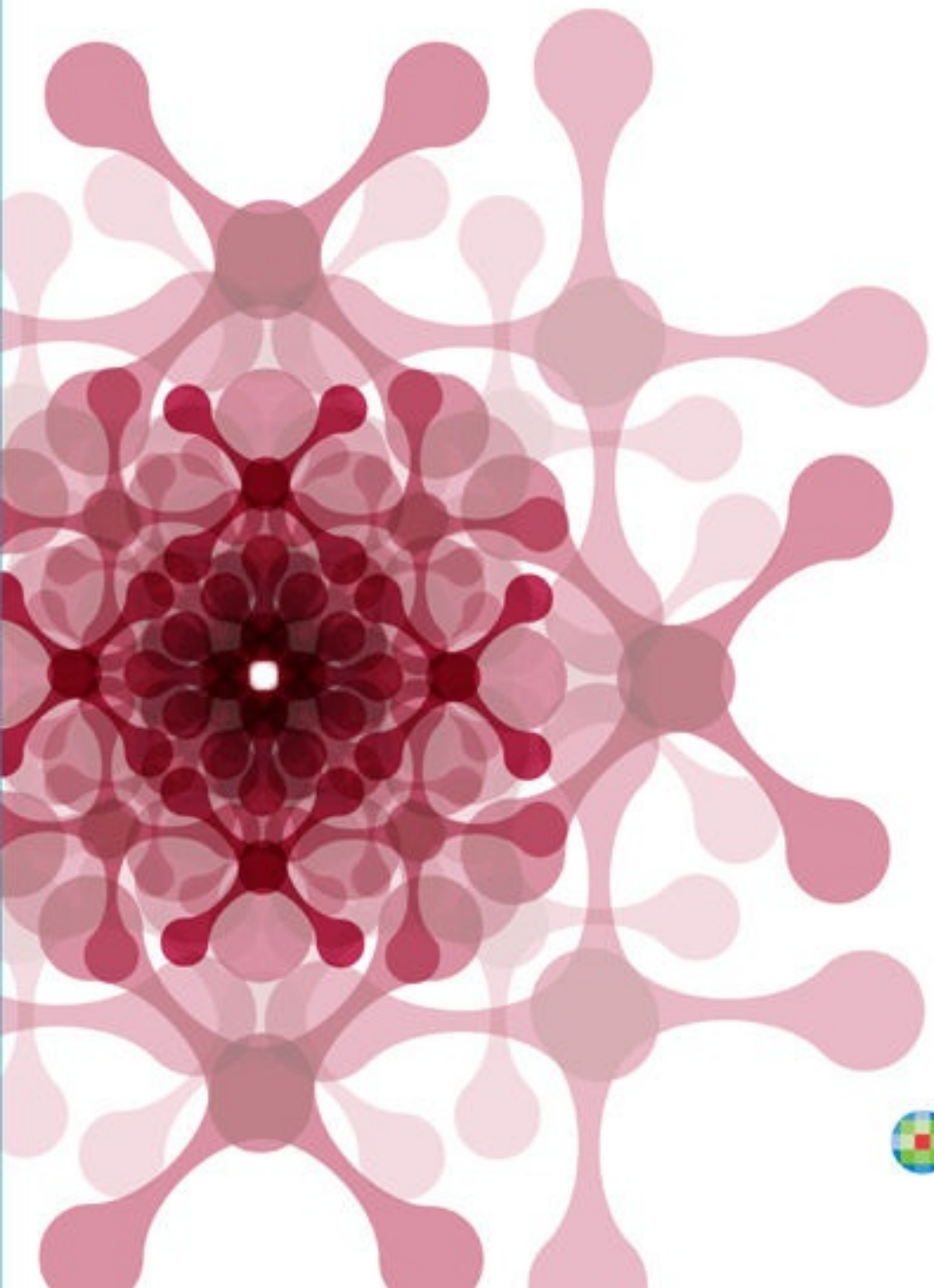
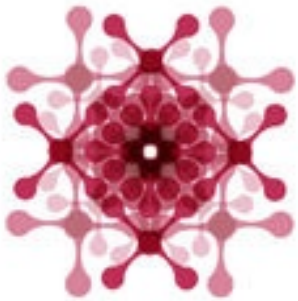
ROACH'S INTRODUCTORY

Clinical Pharmacology





Susan M. Ford

Wolters Kluwer

ELEVENTH EDITION

ROACH'S INTRODUCTORY

Clinical Pharmacology

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ELEVENTH EDITION

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I dedicate the 11th edition to three women.

My future—Pyrola Grothford, my first grandchild, who I hope may see health care in your lifetime as a right for all, not just a privilege for those who can pay.

My past—Sylvia Jones, my mother and the nurse who suggested the nursing profession as a career to me. Aunt Vi (Viola Oberholtzer), whose words encouraged me to look at the community college pathway to become a Registered Nurse where I studied, taught, and lead for most of my nursing career.

Reviewers

I would like to extend my gratitude to the many reviewers of this edition of *Roach's Introductory Clinical Pharmacology*. Know that your feedback helps me grow and to look at ways to improve communication of this vital clinical drug information. At the same time I hope your experience helps you to become a better facilitator of information and inspire life-long learning in your students.

—Sue

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Preface

Roach's Introductory Clinical Pharmacology is one in a series of texts designed to assist beginning nursing students in acquiring a foundation of basic nursing theory and for developing clinical skills. Many publishers give you choices of texts offering information on drug action and activity. Yet, this text is uniquely written *by* nurses *for* nurses in easy-to-read language, not only to teach the novice provider about the drugs but also to role model how to relay this information to patients.

TEXT ORGANIZATION

The 11th edition of *Roach's Introductory Clinical Pharmacology* is organized into 13 units. Specific changes within these units include:

- **Unit 1: Nursing Foundation of Clinical Pharmacology**—Introduction to the new FDA drug labeling system for pregnancy, lactation, and reproduction as well as better clarity to the connection between math concepts and dosage calculation in Chapter 3.
- **Unit 2: Drugs Used to Fight Infections**—Antibacterial chapters (Chapters 6 to 9) group the drugs according to what they do to a bacterial cell. This presentation helps in understanding how the different classes are similar and what to look for in terms of similar actions or adverse reactions. Highlight of combination drugs used with diseases such as TB or HIV (Chapters 10 and 11) emphasizes methods to increase adherence to drug therapy and improving quality of life. Chapter 11 includes the expanding number of drugs to treat once acute illness (such as HIV and Hep C) shifting care to that of chronic conditions.
- **Unit 3: Drugs Used to Manage Pain**—Greater emphasis on learning pain-assessment strategies as well as the drugs for pain relief is threaded through Chapters 13 to 15. Inclusion of information on medical marijuana—written with neither the intent to support nor dismiss the use of marijuana—for conditions such as pain management. Rather, as nurses we need to agree that many of our patients will have used this drug for medical or recreational purposes. Therefore, it is important to provide knowledge of this drug and its uses as well as its effects and interactions. Many nurses never enter the operating room suites, therefore Chapter 17 is written for a better understanding about the effects of anesthetics used in the surgical arena to effectively treat patients and teach family members postoperatively when you are most likely to deal with reactions produced by these drugs.
- **Unit 4: Drugs That Affect the Central Nervous System**—When patients become stressed, mental health issues may surface. This can be a surprising experience for providers in non-psychiatric settings such as acute med-surg floors. The chapters of this unit provide explanation and information to help reduce the stigma associated with patients labeled with a psychiatric diagnosis.
- **Unit 5: Drugs That Affect the Peripheral Nervous System**—Repetition and clarification of terminology in all chapters in this unit help students

understand the importance of the neurologic system in many facets of drug therapy.

- **Unit 6: Drugs That Affect the Neuromuscular System**—Drug reclassification of *anticonvulsant* to *antiepileptic* terminology provides consistency in AED understanding and treatment.
- **Unit 7: Drugs That Affect the Respiratory System**—Over-the-counter products make self-treatment for respiratory conditions a growing concern. Both drugs and strategies for patient teaching are updated in these chapters.
- **Unit 8: Drugs That Affect the Cardiovascular System**—Encouraging students to use their skills at concept mapping with Pharmacology in Practice Case Studies in each chapter, helps the student to discover the poly pharmacology issues when cardiac medications are prescribed with most any other category of drug.
- **Unit 9: Drugs That Affect the Gastrointestinal System**—Biologics used to treat inflammatory bowel diseases are listed in Chapter 41 as well as strategies for self-treatment of both upper and lower gastrointestinal issues.
- **Unit 10: Drugs That Affect the Endocrine System**—Expansion of antidiabetic medications is provided in Chapter 42, which corresponds with the rise of patients being diagnosed with diabetes.
- **Unit 11: Drugs That Affect the Urinary System**—Clarity of new information to help patients remain safe while using medications supporting healthy aging is included in Chapter 47.
- **Unit 12: Drugs That Affect the Immune System**—New information on biologic and targeted drug therapies for multiple chronic conditions as well as updated immunization schedules in easy-to-read versions makes information suitable to share with patients.
- **Unit 13: Drugs That Affect Other Body Systems**—Chapter 54 includes more information on intravenous therapy as well as how to use equal analgesic conversion charts to prepare patients for good pain management when medications change from IV to oral routes.

FEATURES

Written with patient outcomes in mind, complex concepts are introduced in simplified language, helping learners to grasp concepts quicker and to use patient teaching information right from the text leading to better understanding on the part of the patient and adherence to treatment strategies.

Benefit to the Instructor

The basic explanations presented in the text are *not* intended to suggest that pharmacology is an easy subject. As we know it, drug therapy is one of the most important and complicated treatment modalities in modern health care. This text is written to help you *teach* the latest pharmacologic information available by including:

- Clear, concise language to introduce learners to the basics of pharmacology.
- Presentation of drugs in a way to make integration of this text into concept-based curricula seamless and effortless.
- Comprehensive bibliography entries that link the text to the latest evidence-based information and practice.

The new, or improved, features that make this the best pharmacology text for teaching your students include:

- Nursing diagnoses, which are updated to 2015–2017 NANDA-I terminology.
- Special features such as *Alerts* and *Considerations*, which include information to care for a more diverse patient population.
- Removal of old drug brand names that have lost their exclusive patents and confuse learners when used.
- New to this edition are Concept Mastery Alerts, which clarify fundamental nursing concepts to improve the reader's understanding of potentially confusing topics, as identified by Misconception Alerts in Lippincott's Adaptive Learning Powered by prepU. Data from thousands of actual students using this program in courses across the United States identified common misconceptions for the authors to clarify in this new feature.

Benefit to the Student

As a novice provider, this text gives you the introduction you need to begin your journey to gain knowledge and competently practice medication management.

This text is written to help you *learn* the latest pharmacologic information available by including:

- Drug therapy explained uniquely from a nursing perspective.
- Connection of drug therapy to the basic nursing theory you are learning in your nursing curriculum.
- Presentation in an easy-to-read and follow format that helps you understand the drugs and their effects on the human body, which in turn motivates you to continue to learn more about this subject independently and helps you to provide better care, educate patients, and improve outcomes.
- A nursing process section in each chapter that uses a familiar step-by-step method to show how medications are used in the care of patients. Elements of the nursing process—assessment, analysis, planning, intervention, and evaluation—illustrate basic and practical nursing skills to help people understand the treatment, to meet their health care needs, and to improve adherence to treatment, all designed for better patient outcomes.
- Medication calculation using principles of safe practice rather than mathematical formulas used in traditional math classes. Learning focuses on reducing medication errors that result from mathematical mistakes rather than on the traditional arithmetic exercises.
- Seven patients introduced in Chapter 5, whose health issues are woven into subsequent chapters in order to build a story of how drugs impact real people. Your ability to use outcome strategies and communicate what you do to support patient and family confidence in learning self-management skills of medication administration is highlighted using health literacy principles and appreciation of cultural diversity using one of these seven patients individually featured in each chapter.
- Specific quiz review items that are directly linked to the latest NCLEX test plan.
- A list of abbreviations on the inside back cover for easy reference.
- Informational data to construct concept maps of the case study patients when used in conjunction with the *Study Guide to Accompany Roach's Introductory Clinical Pharmacology,* 11th Edition, providing you opportunities to identify potential drug–drug interactions.

What My Nursing Experiences Offer in this Text

To learn skills one needs repetitive practice, and nurses gain this in the clinical setting. This means as elders we must step aside so that new nurses may gain

that experience. Retiring from paid clinical positions does not mean we stop learning; I now gain teaching experience as a volunteer scripted/standardized patient in the Nursing Simulation Center at Swedish RN Residency Program and learn about patient experiences as a volunteer facilitator in chronic illness workshops at Kaiser Foundation Health Plan of Washington. I hear directly what new nurses and patients need in our ever-changing health care systems. These experiences help me to appreciate what novice nurses need in their pharmacologic education and how patients understand what we say as we communicate about drugs in our interventions and teaching. This text is a blending of this newly gained insight with well over 40 years of nursing practice and teaching experience in mental health, acute care, operating room, ambulatory care, home health, and hospice settings, as well as holding nursing certification in areas such as oncology, medical-surgical clinical nurse specialist, and as a certified nurse educator.

As You Learn and Enter Practice

You may find that certain drugs or drug dosages described in this publication may no longer be available. Likewise, there may be new drugs on the market that were not approved by the U.S. Food and Drug Administration (FDA) at the time of publication. With the availability of computers, smart phones, and other Internet resources, current information is always there for verification of any drug question and should be checked when you do have a question before administering a drug. Don’t forget that your colleagues, clinical pharmacists, and primary health care providers are also resources for information concerning a specific drug including dosage, adverse reactions, contraindications, precautions, interactions, or administration.

TEACHING AND LEARNING RESOURCES

To facilitate mastery of this text's content, a comprehensive teaching and learning package has been developed to assist faculty and students.

Resources for Instructors

Tools to assist you with teaching your course are available upon adoption of this text at http://thePoint.lww.com/Ford11e

- A **Test Generator** lets you put together exclusive new tests from a bank containing hundreds of questions to help you in assessing your students' understanding of the material. Test questions link to chapter learning objectives.
- **PowerPoint Presentations** provide an easy way for you to integrate the textbook with your students' classroom experience, either via slide shows or handouts. Multiple-choice and true/false questions are integrated into the presentations to promote class participation and allow you to use i-clicker technology.
- An **Image Bank** lets you use the photographs and illustrations from this textbook in your PowerPoint slides or as you see fit in your course.
- **Case Studies** with related questions (and suggested answers) give students an opportunity to apply their knowledge to a client case similar to one they might encounter in practice.
- **Pre-Lecture Quizzes** (and answers) are quick, knowledge-based assessments that allow you to check students' reading.
- **Guided Lecture Notes** walk you through the chapters, objective by objective.
- **Discussion Topics** (and suggested answers) can be used as conversation starters or in online discussion boards.
- Plus **Syllabi, Lesson Plans, QSEN Competency Maps,** and **Assignments**.

Resources for Students

An exciting set of free resources is available to help students review material and become even more familiar with vital concepts. Students can access all these resources at http://thePoint.lww.com/Ford11e using the codes printed in the front of their textbooks.

- **NCLEX-Style Review Questions** for each chapter help students review important concepts and practice for the NCLEX.
- **Concepts in Action Animations** bring pharmacology concepts to life.
- **Watch & Learn Video Clips** explain how to prepare unit dose-packaged medications as well as administering oral medication, subcutaneous injections, and intramuscular injections. (Icons in the textbook direct readers to relevant videos.)
- **Journal Articles** provided for each chapter offer access to current research available in Wolters Kluwer journals.
- Plus **Learning Objectives, Drug Monographs, Carrington Professional Guide, Dosage Calculation Quizzes,** and an **Audio Glossary**.

Study Guide

The *Study Guide to Accompany Roach's Introductory Pharmacology,* 11th Edition, offers exercises, puzzles, and multiple-choice questions to quiz your pharmacologic knowledge. In the 11th edition, the same seven patients as the text are included to continue the real-life case studies connected to situations in the text. Concept mapping templates are provided to help you learn visually as you go. These maps, which correlate to each of the text case study patients, give you a visual method to see drug–drug interactions, and anticipate problems of polypharmacy as you follow the stories of these seven patients in the text and study guide.

A FULLY INTEGRATED COURSE EXPERIENCE

We are pleased to offer an expanded suite of digital solutions and ancillaries to support instructors and students using *Roach's Introductory Clinical Pharmacology,* 11th Edition. To learn more about any solution, please contact your local Wolters Kluwer representative.

Lippincott CoursePoint+ is an integrated digital learning solution designed for the way students learn. It is the only nursing education solution that integrates:

- **Leading content in context:** Content provided in the context of the student learning path engages students and encourages interaction and learning on a deeper level.
- **Powerful tools to maximize class performance:** Course-specific tools, such as adaptive learning powered by prepU, provide a personalized learning experience for every student.
- **Real-time data to measure students' progress:** Student performance data provided in an intuitive display let you quickly spot which students are having difficulty or which concepts the class as a whole is struggling to grasp.
- **Preparation for practice:** Integrated virtual simulation and evidence-based resources improve student competence, confidence, and success in transitioning to practice.
  - ***vSim for Nursing:*** Codeveloped by Laerdal Medical and Wolters Kluwer, vSim for Nursing simulates real nursing scenarios and allows students to interact with virtual patients in a safe, online environment.
  - ***Lippincott Advisor for Education:*** With over 8500 entries covering the latest evidence-based content and drug information, Lippincott Advisor for Education provides students with the most up-to-date information possible, while giving them valuable experience with the same point-of-care content they will encounter in practice.
- **Training services and personalized support:** To ensure your success, our dedicated educational consultants and training coaches will provide expert guidance every step of the way.

Acknowledgments

MY SINCERE APPRECIATION

To my literary team at Wolters Kluwer—there are so many people involved, it is impossible to single out the importance of one person over another—thank you for making every edition better than the one before.

To my extended family, friends, colleagues, and students-turned fellow nurses: thank you for being there with ideas and stories to share.

To my sister, Nancy Rauch, high school math and science teacher: thank you for helping make math skills real to these students. To my friends, Bonnie, Pam, and Marion: thank you for keeping my BPM and motivation up as I worked on this project.

Most importantly, to my family—Jerry, Stephanie, Eric, Peter, and Lexy—who inspire me on a daily basis to be the best person and nurse possible!

—S. F. (87ord)

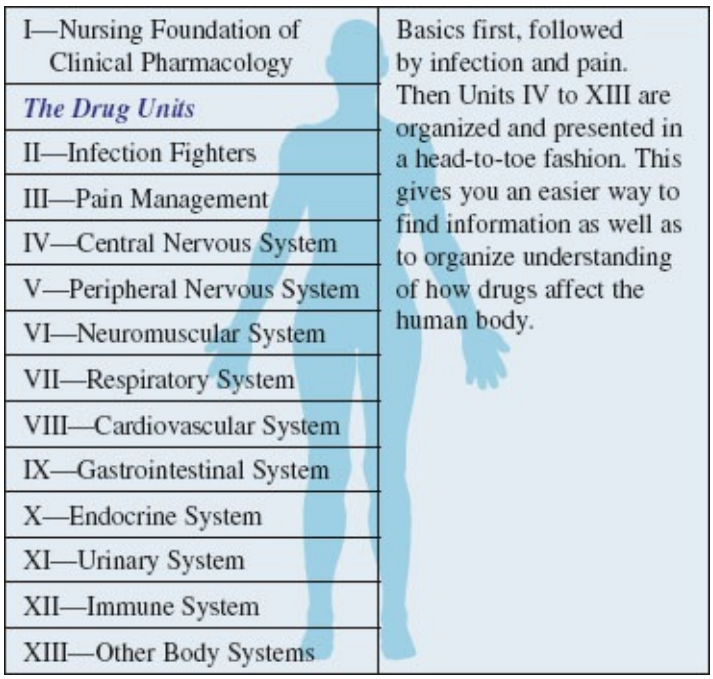
User's Guide

UNIT STRUCTURE AND ORGANIZATION

Learners are more successful when they know *how* to use the text as well as what is in the text. Here are some quick tips on how to use your text more effectively. Thirteen units offer 54 chapters providing information in learnable segments that are not overwhelming to the learner. Organization of the text in this manner allows you to move about the chapters easily when these specific areas of content are covered in your program curriculum.

The text starts with the basic fundamentals of drug therapy. Then units about infection and pain, followed by units about drugs related to different body systems. These units are written in a head-to-toe sequence, making the specific drugs easier to find.

Learning about drug therapy is easier when you can connect the information with life-like clinical experiences. In Chapter 5 you will be introduced to a group of clients in the clinic setting. Their stories establish for you a context in which to begin learning about the selected drugs and their real-world application.



BEGINNING OF THE CHAPTER

The chapter opening page is designed to guide you, the learner, in organizing your study routine as you learn the essential elements of drug therapy in each chapter.

Learning Objectives

These define what you will learn in a specific chapter. Review the objectives first to help you understand what you need to learn after reading the chapter.

Key Terms

With accompanying definitions, the Key Terms help you build your vocabulary. Look for **bold type** in the text at first mention of the word in the chapter to remind you of the definition.

Drug Classes

This gives you a sense of how drugs are grouped according to similar properties. Learning these groupings helps you identify potential errors and safety concerns.

Pharmacology in Practice

Each chapter features a case study individual dealing with an issue related to drugs featured in the chapter. Scenarios focus on assessment, administration, or teaching issues that have an impact on real-life patients. Their stories help you to focus your attention on the concepts important to patient care.

11 Antiviral Drugs

Key Terms

circumoral circling or surrounding the mouth

highly active antiretroviral therapy (HAART) multiple drugs used together for treatment of human immunodeficiency virus (HIV) infection

host cell a live cell (may be plant or animal) where a virus embeds itself to reproduce

retinitis inflammation of the retina of the eyeball

retrovirus virus that uses RNA as its primary component instead of DNA

unlabeled use use of a drug to treat a condition that is not officially approved by the U.S. Food and Drug Administration (FDA)

Learning Objectives

On completion of this chapter, the student will:

1. Discuss the uses, general drug actions, adverse reactions, contraindications, precautions, and interactions of antiviral drugs.
2. Discuss important preadministration and ongoing assessment activities the nurse should perform on the patient receiving an antiviral/antiretroviral drug.
3. List nursing diagnoses particular to a patient taking an antiviral drug.
4. List possible goals for a patient taking an antiviral/antiretroviral drug.
5. Discuss ways to promote an optimal response to therapy and manage adverse reactions, and special considerations to keep in mind when educating the patient and the family about the antiviral/antiretroviral drugs.

Drug Classes

Antivirals
- Anti-herpes agents
- HBV and HCV agents
- Influenza agents, neuraminidase inhibitor (NAI)

Antiretrovirals
- Protease inhibitors
- Nucleoside/nucleotide reverse transcriptase inhibitors (NRTIs)
- Nonnucleoside reverse transcriptase inhibitors (NNRTIs)
- Entry inhibitors
- Integrase inhibitors

Pharmacology in Practice
Mr. Park, 77 years old, lives alone at home. One day, as he was working in the garden, Mr. Park fell. He lay in the garden with a fractured hip for about 2 hours before he was found. This event, compounded with other stressors of living alone, initiated an outbreak of herpes zoster (shingles). Consider this event as you read about medications that reduce the symptoms of viral disease.

Many people still believe bacteria can be treated by drug therapy, yet a virus cannot. In the last decade, scientific breakthroughs have produced a number of antiviral medications. In some cases, these drugs have turned life-threatening viral infections (such as

DRUG INFORMATION

Consistent Framework

Each chapter presents the drugs in such a way that you learn to recognize and respond to patient questions quickly and accurately. Illustrated concepts guide you as each chapter features information about the drug class in a logical and sequential order as **Action, Uses, and Adverse Reactions**—the concepts you, the nurse, deal with on a consistent basis. This is followed by **Contraindications, Precautions, and Interactions**—all items typically reviewed earlier and considered by other health providers, yet at the same time important for you to know to provide safe drug administration to your patients.

Special Features

Special features are sprinkled throughout the text to direct you to priority information about the drugs or individuals who will receive the drugs.

Nursing Alerts

Quickly identify urgent nursing actions in the management of the patient receiving a specific drug or drug category.

Lifespan Considerations

Draw your attention to specific populations at risk or needing specific administration considerations (e.g., gerontology and pediatric). Because texts are written dealing specifically with obstetrical and pediatric patients, the primary focus of these alerts is for geriatric patients, or when specific populations (e.g., women of childbearing age or transgender persons) take a medication that will interact differently than the general population.

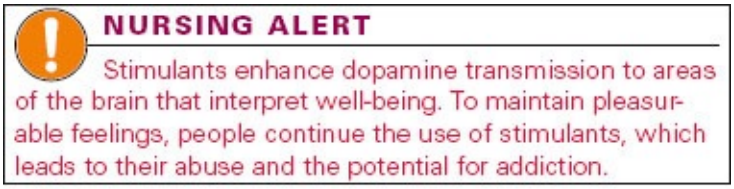
Drug Interaction Tables

A quick visual scan of these tables can tell you if a patient is likely to have a problem when multiple drugs are given. Using these tables as you construct concept maps on the case study patients in each chapter will help you identify harmful interactions, before you see them happen in practice.

Herbal Considerations

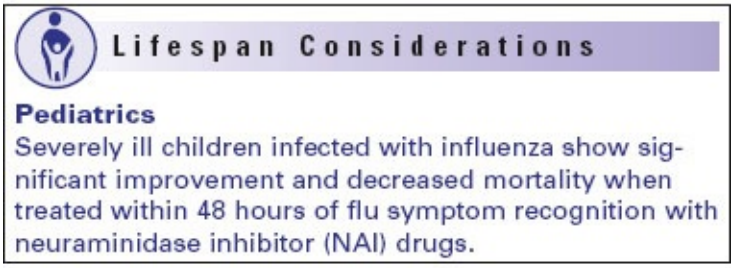
Provide information on herbs and complementary and alternative remedies

used by patients under your care. Additional information is provided in Appendix D where examples of a number of natural products are provided.



NURSING ALERT

Stimulants enhance dopamine transmission to areas of the brain that interpret well-being. To maintain pleasurable feelings, people continue the use of stimulants, which leads to their abuse and the potential for addiction.

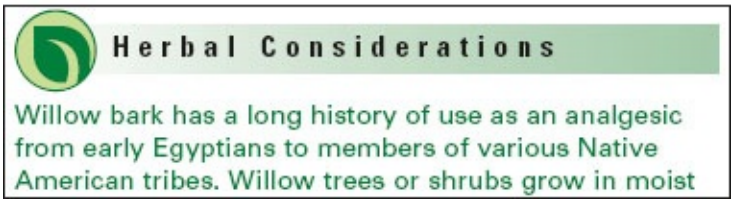


Lifespan Considerations

Pediatrics

Severely ill children infected with influenza show significant improvement and decreased mortality when treated within 48 hours of flu symptom recognition with neuraminidase inhibitor (NAI) drugs.

Interacting Drug	Common Use	Effect of Interaction
Cephalosporins	Anti-infective agent	Increased risk of nephrotoxicity
Loop diuretics (water pills)	Management of edema and water retention	Increased risk of ototoxicity



Herbal Considerations

Willow bark has a long history of use as an analgesic from early Egyptians to members of various Native American tribes. Willow trees or shrubs grow in moist

NURSING PROCESS AND DRUG THERAPY

Uniquely presented, nursing actions regarding drug information are provided in the context of a nurse's clinical practice. The nursing process is featured as a practical guide to connect patients and drug therapy.

Assessment	Here are the questions to ask for the information needed both before and during drug therapy.
Analysis and Planning	Frequently seen **Nursing Diagnoses** are listed and suggested outcomes for patient responses to specific drugs or drug therapy.
Implementation	**Promoting an Optimal Response** Gives you specific information to use for effective and safe administration. **Monitoring and Managing Patient Needs** Gives you a number of strategies to use in your practice as a nurse to help patients deal with the drugs they are taking. **Educating the Patient and Family** LPN/LVNs are the first and often primary contacts in community settings (e.g., assisted living, long-term care, clinics, and offices). You will be the one to teach and provide information to patients and families about the drugs. Here are practical tools and methods to help you work with people to be sure they are taking medications correctly and watching for signs and symptoms.
Evaluation	Bulleted lists highlight important measures and help you decide whether the strategies you use provide the best outcomes while building confidence in your patient's abilities to adhere to medication plans.

END OF THE CHAPTER

Here is where you determine what you have learned from reading each chapter. Information is summarized in an easy-to-read format, giving you the opportunity to demonstrate what you learned by applying information in the chapter case study. Once you review the chapter, use the review questions to demonstrate your skill as you would when you take the NCLEX examination.

Pharmacology in Practice: Think Critically

Each chapter ends with a return to the case study patient. Realistic patient care situations help learners apply the material contained in the chapter by exploring options and making clinical judgments related to the administration of drugs. The case histories of seven patients are used, and different aspects of care are presented in different chapters like puzzle pieces, making connections for learners to appreciate the complex issues in providing care to both individuals and families. Coupled with information from the *Study Guide to Accompany Roach's Introductory Clinical Pharmacology* the learner is encouraged to map out patient problems discovering potential complications or areas for improved patient care.

Key Points

Key points are summarized and the important concepts of the chapter are listed to help you determine if you have mastered the learning objectives.

Summary Drug Tables

Conveniently placed, these tables provide a list of drugs from the classes discussed in each chapter. Current names (generic and, when appropriate, brand names), uses, frequent adverse reactions, and general dosing information are given in an accessible, easy-to-read format.

- ✔ Follow the directions supplied with the prescription regarding taking the drugs with meals or on an empty stomach. Take drugs that must be taken on an empty stomach 1 hour before or 2 hours after a meal.
- ✔ Distinguish between immediate- and extended-release medications. Do not break, chew, or crush extended-release medications.
- ✔ Notify the primary health care provider if symptoms of the infection become worse or if original symptoms do not improve after 5 to 7 days of drug therapy.
- ✔ Avoid any exposure to sunlight or ultraviolet light (tanning beds, sunlamps) while taking these drugs and for several weeks after completing the course of therapy. Wear sunblock, sunglasses, and protective clothing when exposed to sunlight.
- ✔ Avoid tasks requiring mental alertness until response to the drug is known.

Specific Instructions Regarding Sulfonamides

- ✔ Take sulfasalazine (Azulfidine) with food or immediately after a meal.
- ✔ When taking sulfasalazine, the skin or urine may turn orange-yellow; this is normal. Soft contact lenses may acquire a permanent yellow stain. It is a good idea to seek the advice of an ophthalmologist regarding disposable lenses while taking this drug.

EVALUATION

- Therapeutic response is achieved, and there is no evidence of infection.
- Adverse reactions are identified, reported to the primary health care provider, and managed successfully with appropriate nursing interventions:
  - Patient maintains an adequate fluid intake for proper urinary elimination.
  - Skin is intact and free of inflammation, irritation, infection, or ulcerations.
  - No evidence of infection is seen.
- Patient and family express confidence and demonstrate an understanding of the drug regimen.

Pharmacology In Practice
THINK CRITICALLY
Information from the preassessment can help you determine whether Mrs. Moore's confusion is an ongoing problem or caused by her current illness. What questions will you ask her? What about other family members? Are there specific lab tests that will help you understand her confusion better? When her urinalysis comes back from the lab showing 3+ for bacteria, how does that influence your assessment?

KEY POINTS

- Infections occur when pathogenic microorganisms breach our natural defenses, such as the skin.
- Culture and sensitivity testing helps to identify the best drug for eradicating the bacterial infection.
- Sulfonamides are primarily bacteriostatic; they slow or retard the multiplication of bacteria, not destroy it.
- Sulfonamides are used primarily for UTIs and as topical preparations.
- Persons taking sulfonamides need to increase fluid intake to at least 2000 mL to prevent genitourinary problems caused by the drug. Because kidney function diminishes as we age, there is an increased danger of renal damage and fluid increase is even more important with the elderly.
- Photosensitivity is an adverse reaction of sulfonamides; people taking these drugs should lessen outdoor activities or take care to protect their skin while outdoors.

SUMMARY DRUG TABLE
Sulfonamides

Generic Name	Trade Name	Uses	Adverse Reactions	Dosage Ranges
Single Agents				
sulfadiazine sul-fah-dye-ah-zeen		UTIs, chancroid, acute otitis media, *Haemophilus influenzae* and, rheumatic fever	Vomiting, headache, diarrhea, chills, fever, anorexia, crystalluria, stomatitis, urticaria, pruritus, hematologic changes, Stevens-Johnson syndrome, nausea	Loading dose: 2–4 g orally; maintenance dose: 2–4 g/day orally in 4–6 divided doses
sulfisoxazole sul-fah-sel'-ah-zeen	Azulfidine, Azulfidine EN-tabs	UTI, acute otitis media, *H. influenzae*	Same as sulfadiazine; may cause skin and urine to turn orange-yellow	Initial therapy: 1–4 g/day orally in divided doses; maintenance dose: 2 g/day orally in evenly spaced doses (500 mg Q6)

CHAPTER REVIEW

Know Your Drugs

Use the matching exercise to identify drug names and connect generic with brand names to help you recognize the potential for and prevention against using the wrong drug.

Calculate Medication Dosages

Practice the math skills to learn accurate drug dosing and recognize the potential for error, thus ensuring that you give the correct dose.

Prepare for the NCLEX

Here questions allow you to test your knowledge of the material.

1. **Build Your Knowledge**—information- and fact-based questions are presented to get you "warmed up" to apply what you've learned.
2. **Apply Your Knowledge**—keyed to the latest NCLEX-PN test plan (see examples in Appendix H), these application and analysis questions about concepts in the chapter help you apply what you've learned as well as prepare for the NCLEX examination.
3. **Alternate-Format Questions**—provide you experience in applying what you've learned in a different manner.

Special Features Questions are structured like the NCLEX examination. The design helps you become familiar with the language and format of NCLEX testing.

Patient or Client In this section of each chapter, you see wording change from "patient" to "client." In your course of study the terms *patient*, *resident*, *consumer*, or *client* may be used. The change is intentional and designed to help you recognize the interchange of words so you may adapt to testing format more easily.

Numbered (1, 2, 3, 4) Distractors The NCLEX provides a single question on a computer screen. The options you are given are listed as numbers. Distractor options in these questions are labeled 1, 2, 3, 4 instead of A, B, C, D—again, to simulate the NCLEX examination.

CHAPTER REVIEW

Know Your Drugs

Clients sometimes know a medication by the brand (or trade) name and not the generic name. To help you recognize both names, match the brand name with the generic name of the same medication.

Generic Name	Brand Name
1. cefuroxime	A. Augmentin
2. ceftazidime	B. Vancocin
3. amoxicillin/clavulanic acid	C. Rocephin
4. vancomycin	D. Vibramycin

Calculate Medication Dosages

1. A client is prescribed amoxicillin oral suspension. The drug is reconstituted to a solution of 250 mg/5 mL. The primary health care provider prescribes 500 mg of the amoxicillin. The caregiver listens on using a spoon to administer the drug. Answer the following questions: How much amoxicillin will 1 teaspoon contain? How many milliliters (mL) were ordered, and what is the conversion to teaspoons (how much should the nurse teach the caregiver to administer)?
2. The health care provider at the Sexual Assault Clinic prescribes 1 g of cefoxitin (Mefoxin) for parenteral administration. Cefoxitin is available in a solution of 250 mg/1 mL. What amount of cefoxitin would the nurse prepare? Could this be given in one IM injection?

Prepare for the NCLEX

BUILD YOUR KNOWLEDGE

1. Bacterial cells are different from human cells because they:
   1. have a cell wall
   2. synthesize DNA and RNA
   3. contain a beta-lactam ring
   4. contain proteins
2. Cephalosporins are divided into "generations" according to:
   1. when they were discovered
   2. their administration method
   3. manufacturer's preference
   4. sensitivity to microorganisms
3. A client taking oral penicillin reports he has a sore mouth. On inspection, the nurse notes a black, furry tongue and bright red oral mucous membranes. The primary care provider is notified immediately because these symptoms may be caused by:
   1. a vitamin C deficiency
   2. a superinfection
   3. an allergic reaction
   4. poor oral hygiene
4. The nurse currently administers penicillin V:
   1. 1 hour before or 2 hours after meals
   2. without regard to meals
   3. with meals to prevent GI upset
   4. every 3 hours around the clock
5. When giving a cephalosporin by the IM route, the nurse tells the client that _____.
   1. a stinging or burning sensation and soreness at the site may be experienced
   2. the injection site will be red for several days
   3. all injections will be given in the same area
   4. the injection will not cause any discomfort
6. The nurse observes a client taking a cephalosporin for common adverse reactions, which include _____.
   1. hypotension, dizziness, urticaria
   2. nausea, vomiting, diarrhea
   3. skin rash, constipation, headache
   4. bradycardia, pruritus, insomnia
7. After administering penicillin in an outpatient setting, the nurse:
   1. asks the client to wait 10 to 15 minutes before leaving the clinic
   2. instructs the client to report any numbness or tingling of the extremities
   3. keeps pressure on the injection site for 10 minutes
   4. asks the client to walk in the area for at least 30 minutes

APPLY YOUR KNOWLEDGE

8. *When reviewing a client's culture and sensitivity test results, the nurse learns that the bacteria causing the infection are sensitive to penicillin. The nurse interprets this result to mean that:
   1. the client is allergic to penicillin
   2. penicillin will be effective in treating the infection
   3. penicillin will not be effective in treating the infection
   4. the test must be repeated to obtain accurate results
9. *A nurse asks if the client is allergic to penicillin before the first dose of the cephalosporin is given. The rationale for this question is that persons allergic to penicillin _____.
   1. are usually allergic to most antibiotics
   2. respond poorly to antibiotic therapy
   3. require higher doses of other antibiotics
   4. have a higher incidence of allergy to the cephalosporins

Box, Table, and Figure Credits

CHAPTER 1

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Figure 2.10. Adapted from Lynn, P. (2015). *Lippincott's photo atlas of medication administration* (5th ed.). Philadelphia, PA: Wolters Kluwer.

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Box 32.1. Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma, National Heart, Lung, and Blood Institute, 2007.

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Figure 34.1. Courtesy of Anatomical Chart Co.

Table 34.1. From 2013 ACC/AHA Prevention Guidelines.

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Figure 39.1. Courtesy of Anatomical Chart Co.

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UNIT 1

Nursing Foundation of Clinical Pharmacology

As you become a nurse, you will realize that medication management is one of the most significant tasks of your practice. Individuals rely heavily on the knowledge and instruction of nurses to learn how to become good managers of their own health care needs. When you work in an institutional setting, the patients rely on nurses to accurately administer and monitor medications to keep them safe and promote health. Both situations require a competent nursing professional who has a strong foundation of clinical pharmacology.

Unit 1 provides you with the foundation for understanding pharmacology in the context of nursing clinical practice. Three of the five chapters in this unit specifically discuss concepts focal to nursing: drug administration, nursing process, and patient teaching. The general principles of pharmacology and the mathematics involved in dosage calculation are concepts used by all providers. These concepts are included in their own chapters. Here is a brief summary of the content in each chapter of Unit 1.

Basic principles are covered in Chapter 1, beginning with how drugs are derived from natural sources, such as plants, or made synthetically. Other key concepts include facts about drug categories and the differences between a prescription drug (those given under the supervision of a licensed health care provider) and a nonprescription drug (those obtained over the counter and designated as safe when taken as directed). Finally, you will gain an understanding of how drugs undergo a series of steps to be processed, utilized, and eliminated by the body—this is the basis for the study of pharmacology for health care providers.

Administration of a drug is primarily the responsibility of the nurse and is discussed in Chapter 2. Nurses have the duty to safely provide patient care by correctly administering the medication prescribed by the primary health care

provider. This is achieved by learning and following the principles of drug administration, proper technique, and using medication systems correctly.

Your ability to correctly calculate mathematical problems is one of the most important steps in providing safe care to patients. Mastering steps in drug administration and delivery help to ensure accuracy in those math calculations. Chapter 3 provides both the opportunity to practice calculations and an overview of the tasks that you will undertake to be sure drug doses are correct before administration.

Most patients experience problems of anxiety or lack knowledge regarding new medication routines. The nursing process is used to help members of the health care team provide effective patient care. This process is used to develop an individualized care and teaching plan for use when medications are ordered. Nursing process concepts are covered in Chapter 4.

It is crucial that the patient understand the important information about the medication prescribed, including the dosage, how to take the medication, the expected effect, and adverse reactions. In Chapter 5, components needed for successful patient teaching are described. Additionally, a group of individuals receiving nursing care in an ambulatory setting are introduced. Their stories are designed to help you understand how all this information is used in the nursing care of patients receiving drug therapy. You will learn how concepts are put into practice using case studies throughout the textbook.

By understanding the basic principles of pharmacology, you can build a sound knowledge base of the drugs used to help patients maintain their highest levels of wellness.

General Principles of Pharmacology

Learning Objectives

On completion of this chapter, the student will:

1. Define the term *pharmacology.*
2. Identify the different names assigned to drugs.
3. Distinguish between prescription drugs, nonprescription drugs, and controlled substances.
4. Discuss drug development in the United States.
5. Discuss the various types of drug activity and reactions produced in the body.
6. Identify factors that influence drug action.
7. Define drug tolerance, cumulative drug effect, and drug idiosyncrasy.
8. Discuss the types of drug interactions that may be seen with drug administration.
9. Discuss the nursing implications associated with drug actions, interactions, and effects.
10. Discuss the use of herbal medicines.

Key Terms

absorption a drug is moved from site of administration to body fluids; first process during pharmacokinetics

adverse reaction undesirable drug effect

allergic reaction immediate hypersensitive reaction by the immune system; it presents as itching, hives, swelling, and difficulty breathing

anaphylactic shock sudden, severe hypersensitivity reaction with symptoms that progress rapidly and may result in death if not treated; also called *anaphylactic reaction* or *anaphylactoid reaction*

angioedema localized wheals or swellings in subcutaneous tissues or mucous membranes, which may be caused by an allergic response; also called *angioneurotic edema*

controlled substances drugs that have the potential for abuse and dependency, both physical and psychological

cumulative drug effect when the body is unable to metabolize and excrete one dose of a drug before the next is given

complementary/alternative medicine (CAM) group of diverse medical practices or products not presently part of conventional medicine

distribution drug moves from circulation to body tissue or a target site

drug idiosyncrasy any unusual or abnormal response that differs from the response normally expected to a specific drug and dosage

drug tolerance decreased response to a drug, requiring an increase in dosage to achieve the desired effect

excretion elimination of a drug from the body

first-pass effect action by which an oral drug is absorbed and carried directly to the liver, where it is inactivated by enzymes before it enters the general bloodstream

half-life time required for the body to eliminate 50% of a drug

herbal medicine type of complementary/alternative therapy that uses plants or herbs to treat various disorders; also called *herbalism*

hypersensitivity undesirable reaction produced by a normal immune system

metabolism drug is changed to a form that can be excreted

metabolite inactive form of the original drug

nonprescription drugs drugs designated by the U.S. Food and Drug Administration (FDA) to be safe (if taken as directed) and obtainable without a prescription; also called *over-the-counter* (OTC) drugs

pharmaceutic pertaining to the phase during which a drug dissolves in the body

pharmacodynamics study of the drug mechanisms that produce biochemical or physiologic changes in the body

pharmacokinetics study of drug transit (or activity) after administration

physical dependency habitual use of a drug, where negative physical withdrawal symptoms result from abrupt discontinuation

prescription drugs drugs the federal government has designated as

potentially harmful unless their use is supervised by a licensed health care provider, such as a nurse practitioner, physician, or dentist

psychological dependency compulsion or craving to use a substance to obtain a pleasurable experience

receptor *in pharmacology,* a reactive site on the surface of a cell; when a drug binds to and interacts with the receptor, a pharmacologic response occurs

risk evaluation and mitigation strategies (REMS) program of the FDA, designed to monitor drugs that have a high risk compared to benefit ratio

teratogen drug or substance that causes abnormal development of the fetus, leading to deformities

toxic poisonous or harmful

Pharmacology is the study of drugs and their action on living organisms. A sound knowledge of basic pharmacologic principles is essential for nurses to administer medications safely and monitor patients who receive these medications. The first task in learning about drug therapy is to understand how drugs are named. Once you understand this concept it will be easier to understand classes and categories of drugs, as well as federal regulations pertaining to drugs and how they are developed. This chapter presents a basic overview of the pharmacologic principles needed to understand medication administration. Lastly, it discusses **herbal medicines** as they relate to pharmacology.

Over the last century, drugs have changed the way health care providers treat patients. In the early 1900s, individuals died from infections and medical and surgical complications partly because of a lack of sanitary conditions and the fact that medicines used to combat infection did not exist at the time. The discovery of drug substances has changed an infection from being a death sentence into an acute or chronic health condition. Drug therapy also means that patients lacking certain substances in their bodies, such as insulin, or those diagnosed with cancerous tumors can now live long and productive lives.

Medications are either derived from natural sources, such as plants and minerals, or they are synthetically produced in a laboratory. An example of a drug derived from a natural source includes digitalis, which is an extract from