, orthopedic assessment, arthritis, multiple organ dysfunction syndrome, Alzheimer's disease, and intravenous workshops. She has published articles in nursing journals and authored many chapters in several nursing textbooks including *Pharmacotherapeutics: Clinical Decision-Making in Nursing* (1999), *Saunders Manual of Medical-Surgical Nursing: A Guide for Clinical Decision-Making* (2002), and the *Saunders Nursing Survival Guide: Pathophysiology* (2007). She is author and coauthor of many chapters and co-editor of the *Saunders Nursing Survival Guide: Pharmacology* (2007).

Linda enjoys cruises to the Caribbean and traveling to Europe, Aruba, and across the United States. When at home, she enjoys visiting family and friends, playing golf, and writing.



# Contributors

**Margaret Barton-Burke, PhD, RN**

Assistant Professor  
University of Massachusetts Amherst  
Amherst, Massachusetts  
*Chapter 38*

**Joseph Boullata, PharmD, BCNSP**

Associate Professor—Pharmacology and Therapeutics  
University of Pennsylvania, School of Nursing  
Philadelphia, Pennsylvania  
*Table 9-3: "Selected Herb-Drug Interactions"*

**Michelle M. Byrne, MS, PhD, CNOR**

Associate Professor of Nursing  
North Georgia College and State University  
Dahlonega, Georgia  
*Chapter 6*

**Robin Webb Corbett, PhD, RN, C**

Associate Professor  
East Carolina University  
School of Nursing  
Greenville, North Carolina  
*Chapters 52, 53, and 54*

**Sandy Elliott, CNM, MSN**

President  
Woman to Woman Health Care  
Milford, Delaware  
*Chapters 55 and 57*

**Judith W. Herrman, PhD, RN**

Assistant Director/Assistant Professor  
School of Nursing, University of Delaware  
Newark, Delaware  
*Chapter 10*

**Kathleen J. Jones, RN-C, MS, ANP**

Adult Nurse Practitioner  
Walter Reed Army Medical Center  
Washington, DC  
*Chapter 56*

**Robert J. Kizior, BS, RPh**

Educational Coordinator  
Alexian Brothers Medical Center  
Elk Grove Village, Illinois  
*Chapter 34*

**Paula R. Klemm, PhD, RN, OCN**

Professor and Coordinator of Graduate Program  
University of Delaware, School of Nursing  
Newark, Delaware  
*Chapter 36*

**Linda Laskowski-Jones, RN, MS, APRN-BC, CCRN, CEN**

Vice President: Emergency, Trauma, and Aeromedical Services  
Christiana Care Health System  
Wilmington, Delaware  
*Chapter 58*

**Patricia O'Brien, MA, MSN**

Clinical Research Coordinator/Nursing Instructor  
Lovelace Scientific Resources/University of New Mexico  
Albuquerque, New Mexico  
*Chapter 8*

**Laura K. Williford Owens, PharmD**

Chief of Pharmacy Services  
Carolina Family Health Centers, Inc.  
Wilson, North Carolina  
*Chapters 52, 53, and 54*

**Lisa Ann Plowfield, PhD, RN**

Professor and Dean  
College of Nursing  
Florida State University  
Tallahassee, Florida  
*Chapter 34*

**Lynette M. Wachholz, MN, APRN, IBCLC**

Clinical Faculty  
University of Washington  
Department of Family and Child Nursing  
Seattle, Washington  
Pediatric Nurse Practitioner and Lactation Consultant  
The Everett Clinic  
Everett, Washington  
*Chapter 35*

**Gail Wilkes, MS, RNC, AOCN**

Oncology Nurse Educator  
Boston Medical Center  
Boston, Massachusetts  
*Chapter 38*

**Additional Teaching and Learning Resources****Judith W. Herrman, PhD, RN**

Associate Professor and Assistant Director  
University of Delaware, School of Nursing  
Newark, Delaware  
*Test Bank and Audience Response Questions for i-Clicker and Other Systems*



**Marilyn Herbert-Ashton, MS, RN, BC**

Grants Development and Special Projects  
Coordinator, Grants Development, Special Projects, and  
Community Relations  
Associate Professor  
Virginia Western Community College  
Roanoke, Virginia  
Adjunct Faculty  
Department of Nursing  
Finger Lakes Community College  
Canandaigua, New York

*NCLEX® Examination Review Questions, Medication Errors  
Checklists, and IV Therapy Checklists for the Companion CD*

**Caroline Peltz, MSN, MSHSA, RN  
with Brian J Peltz, MS, RPh**

Professor of Nursing  
Wayne County Community College District  
Detroit, Michigan  
*Evolve Case Studies and FAQs*



# Reviewers

**Rachel Blankstein Breman, MSN, MPH, RN**

School of Nursing Faculty  
Brockton Hospital  
Brockton, Massachusetts

**Michelle M. Byrne, RN, PhD, CNOR**

Associate Professor of Nursing  
North Georgia College and State University  
Dahlonega, Georgia

**Brigitte L. Casteel, RN, MSN**

Program Director, Associate Professor  
Mountain Empire Community College  
Big Stone Gap, Virginia

**Darlene Clark, RN, MS**

Senior Lecturer in Nursing  
School of Nursing  
Penn State University  
University Park, Pennsylvania

**Linda Coakley, EdD, APN**

Assistant Professor of Nursing  
Western Kentucky University  
Bowling Green, Kentucky

**Barb Diederick, MS, RN**

Chair, Department of Nursing  
North Dakota State College of Science  
Wahpeton, North Dakota

**Robert D. Ekas, PhD**

Associate Director, Medical Sciences  
Gilead Sciences, Inc.  
New Orleans, Louisiana

**Teresa S. Fox, ADN, RN, BSN**

Practical Nursing Instructor  
Virginia Western Community College  
Roanoke, Virginia

**Alice Gardner, PhD**

Assistant Professor of Pharmacology/Toxicology  
Department of Pharmaceutical Sciences  
Massachusetts College of Pharmacy and Health Sciences  
Worcester, Massachusetts

**Kathleen M. Geib, DNSc, RN**

Associate Professor of Nursing  
Malone College  
Canton, Ohio

**Cene' L. Gibson, RN, MSN, ARNP**

Family Nurse Practitioner  
Family Healthcare and Minor Emergency Clinic  
Oklahoma City, Oklahoma

**Margaret M. Gingrich, RN, MSN**

Professor of Nursing  
Harrisburg Area Community College  
Harrisburg, Pennsylvania

**Mary E. Greipp, RN, EdD, FAAN**

Professor of Nursing  
Rutgers the State University of New Jersey  
Camden, New Jersey

**Rhonda Helm, RN, MSN, PhD(c)**

Assistant Professor of Nursing  
Western Kentucky University  
Bowling Green, Kentucky

**Marilyn Herbert-Ashton, MS, RN, BC**

Associate Professor  
Virginia Western Community College  
Roanoke, Virginia

**Marita Hoffart, PhD**

Professor of Nursing  
Minot State University  
Minot, North Dakota

**Susie Huyer, RN, MSN, CHPN**

Administrator  
Heartland Hospice  
Fairfax, Virginia  
Online Nursing Faculty  
University of Phoenix  
Phoenix, Arizona

**Suzanne Jed, MSN, APRN-BC**

Nurse Practitioner  
Los Angeles, California

**BJ Taylor Kosak, MSN, RN, CS**

Assistant Professor of Nursing  
Northern Kentucky University  
Highland Heights, Kentucky

**Wendy Likes, DNSc, ARNP-BC**

Assistant Professor  
Acute and Chronic Care  
University of Tennessee Health Science Center  
Memphis, Tennessee

**Lora McGuire, RN, MS**

Professor of Nursing  
Joliet Junior College  
Joliet, Illinois



**Charles E. McPherson, III, PharmD**

Clinical Assistant Professor  
University of Illinois at Chicago College of Pharmacy  
Chicago, Illinois

**Brenda Michel, EdD, MS, RN, CDE**

Professor of Nursing  
Lincoln Land Community College  
Springfield, Illinois

**Diane Muckenhirn, RN, MSN, CNP**

Nurse Practitioner  
Hutchinson Medical Center  
Hutchinson, Minnesota

**Julie D. Painter, RN, MSN, OCN**

Clinical Nurse Specialist/Adult Nurse Practitioner  
Clinical Practice Education and Research  
Community Health Network  
Indianapolis, Indiana

**Brenda Condusta Pavill, RN, PhD**

Nursing Faculty  
College Misericordia  
Dallas, Pennsylvania

**Peggy Przybycien, RN, MS**

Professor of Nursing  
Onondaga Community College  
Syracuse, New York

**Carolyn Ryan, RPh, PharmD**

Tri-Regional Pharmacist, Strategic National Stockpile  
Office of Public Health  
Shreveport, Louisiana

**Kimberly J. Sharp, RN, OHND, BA, BSN, MSc, PhD**

Professor of Nursing  
Cedarville University  
Cedarville, Ohio

**Carla Petsick Smith, MS, RN**

Assistant Professor of Nursing  
East Texas Baptist University  
Marshall, Texas

**Patricia A. Tabloski, PhD, APRN, BC**

Associate Dean of Graduate Studies  
William F. Connell School of Nursing at Boston College  
Chestnut Hill, Massachusetts

**Martha A. Tafoya, MSN, RN**

Professional Specialist in Nursing  
Angelo State University  
San Angelo, Texas

**Scott Thigpen, RN, MSN, CCRN, CEN**

Assistant Professor of Nursing  
South Georgia College  
Douglas, Georgia

**Sheryl Thomas, MSN, RN**

Nursing Instructor  
Wayne County Community College  
Detroit, Michigan

**Darlene Thomay, RN, BA, DNC**

Staff Nurse  
Medical Specialties Clinic  
Metrohealth Medical Center  
Cleveland, Ohio

**Barbara Timby, MA, BSN, RN, BC**

Nursing Professor  
Glen Oaks Community College  
Centreville, Michigan



# Preface

The sixth edition of *Pharmacology: A Nursing Process Approach* is written for students in a variety of nursing programs who can benefit from its presentation of the principles of pharmacology in a straightforward, student-friendly manner. It focuses on the need-to-know content and it helps students learn to administer drugs safely and eliminate medication errors through extensive practice of dosage calculations and careful application of the nursing process.

## Organization

*Pharmacology: A Nursing Process Approach* is organized into **19 units** and **58 chapters**. Unit One is an overview of the principles of pharmacology from the unique perspective of nursing. The unit begins with chapters on drug action, the nursing process and client teaching, and principles of drug administration. Unit Two—a comprehensive review of drug dosage calculation for adults and children—is a unique strength of this book. This extensive unit—tabbed for quick reference—consists of six sections:

- Section 4A: Systems of Measurement with Conversion
- Section 4B: Methods for Calculation
- Section 4C: Calculations of Oral Dosages
- Section 4D: Calculations of Injectable Dosages
- Section 4E: Calculations of Intravenous Fluids
- Section 4F: Pediatric Drug Calculations

Unit Two presents six methods of dosage calculation, **color-coded to identify each method**:

- Method 1: Basic Formula
- Method 2: Ratio and Proportion
- Method 3: Fractional Equation
- Method 4: Dimensional Analysis
- Method 5: Body Weight
- Method 6: Body Surface Area

Integral to Unit Two are its **clinical practice problems**, featuring **over 100 problems with 85 actual drug labels in full color**, which provide extensive practice in real-world dosage calculations. With this wide array of practice problems in a variety of health care settings, the chapter eliminates the need to purchase a separate dosage calculation book. In addition, color photographs illustrate the equipment used to deliver medications. The accompanying **Study Guide** and **Companion CD** included with the text provide additional practice problems with answers, a review of need-to-know mathematics, printable checklists, and more.

Unit Three covers contemporary issues in pharmacology, including the changing drug approval process (Chap-

ter 5), drug interactions and over-the-counter drugs (Chapter 7), a chapter dedicated to discussion of drugs of abuse (Chapter 8), and more. The book promotes a global approach toward client care with a separate transcultural considerations chapter (Chapter 6), thoroughly updated for the sixth edition. An expanded chapter on herbal therapy (Chapter 9) discusses client self-treatment with herbal products and its nursing implications. Lifespan issues are addressed in chapters on pediatric and geriatric pharmacology (Chapters 10 and 11).

Unit Four addresses nutrition and fluids and electrolytes, with separate chapters covering vitamin and mineral replacement (Chapter 14), fluid and electrolyte replacement (Chapter 15), and nutritional support (Chapter 16).

Units Five through Nineteen are the core of *Pharmacology: A Nursing Process Approach* and cover the drug families that students will need to understand in order to practice effectively. Each drug family chapter includes a chapter outline, learning objectives, a list of key terms, at least one Prototype Drug Chart, a drug table, and an extensive Nursing Process section. For the sixth edition, a **new unit on pain and inflammation management** makes drug therapy for pain easier to find. Also, the **antibacterial and antiinfective agents are now discussed in two separate units** to differentiate and clarify this important and complex content.

The **Prototype Drug Charts**—over 100 throughout the sixth edition—are a unique tool that students can use to view the many facets of a prototype drug through the lens of the nursing process. Each prototype drug is one of the common drugs in its drug class. Each of these charts includes Drug Class, Trade Names, Contraindications, Dosage, Drug-Lab-Food Interactions, Pharmacokinetics, Pharmacodynamics, Therapeutic Effects/Uses, Side Effects, and Adverse Reactions. With these charts, students can see how the steps of the Nursing Process correlate with these key aspects of drug information and therapy.

The **drug tables** provide a quick reference to routes, dosages, uses, and key considerations for the most commonly prescribed medications for a given class. They list drug names (generic, brand, and Canadian), dosages, uses and considerations, pregnancy categories, and specific information on half-life and protein-binding.

The **Nursing Process sections** provide a convenient summary of how to assess a client, develop nursing diagnoses, determine and follow through with the plan of care, and evaluate the outcomes of your efforts. The Nursing Process sections also include highlighted **culturally sensitive content** (denoted with a ♦ symbol), nursing inter-



ventions, suggestions for **client teaching**, and relevant **herbal information** (🌿).

## New to this Edition

The sixth edition of *Pharmacology: A Nursing Process Approach* features several significant new components.

- **NCLEX Study Questions** have been added to the end of each chapter to help prepare students for the NCLEX examination, with its increasing emphasis on pharmacology; answers are listed upside-down at the bottom of the page for quick feedback.
- A **new chapter on targeted therapies to treat cancer** discusses newer, cutting-edge cancer treatments such as multikinase inhibitors, angiogenesis inhibitors, monoclonal antibodies, and more.
- **Preventing Medication Errors boxes** have been updated and expanded to include information on packaging, doses, and other types of potential medication errors.
- **Several new photos and illustrations** give the book a fresh and exciting new look.
- The **explanation of dimensional analysis** has been clarified to make this challenging content even more understandable to students.
- **Chapter objectives have been revised** to reflect more of an emphasis on the analysis level.
- **Key terms now include page numbers** and have been bolded and defined in the text to enhance this “built-in glossary” feature for students.
- As mentioned previously, **new units for pain and inflammation management, antibacterial agents, and antiinfective agents** clearly delineate and explain these important concepts more clearly.
- **Additional Canadian drug names that correspond with the generic drug names** used in the United States have been added to the Evolve website.

## Additional Features

Throughout this edition, we have retained and enhanced a variety of popular features that teach students the fundamental principles of pharmacology and the role of the nurse in drug therapy:

- **Coverage of Pathophysiology.** Relevant pathophysiology is included in Units Five through Nineteen. Understanding the pathophysiology of disease processes is foundational to understanding the rationale for drug therapy.
- **Nursing Process.** In addition to the nursing considerations in the Prototype Drug Charts, each chapter includes special Nursing Process sections that clearly delineate coverage of all five steps of the nursing process, with the following headings: Assessment, Nursing Diagnoses, Planning, Nursing Interventions, and Evaluation.
- **Client Teaching.** Under Nursing Interventions, we include client and family teaching information. This

content includes helpful **teaching tips** that relate to general information, self-administration, diet, side effects, and cultural considerations.

- **Cultural Considerations.** In addition to an entire chapter discussing general cultural considerations in drug therapy, this text includes specific Cultural Considerations in the Nursing Interventions sections of the Nursing Process.
- **Critical Thinking Case Studies.** Each chapter concludes with a clinical scenario, followed by a series of critical thinking questions. These exercises challenge students to carefully consider the scenario and apply their knowledge and analytical skills to respond to the situations. Answers are provided only in the Instructor’s Manual to encourage thorough consideration before seeking expert feedback.
- **Appendixes.** Also listed in the appendixes are Therapeutic Drug Monitoring, which contains over 100 drugs, their therapeutic range, peak time, and toxic level; and a list of the 200 most commonly prescribed drugs with pronunciations.
- **Electronic Resources boxes** direct students to the Evolve website and Companion CD for more in-depth researching and application of the material discussed within each chapter.
- **Herbal Alerts.** These boxes appear throughout the text, providing students with a quick reference to information on popular herbs and their side effects, drug interactions, and more.
- **Anatomy and Physiology.** Unit openers for all drug therapy chapters include illustrated overviews of normal anatomy and physiology. These introductions give students the foundation for understanding how drugs work in various body systems.
- **Bioterrorism information.** An appendix on bioterrorism agents covers potential weapons of bioterrorism, clinical manifestations, and drug treatment considerations.

## Additional Teaching and Learning Resources

The sixth edition of *Pharmacology: A Nursing Process Approach* is the core of a complete teaching and learning package for nursing pharmacology. Additional components of this package include resources for students, resources for both students and faculty members, and resources just for faculty members.

### For Students

A comprehensive *Study Guide* provides more than 1800 study questions and answers, including clinically-based situational practice problems, more than 160 drug calculation problems and questions (many with actual drug labels), and critical thinking exercises to help students master text-book content. A new format for each chapter



begins with **Study Questions** (multiple-choice, matching, word searches, crossword puzzles, completion exercises, and so on) and is followed by a section for **NCLEX Review Questions** (now including alternate format questions!). **Critical Thinking Exercises** are provided for all drug chapters. Answers—with detailed math solutions and rationales where appropriate—are provided at the end of the *Study Guide*.

A **Companion CD** is packaged with each sixth edition text, a valuable *free* learning tool including:

- 450 NCLEX examination review questions, *now organized by chapter and including NCLEX alternate-item formats*
- 30 Pharmacology animations
- IV therapy and medication error checklists
- Drug calculation problems
- Electronic calculators
- Top 200 drugs with pronunciations
- References from the textbook

### For Both Students and Faculty

A completely updated Evolve website (<http://evolve.elsevier.com/KeeHayes/pharmacology/>) provides additional resources for students and faculty, including student review activities, weblinks, content updates, answers to frequently asked questions, case studies, suggestions for using the book in various programs, teaching tips, and additional reference content. The site is updated periodically to keep both faculty members and students informed of the latest information in nursing pharmacology.

### Pharmacology Online

This unique collection of ready-to-use modules and a library of online assets may be used to create or customize an online, “blended,” or web-enhanced pharmacology course that corresponds to *Pharmacology: A Nursing Process Approach*. Assets include:

- **15 Self-study modules**, including 11 modules covering the basic principles of pharmacology, a concise *Drug Calculation Review* module, and three new *Drug Content Review* modules. The self-study modules include an integrated *Online Drug Handbook* and *Audio Glossary*, with pronunciations for more than 1400 drug names and terms; they also include a rich variety of interactive activities and animations, as well as a quiz to ensure content mastery
- **Unit Resources**, including:
  - **26 Interactive case studies** using true-to-life clinical scenarios to promote “learning by doing,” with feedback for both correct and incorrect choices
  - **220 Interactive learning activities**, offering a challenging, game-like review of drug essentials
  - **20 care planning activities** that challenge you to create complete care plans
  - Online drug handbook
  - Over **800 NCLEX examination-style practice questions** (1 quiz for each chapter) that help stu-

dents prepare for the NCLEX exam with its increased emphasis on pharmacology

- **Approximately 2,000 Flashcards** that offer a handy, easy-to-use way to memorize information about major drugs, drug classes, and pharmacologic principles
- **Library of Supplemental Resources** includes unique *Roadside Assistance* video clips, all of the animations from the self-study modules, a complete audio glossary, and more; the *Roadside Assistance* video clips use humor, analogy, and memorable visuals to help clarify core pharmacology concepts in a way students and faculty will never forget!

### Evolve Select

This innovative resource is available to faculty who adopt a number of Elsevier texts, including *Pharmacology: A Nursing Process Approach*. Evolve Select is an integrated electronic study center consisting of a collection of textbooks made available electronically in CD format. It is carefully designed to “extend” the textbook for an easier and more efficient teaching and learning experience. It includes study aids such as highlighting, e-note taking, and cut and paste capabilities. Even more importantly, it allows students and instructors to do a comprehensive search within the specific text or across a number of titles. Please check with your Elsevier sales representative for more information.

### Evolve Reach

A complete online testing and remediation solution, Evolve Reach helps students prepare for certification examinations with reliable, valid questions and exams. Diagnostic reports pinpoint any weaknesses, and personalized remediation comes from Elsevier’s trusted Mosby and Saunders textbooks.

### Evolve Apply

Online case studies challenge students to apply key concepts and develop skills in critical thinking. By answering questions and viewing rationales for a range of realistic scenarios, students learn to manage complex patient conditions and make sound clinical judgments.

### Just for Faculty Members

An *Instructor’s Electronic Resource* is available on CD and on the faculty Evolve website. This resource includes the following:

- **Instructor’s manual**: Thoroughly revised to include new chapter focus summaries, key terms, learning objectives, chapter outlines with teaching strategies, answers to the critical thinking case studies in the text, and cross-references to relevant items on the companion CD and student Evolve site
- **Test bank**: Over 1000 ExamView test questions, including over 50 NCLEX alternate-item format questions as well as rationales and page references for each question



- **PowerPoint presentations:** Approximately 800 customizable slides with images and discussion questions incorporated
- **Image collection:** Approximately 150 full-color images from the book
- **Audience response questions:** Approximately 150 questions for use with i-Clicker and other systems

It is our hope that *Pharmacology: A Nursing Process Approach* and its comprehensive ancillary package will serve as a dynamic resource for teaching nursing students the basic principles of pharmacology and their vital role in drug therapy.

Joyce LeFever Kee

Evelyn R. Hayes

Linda E. McCuiston