EIGHTH EDITION

Administering Medications

Pharmacology for Healthcare Professionals

DONNA F. GAUWITZ

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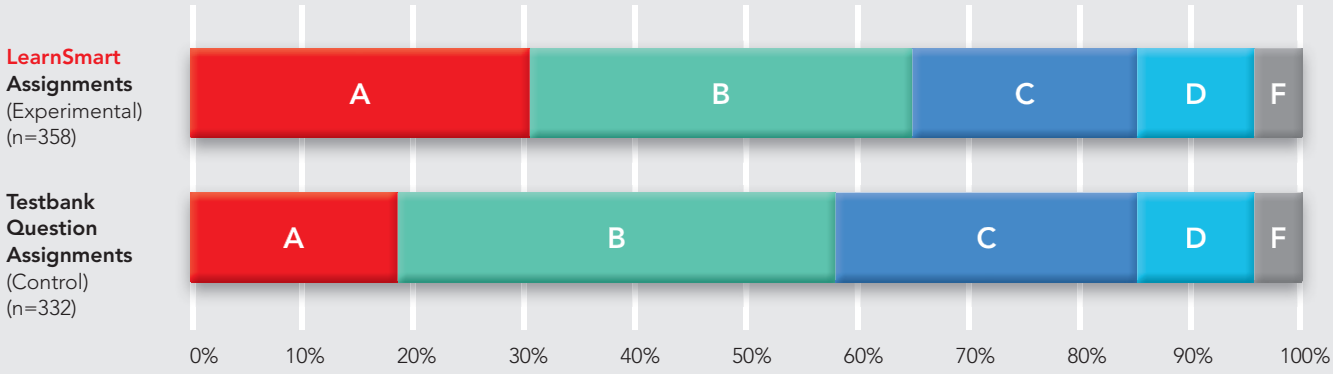

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Administering Medications

Pharmacology for Healthcare Professionals

eighth edition

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Dedication

I want to thank my husband, William, who is my best friend, for his love and support through all of the phases of this edition. He is my rock and driving force.

About the Author

Donna Faye Gauwitz, MS, RN, received her diploma in nursing from St. Francis School of Nursing in Peoria, Illinois. After graduation, she worked on medical-surgical nursing units, specifically neurology, and on the psychiatric unit at St. Francis Hospital, a major acute care facility and trauma center in central Illinois. She obtained a bachelor of science degree from Bradley University in Peoria, Illinois. After graduating with a BSN, Donna began her career in nursing education as a staff development coordinator at St. Francis Medical Center, orienting new graduate nurses to the largest medical-surgical unit. She was also an adjunct faculty member at Illinois Central College in East Peoria, Illinois, and at Illinois Wesleyan University in Bloomington, Illinois, teaching medical-surgical and pediatric nursing. While at Illinois Central College, she developed a brand-new college course, Introduction to Eating Disorders, that she taught at the college.

Donna further developed her research and publication interest as a research assistant at the University of Illinois Department of Psychiatry and Behavioral Medicine in Peoria, Illinois, and at Northwestern University College of Nursing in Chicago, Illinois. She did the research and wrote the proposal for an Eating Disorders Clinic and became the director of the clinic at St. Francis Medical Center in Peoria. Her pursuit of advanced education took her to Northwestern University College of Nursing in Evanston, Illinois, to obtain her master's degree. After graduation from Northwestern University, Donna began her full-time teaching career at Methodist Medical Center in Peoria, followed by positions at Barry University in Miami Shores, Florida, and Broward Community College in Pembroke Pines, Florida, teaching medical-surgical, orthopedic, rehabilitation, women's health, and neurology nursing.

During her tenure in education, she had the opportunity to serve as an item writer eight times for the National Council of Licensure in the development of the NCLEX-RN. She published an article in *Insight,* a National Council of Licensure publication. She further pursued her interest in writing by publishing three articles in the *Nursing* journal and one article in the *American Journal of Nursing.* She is also currently the author of *Complete Review NCLEX-RN, and Practice Questions for NCLEX-RN.*

After relocating to Minnesota, she became a nursing education specialist for an acute care surgical unit at the Mayo Clinic in Rochester, Minnesota. Her love of nursing education then took her to the University of Minnesota as a senior teaching specialist and coordinator of the Nursing Skills Laboratory in Minneapolis, Minnesota.

Donna is a member of Sigma Theta Tau and has been listed in *Who's Who in American Nursing.*

Brief Contents

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Preface

Administering Medications: Pharmacology for Healthcare Professionals teaches safe medication administration to healthcare students entering nursing, medical assisting, and other allied healthcare professions. Because this textbook speaks directly to students, they can easily identify and apply the concepts they've learned.

The organization of the chapters allows students and instructors to build a knowledge base that starts with the fundamentals of medication administration and progresses through the drugs frequently used to treat most common diseases. Most chapters are organized around a body system to help students fully understand drug actions. For easy identification, the 50 most frequently prescribed drugs are boldfaced in the Representative Drug tables.

The Patient Education, Healthcare for Today and Tomorrow, and Legal and Ethical Issues boxes continue to be highlighted features in this edition. The Patient Education boxes contain important information for the healthcare professional to communicate to the patient. This feature also includes cultural diversity and pediatric and geriatric implications where appropriate. The Healthcare for Today and Tomorrow boxes alert the healthcare professional to issues or problems that may be encountered today or in the future. The Legal and Ethical Issues boxes illustrate the role of the healthcare professional in actual legal and ethical situations pertinent to the content of each chapter.

New to This Edition

The eighth edition of *Administering Medications* has been updated to reflect the most up-to-date information on the safety and education of medications. Revisions are based on updates needed for currency and accuracy, as well as feedback from instructors and students.

General revisions throughout the text include the following:

- Learning outcomes—reduced length and revised to improve clarity and conciseness
- Key terms list—condensed to include only the terms and definitions included in the end-of-book glossary
- Chapter openers—visually enhanced layout and updated photos
- Section headings—improved organization of heading hierarchy
- Icons added throughout to reference new technology offerings
- End-of-chapter summary points revised to be consistent with changes to learning outcomes
- End-of-chapter review assignments updated to be consistent with changes to learning outcomes

Chapter-by-chapter revisions are as follows:

Chapter 1 Orientation to Medications

- Added *new* Table 1.1 Five Top Generic versus Brand-Name Drugs
- Presented drug reference information in a table (Table 1.2) that includes nursing implications

- Updated Figure 1.1 sample drug card to include nursing implications
- Presented drug categories in a table (Table 1.5)
- Deleted Caution box on Darvon (drug was taken off the market)
- Added *new* Caution box on appropriate dose of acetaminophen in drugs

Chapter 2 Principles of Drug Action

- Added *new* Table 2.2, Common Food and Drug Interactions
- Added *new* Table 2.3, Drug Effects on Nutritional Disorders

Chapter 3 Measurement and Dosage Calculations

- Added metric abbreviations

Chapter 4 Administering Parenteral Medications

- Added *new* Pediatric Considerations and Older Adult Considerations boxes on intramuscular injections

Chapter 5 Medication Therapy

- Updated terminology for currency

Chapter 6 Vitamins, Minerals, and Herbs

- Updated USDA's MyPyramid to new title MyPlate
- Updated Figure 6.1 to MyPlate
- Updated Table 6.1, with vitamin D dosage changed from 400 IU to 600 IU

Chapter 7 Antibiotics, Antifungals, and Antivirals

- Updated Table 7.1 to include ceftaroline (*Teflaro*) under cephalosporins and rilpivirine (*Edurant*) under antivirals

Chapter 8 Drugs for the Eye and Ear

- Made only general revisions

Chapter 9 Drugs for the Skin

- Added new lice medication ivermectin (*Sklice*)

Chapter 10 Drugs for the Cardiovascular System

- Updated drugs under anticoagulants to include dabigatran (*Pradaxa*) and rivaroxaban (*Xarelto*)

Chapter 11 Drugs for the Respiratory System

- Presented symptoms of respiratory disorders in a table (Table 11.1)
- Updated treatment of emphysema to include roflumilast (*Daliresp*) as selective inhibitor of phosphodietrease 4 (PDE4)
- Added mometasone and formoterol for patients not controlled by other medications or when more than one medication is needed for asthma

Preface

Chapter 12 Drugs for the Gastrointestinal System

- Deleted kaolin and pectin from discussion of antidiarrheals and changed to current ingredients bismuth subsalicyate
- Deleted casanthranol as an ingredient in *Peri-Colace* and changed to senna
- Added lorcasin (*Belviq*) as a new weight-loss drug to be used in conjunction with diet and exercise
- Added phentermine and topiramate (*Qsymia*) to be prescribed for weight-loss management
- Presented general principles for giving medications for the GI system in a table (Table 12.2)

Chapter 13 Drugs for the Urinary System and Fluid Balance

- Emphasized parts of the urinary system
- Emphasized abnormal alterations in the urine
- Changed pediatric concerns to pediatric dehydration
- Added that phenazopyridine (Pyridium) may now be purchased at a lower dose over the counter than the prescription Pyridium

Chapter 14 Drugs for the Reproductive System

- Added dienogest (Natazia) as a new progestin used with estradiol in a combination oral contraceptive formulation

Chapter 15 Drugs for the Endocrine System

- Added linagliptin (Trajenta) as an oral hypoglycemic known as a DPP4 inhibitor
- Presented instructions for giving insulin in a table (Table 15.5)

Chapter 16 Drugs for the Musculoskeletal System

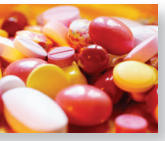
- Added denosumab (Prolia) to the drugs for osteoporosis
- Added new drug tocilizumab (Actemra) as a biological agent or interleukin

Chapter 17 Drugs for the Nervous and Sensory Systems

- Added potassium blocker dalfampridine (*Ampyra*)
- Added pediatric seizure medication ezogabine (*Potiga*)
- Deleted Darvocet –N, which has been taken off the market

Chapter 18 Psychotropic Drugs

- Added duloxetine (*Cymbalta*), an antidepressant, and vilazodone (*Vibryd*)
- Added lurasidone (*Latuda*) to antipsychotics
- Presented guidelines that make sedatives more effective in a table (Table 18.1)



Chapter 19 Antineoplastic Drugs

- Presented characteristics of cancer in a table (Table 19.1)
- Changed drugs for chemotherapy to chemotherapy
- Added drugs for chemotherapy before discussion of alkylating agents
- Presented physical side effects of chemotherapy in a table (Table 19.2)

Chapter 20 Drugs for the Pediatric Patient

- Added methods of administration before discussion of oral administration

Chapter 21 Drugs for the Older Adult Patient

- Revised learning outcomes

Teaching Resources

Instructor's Manual

Prepared by Donna Gauwitz, each chapter of the Instructor's Manual includes chapter learning outcomes, a chapter outline, teaching strategies, a critical-thinking activity, and answers to the end-of-chapter review assignments. Also available are practice NCLEX questions. Correlation charts for the AAMA, AMT, SCANS, and National Health Care Skills Standards are also available.

Test Bank

The test bank includes over 1,500 multiple-choice, fill-in-the-blank, and essay problems to meet any instructor's testing needs. The computerized test bank allows instructors to create their own tests and measure students' knowledge of chapter content.

PowerPoint Presentation

PowerPoint slides allow instructors to illustrate key points from each chapter and include additional critical-thinking questions to prompt classroom discussion.

McGraw-Hill *Connect Plus* [Administering Medications]

McGraw-Hill *Connect Plus* [Administering Medications] is a web-based assignment and assessment platform that gives students the means to better connect with their coursework, with their instructors, and with the important concepts that they will need to know for success now and in the future. With *Connect Plus* [*Administering Medications*], instructors can deliver assignments, quizzes, and tests easily online. Students can practice important skills at their own pace and on their own schedule. With *Connect Plus* [Administering Medications], students also get 24/7 online access to an eBook—an online edition of the text—to aid them in successfully completing their work, wherever and whenever they choose.

Preface

LearnSmart Advantage

New from McGraw-Hill Education, LearnSmart Advantage is a series of adaptive learning products fueled by LearnSmart, the most widely used and intelligent adaptive learning resource proven to improve learning since 2009. Developed to deliver demonstrable results in boosting grades, increasing course retention, and strengthening memory recall, the LearnSmart Advantage series spans the entire learning process from course preparation to providing the first adaptive reading experience found only in SmartBook. Distinguishing what students know from what they don't, and honing in on concepts they are most likely to forget, each product in the series helps students study smarter and retain more knowledge.

A smarter learning experience for students coupled with valuable reporting tools for instructors, and available in hundreds of course areas, LearnSmart Advantage is advancing learning like no other products in higher education today.

LearnSmart

LearnSmart is one of the most effective and successful adaptive learning resources available on the market today and is now available for *Administering Medications.* Over 2 million students have answered more than 1.3 billion questions in LearnSmart since 2009, making it the most widely used and intelligent adaptive study tool that's proven to strengthen memory recall, keep students in class, and boost grades. Students using LearnSmart are 13 percent more likely to pass their classes, and 35 percent less likely to drop out.

This revolutionary learning resource is available only from McGraw-Hill Education. Join the learning revolution and start using LearnSmart today!

SmartBook

SmartBook is the first and only adaptive reading experience available today. SmartBook personalizes content for each student in a continuously adapting reading experience. Reading is no longer a passive and linear experience, but an engaging and dynamic one where students are more likely to master and retain important concepts, coming to class better prepared. Valuable reports provide instructors insight as to how students are progressing through textbook content, and are useful for shaping in-class time or assessment.

As a result of the adaptive reading experience found in SmartBook, students are more likely to retain knowledge, stay in class, and get better grades. This revolutionary technology is available only from McGraw-Hill Education and for hundreds of course areas as part of the LearnSmart Advantage series.

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The Learning System

Each chapter opens with the learning outcomes and key terms that will be presented throughout the chapter.

chapter 11

Drugs for the Respiratory System

Learning Outcomes

After studying this chapter, you should be able to:

11-1 Describe the parts and normal functions of the respiratory system.

11-2 Describe the major respiratory disorders and related symptoms, using the correct medical terms.

11-3 Describe nicotine dependency and methods for smoking cessation.

11-4 Describe the actions of the following drug groups: antitussives, expectorants, decongestants, antihistamines, and bronchodilators.

11-5 Understand the procedures of chest physiotherapy; operating a pulse oximeter; and administering nose drops, inhalants, and oxygen.

In this chapter you will review the parts and functions of the respiratory system. You will learn how breathing takes place and how common respiratory disorders affect this process. You will study the types of drugs used to treat respiratory disorders and their actions. You will also learn to administer drugs in the form of nose drops and sprays to the mucous membranes of the nose and throat.

Key Terms

acute
antihistamine
antitussive
apnea
bronchodilator
chronic
decongestant
dyspnea
emphysema
expectorant
Fowler's position
hemoptysis
hyperpnea
hypoxia
inhaler
mucolytic
nebulizer
nicotine dependence
orthopnea
peak flow meter
percussion
pneumococcal disease
postural drainage
pulse oximeter
rebound effect
semi-Fowler's position
tachypnea
vibration

RESPIRATORY SYSTEM [LO 11-1]

The respiratory system consists of the organs that make it possible for blood to exchange gases with air. They are the nose, pharynx, larynx, trachea, bronchi, and lungs (Figure 11.1). These structures constitute the lifeline of the body, supplying a continuous, uninterrupted source of oxygen. The exchange of gases between blood and air is called respiration. If anything jeopardizes the functioning of this vital system, death is certain within a short time.

Air enters the body through the mouth or the nose. Like all of the respiratory system, the nose is lined with mucous membranes. As air enters the nose, very small hairs called cilia warm and moisten the air and trap dust particles and bacteria. The pharynx is a tubelike structure that extends from the base of the skull to the esophagus and serves both the respiratory tract and the digestive tract. The larynx, or voice box, lies at the upper end of the trachea just below the pharynx.

The larynx is responsible for making sounds. The larynx serves a protective function because the epiglottis, a leaf-shaped structure on top of the larynx, closes the airway when a person swallows. The epiglottis thus keeps food and saliva from entering the lungs.

The larynx joins a tube called the trachea, or windpipe, that leads into the lungs. C-shaped pieces of cartilage line the trachea to keep it firm and prevent it from collapsing and shutting off the airway. The trachea branches off into two tubes: the right and left bronchi, which lead to the right and left lungs. The right bronchus is slightly larger and more vertical than the left. This is why, when an individual aspirates, the aspirated object generally lodges in the right bronchus. The bronchi branch into increasingly smaller tubes, the bronchioles, that subdivide into smaller tubes. The smaller branches further divide into alveolar ducts. These terminate in several alveolar sacs whose walls consist of alveoli, small sacs that are the functional units of the lungs.

The alveolar sacs are tiny air sacs with thin walls. They are in close contact with many capillaries. This is where inhaled oxygen is picked up from the air by the red blood cells. At the same time, carbon dioxide is released from the blood into the air sacs and travels back up the air passages. During exhalation, the carbon dioxide and other waste gases pass out of the body.

The lungs are cone-shaped organs that fill the pleural portion of the thoracic cavity. They provide a place where the exchange of gases can take place between blood and air.

The average person breathes in and out about 16 to 18 times per minute. The normal respiration rate varies between 12 and 25 times per minute.

Healthcare for Today and Tomorrow boxes offer advice and prepare students for the situations they could encounter in the workplace.

of doing things are sometimes hard to accept. Patients may be depressed or fearful. You can help by teaching them, by reassuring them, and by focusing on the benefits of their lifestyle changes.

Healthcare for Today and Tomorrow Crushing or Not Crushing Medications

Some patients want to crush their pills and put them in liquid so that they are easier to take. However, certain common cardiovascular medications, when crushed, either will degrade and become less effective or will be absorbed too quickly. You should instruct your patients never to crush extended-release drugs such as *Procardia XL*, enteric-coated pills such as aspirin, and sublingual drugs such as nitroglycerin.

Legal and Ethical Issues Right to Know

When you take patients' blood pressure and they ask what their blood pressure is, it is your legal responsibility to tell them their blood pressure reading. You should also teach them what their desired reading is. By understanding their targeted blood pressure reading, patients will be more likely to comply and take their antihypertensive medication.

The Learning System

auricle because that contaminates the remainder of the solution in the bottle. Administering antibiotics in the ear canal is an excellent opportunity to teach the patient how to prevent future ear infections or hearing problems.

Patient Education Preventing Hearing Problems

- Do not put objects in the ears.
- Avoid environmental noise, such as loud music, equipment, and airplanes.
- Get all childhood and adult immunizations, particularly mumps, measles, and rubella.
- Congenital deafness can occur if a pregnant woman is exposed to rubella during the first 16 weeks of gestation.
- When taking medications, report any hearing loss, **vertigo** (dizziness), nausea, or vomiting or a spinning sensation in the head while sitting.
- Chronic mouth breathing may result from enlarged adenoids, which may block the eustachian tubes and predispose a person to infection.
- Always take the full course of an antibiotic, even if a condition improves before the medicine is gone.
- Report any symptoms that may indicate hearing loss, such as asking others to speak up, answering questions inappropriately, or having increased sensitivity to even slight changes in noise level.
- Avoid self-medicating.

Patient Education boxes provide beneficial information for effective patient communication.

Legal and Ethical Issues boxes help you gain insight into the necessary information related to the performance of your duties.

Legal and Ethical Issues Wrong Abbreviations

The use of abbreviations that are illegible or incorrectly written can cause medication errors, some of which can be serious or life threatening. An order was written for "Heparin 5000 units sub q 2 hours before surgery." The order was misread as "q 2 hours before surgery," so the patient received 5000 units of heparin (a potent anticoagulant) every 2 hours instead of the intended one dose before surgery. The recommended time interval for the administration of heparin 5000 units subcutaneous is every 8 to 12 hours. To prevent such serious errors, avoid abbreviations and write out "subcutaneous."

must be measured carefully, using a dropper or a medicine glass. T medicine may be added to water, juice, or another solution suggested by t doctor. The patient then drinks this mixture. These mixtures should nev be injected.

Caution Solutions with Alcohol

Tinctures, fluidextracts, elixirs, and spirits contain alcohol. Do not administer them to a diagnosed alcoholic or a patient with diabetes. Storage is important with these alcohol solutions. They must be kept tightly stoppered so that the alcohol cannot evaporate. Store them in a dark place, as stated on the labels. Otherwise, the drug may separate from the alcohol. If this should happen do not use the preparation. Order another preparation from the pharmacy.

Caution boxes inform you about special information to enhance your understanding and make you a safer practitioner.

Pediatric Considerations boxes focus on major drug categories and the special issues they present in pediatric care.

Older Adult Considerations boxes focus on major drug categories and the special issues they present in the care of older adults.

Pediatric Considerations Antitussives, Mucolytics/Expectorants, and Decongestants

- Upper respiratory infections, including those with increased secretions, nasal congestion, and cough, are common in children.
- Several over-the-counter cough and cold medications are available for pediatric use, although a number of others have been taken off the market because of an increased potential for overdose.
- Nasal decongestants, especially those containing pseudoephedrine, are considered safe in children older than 5 years of age. Their use in children under 2 years of age has not been established.
- The dose of pseudoephedrine in nasal decongestants for children is low, so healthcare providers can't agree on their effectiveness.
- Phenylephrine nasal solution may be given to infants to decrease their problem with nasal congestion and their ability to nurse.
- Caution parents against using acetaminophen or ibuprofen to treat any fever in a child. Some healthcare providers recommend administering them only for a fever above 101°.

Older Adult Considerations Antitussives, Mucolytics/Expectorants, and Decongestants

- The effectiveness of antitussives and mucolytic/expectorants in older adults has not been proved.
- Older adults taking nasal decongestants are at risk for side effects such as hypertension, cardiac dysrhythmias, nervousness, and insomnia. Older adults with cardiovascular disease should avoid their use.
- Although there are fewer side effects from topical decongestants, rebound nasal congestion may occur.

Full-color illustrations and photos present a realistic view to enhance your learning.

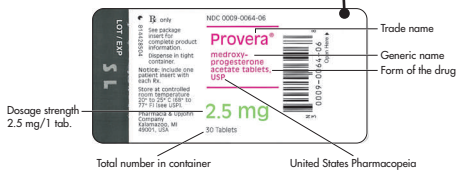

Figure 5.19
Form of drug.

several brand names. For example, the generic drug levothyroxine sodium is also sold under the brand names of *Levothroid, Levoxyl, Synthroid, Thyro-Tabs,* and *Unithroid.* Although many generic drugs have brand names, some drugs such as heparin sodium have no brand name.

The manufacturer of a drug may supply a drug in several forms such as oral, injectable, topical, inhalant, drops, spray, mist, or rectal. For example, morphine sulfate is produced to be administered orally, rectally, and as an injectable including intramuscular, subcutaneous, intravenous, intrathecal, and epidural.

The amount of drug present in the type of medication such as oral or liquid is listed on the drug label. Generally the drug is listed in grams, milligrams, micrograms, and grains. Liquid drugs are listed in milliliters, and special drugs such as heparin and insulin are listed in units.

Assume that the dose of a solid medication is in one tablet, capsule, or gelcap unless stated otherwise. For example, *Provera* 2.5 mg is in one tablet (Figure 5.19).

The dose of a liquid medication is the amount of the drug in a quantity of solution. In *Tigan,* the dose of a drug is 100 mg in 1 milliliter (mL) (Figure 5.20).

In the case of liquid medications, don't assume that the medication is always delivered in 1 mL. Assuming the amount of solution the medication is in is 1 mL may result in an incorrect calculation and medication error. Look at the drug label for *Amoxil* and notice that the dose amount is 250 mg in 5 mL.

The final dose of medication you may encounter is in units. Look at the *Novolin R* insulin label to find that the available dose is 100 units per 1 mL and the calculated amount is the units. Again, be careful to read the medication label correctly to prevent a medication error.

Pay attention to how the medication is to be given. For example, all tablets are not meant to be swallowed. *Nitrostat* tablets are to be administered sublingually, under the tongue (Figure 5.21). The *Singulair* tablets are to

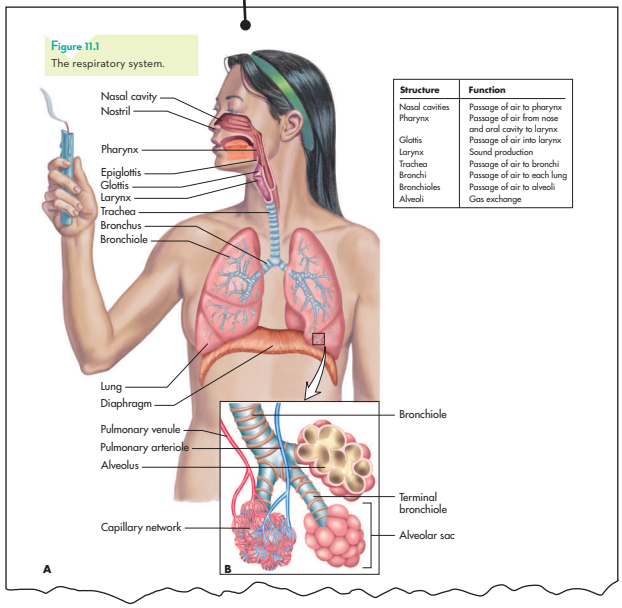

Figure 11.1
The respiratory system.

Structure	Function
Nasal cavities	Passage of air to pharynx
Pharynx	Passage of air from nose and oral cavity to larynx
Glottis	Passage of air into larynx
Larynx	Sound production
Trachea	Passage of air to bronchi
Bronchi	Passage of air to each lung
Bronchioles	Passage of air to alveoli
Alveoli	Gas exchange

Representative Drug tables summarize major drugs to better assist you in administering them in practice. The 50 most commonly prescribed drugs are bolded in each table.

Representative Drugs for Vitamin and Mineral Deficiencies

Category, Name,[a] and Route	Uses and Diseases	Actions	Usual Dose[b] and Special Instructions	Side Effects and Adverse Reactions
Fat-Soluble Vitamins				
vitamin D Oral, IM	Rickets; hypocalcemia; malabsorption	Promotes absorption and utilization of calcium	Initially, 12,000 IU PO or IM daily; increased up to 500,000 IU daily	Rare; seen only with vitamin D toxicity
vitamin K (*AquaMEPHYTON*) PO, subcut, IM	Hypoprothrombinemia	Formation of prothrombin	25 mg PO daily	Rare; flushing, taste alterations, redness at injection site
Water-Soluble Vitamins				
thiamine hydrochloride (vitamin B_1) Oral, IM, IV	Beriberi; malabsorption syndrome; anemia; polyneuritis	Combines with ATP enzyme necessary for carbohydrate metabolism	*Beriberi:* 10–500 mg IM TID for 2 weeks, followed by 5–100 mg for 1 month *Anemia and polyneuritis:* 100 mg PO daily *Crisis state:* 500 mg–1 g IV	Rare; skin rash, itching, wheezing after IV administration
riboflavin (vitamin B_2) Oral	Malnutrition; malabsorption	Converted into two coenzymes necessary for normal tissue respiration	50 mg PO daily	Rare; bright yellow urine with high doses
cyanocobalamin (vitamin B_{12}) Oral, subcut, IM	Malabsorption; pernicious anemia; strict vegetarianism	Necessary for red blood cells, protein, fat, and carbohydrate metabolism	30–100 mcg subcut or IM daily for 5–10 days; monthly maintenance dose 100–200 mcg IM	Rare; itching

Practice Procedures provide step-by-step instructions on how to perform procedures that reflect current medical administration practices.

Practice Procedure 4.2 (LO 4-4)

DRAWING UP MEDICATION FROM AN AMPULE

Demonstrate how to correctly draw up medication from an ampule.

Equipment

Medication order (e.g., *Vistaril,* 25 mg IM stat)
Medication administration record, patient chart
Variety of syringes and needles with covers
Ampule of medication (e.g., 1-mL ampule of *Vistaril* containing 100 mg/mL); check the expiration date
Ampules of sterile water for injection (for practice)
Sterile gauze
Antiseptic wipes or sponges

Procedure

1. Read the medication order and assemble the equipment. Check for the "seven rights." Read the ampule label by holding it next to the medication administration record or physician's order.
2. Wash your hands.
3. Select the proper-sized needle and syringe for the medication and the route (e.g., 3-mL standard hypodermic syringe and 22G, $1\frac{1}{2}$-inch needle for intramuscular injection of *Vistaril*). If necessary, attach the needle to the syringe.
4. Check the ampule label against the medication administration record a second time.
5. Tap down any medication in the top of the ampule.
6. Place a small gauze pad around the neck of the ampule to protect your fingers from broken glass.
7. Snap the neck of the ampule quickly and firmly away from you.
8. Withdraw the medication. Insert the needle into the open end of the broken ampule. Check your agency policy to see if a filter needle is to be used for drawing up the medication. Do not let the needle touch the rim of the ampule; this contaminates the needle. The needle should be kept below the fluid level to prevent drawing up air. The ampule may be tipped to allow the fluid to accumulate in one corner of the ampule to facilitate drawing up all the medicine. Pull back on the plunger and remove a measured dose of medication. The ampule may be held right side up on a flat surface or inverted. Measure accurately. (If using the sample order of *Vistaril,* draw up 1.0 mL of the drug.)
9. Check the syringe for air bubbles. Remove them by tapping sharply on the syringe. Draw back on the plunger and then slowly push the plunger upward to expel air. Be careful not to eject any of the medicine.
10. If the syringe contains too much medicine, hold the syringe vertically with the needle tip up and slanted toward the sink. Slowly eject the excess medicine into the sink. Place the syringe vertically and recheck the dose.

The Learning System

Chapter 8 Review

Match the terms to their definitions.

_____	1. (LO 8-1) Referred to as the "white" of the eye	a. cochlea
_____	2. (LO 8-1) Mucous linings of the eye socket and eyelid	b. conjunctiva
_____	3. (LO 8-1) Ear canal	c. external auditory meatus
_____	4. (LO 8-1) Earwax	d. cerumen
_____	5. (LO 8-1) Primary organ of hearing	e. sclera
_____	6. (LO 8-1) Gland that produces tears	f. lacrimal

Define each of the terms listed below.

7. (LO 8-1) Acoustic _____

8. (LO 8-1) Vertigo _____

9. (LO 8-2) Otic _____

Complete the following statements by filling in the blanks.

13. (LO 8-1) The tiny bones in the middle ear that receive the vibrations of the eardrum are the _____, _____, and _____.

14. (LO 8-1) The covering of the outer eye that closes quickly to prevent a foreign body from entering the eye is the _____.

15. (LO 8-1) The _____ tube connects the middle ear to the nasopharynx and is usually collapsed except when a person is chewing, yawning, or moving the jaw.

Define the purpose of the following drug categories.

16. (LO 8-3) Miotics _____

17. (LO 8-3) Mydriatics _____

Match the drug names to their use(s).

_____	18. (LO 8-3) *Betoptic, Diamox, Timoptic*	a. cerumen
_____	19. (LO 8-3) *Isopto Atropine*	b. glaucoma
_____	20. (LO 8-3) Chloramphenicol	c. superficial eye infections
_____	21. (LO 8-3) *Neosporin Ophthalmic*	d. infections of the ear canal
_____	22. (LO 8-3) *Cerumenex*	e. iritis, uveitis, refraction during eye exam

Chapter 8 Case Studies

37. (LO 8-2) You have been assigned to teach a class on the prevention of hearing loss. What should you include? _____

38. (LO 8-3) A patient is getting triethanolamine polypeptide oleate-condensate (*Cerumenex*) for cerumen. The patient asks you what cerumen is. What should you tell her? What is its action? How should you administer the medication? What are the side effects you should tell the patient to watch for? _____

Critical Thinking

Select the disorder that best matches the patient description and write it in the blank.

cerumen external otitis glaucoma conjunctivitis

39. (LO 8-2) Jackie Palmer went swimming last week in a polluted stream and developed an infection in his right ear. _____

40. (LO 8-2) Mr. Brown comes to the physician's office complaining of a "hollow sensation" and decreased hearing. _____

41. (LO 8-2) Mr. Crane is having an operation to relieve increased intraocular pressure inside his eye. Without this surgery, he may become blind. _____

42. (LO 8-2) Juana, who is 5 years old, has an inflammation of the mucous membranes that line the back of the eyelids and the front of the eye except the cornea, referred to as "pink eye." _____

Chapter Reviews and calculation questions are included at the end of every chapter to offer more practice and assist students in becoming proficient at dosage calculations.

Orientation to Medications

In this chapter you will learn where drugs come from, how they are standardized, and how their use is governed by law. You will also learn how to use drug references and drug cards to gather information about medications.

Learning Outcomes

After studying this chapter, you should be able to:

1-1 Define terms to understanding the administration of medications.

1-2 List the major sources and uses of drugs.

1-3 Define *drug standards*, indicating how they are determined and why they are necessary.

1-4 List the names by which drugs are known.

1-5 List drug references, explain how to use at least one, and make a drug card.

1-6 List the major drug laws and their main features.

1-7 List the federal agencies that enforce drug laws and the importance of enforcing them.

Key Terms

action
adverse reaction
anatomy
brand name
chemical name
contraceptives
contraindications
controlled substances
diagnostic drugs
drug
generic name
indications
over-the-counter (OTC) drugs
palliative drugs
pathology
pharmacodynamics
pharmacokinetics
pharmacology
physiology
precautions
psychology
side effects
standards
synthetic drugs
therapeutic effect

DEFINITION OF TERMS [LO 1-1]

Not long ago, only doctors and nurses were allowed to administer medications. But times are changing; many other members of the health occupations are now asked to give or know about medications. They are also expected to observe how patients react after taking medications. These are important new responsibilities. They demand that you, a member of the healthcare team working with medications, also have knowledge of many health-related topics. You must know the basic principles of **pharmacology**, which is the study of drugs and their uses. You must understand how the body responds to drugs, or **pharmacodynamics**. You must also understand **pharmacokinetics**, the absorption, distribution, metabolism, and excretion of drugs. These areas require some knowledge of human **anatomy**, the study of body parts, and of **physiology**, the science that deals with the functions of cells, tissues, and organs of living organisms. You must understand the study of disease processes, including changes in the structure and function of the body, or **pathology**, and how drugs change the course of disease. You must also give attention to **psychology**, the study of the normal and abnormal processes of the mind, because a patient's mental state influences how the body reacts to drugs.

This textbook will teach you, step by step, the basics of pharmacology, pharmacodynamics, pharmacokinetics, anatomy, physiology, and pathology. You will also find suggestions for responding to patients' psychological needs, along with information you should tell patients about medications they may be taking. The uses of specific drugs for treatment of disease are discussed in connection with the body systems on which they act. As you learn general principles, most of you will also carry out practice tasks that give you experience in giving medications.

PHARMACOLOGY [LO 1-1]

A **drug** is a chemical substance used in the diagnosis, treatment, cure, or prevention of a disease. Pharmacology is the study of drugs: their uses, preparation, routes, and laws. Pharmacology includes the study of how drugs affect the human body. Healthcare professionals are particularly interested in the desired or predicted physiological response that a drug causes, or the drug's **therapeutic effect**.

Pharmacology attempts to describe a drug's desirable or undesirable effects apart from the primary reason for giving the drug. These are called **side effects**. Pharmacology also focuses on the proper amounts of drugs

to give and how to give them. Knowledge of the laws and responsibilities surrounding drug use, along with practical experience in giving medications, will prepare you to play a vital role on the healthcare team.

DRUG SOURCES [LO 1-2]

Drugs come from four sources: plants, animals, and minerals, as well as chemicals **(synthetic drugs)** by means of biotechnology or genetic engineering.

Our ancestors long ago discovered that the roots, leaves, and seeds of certain plants had the power to cure illnesses, ease pain, and affect the mind. Today many drugs are still extracted from parts of plants. An example is digitalis, a cardiac glycoside used to treat congestive heart failure. Digitalis is made from a wildflower, purple foxglove. Drugs from the poppy plant are morphine and codeine, which are potent analgesics. Other drugs of plant origin are gums and oils. An example of a gum is psyllium seed, which is a bulk-forming laxative. Castor oil from the castor bean acts as a stimulant laxative.

Drugs of animal origin are prepared by extracting natural substances, such as hormones, from animal tissues and organs. Insulin, for example, is extracted from the pancreases of cattle and pigs. Insulin is a valuable drug used to treat diabetes mellitus by lowering the blood glucose level. Heparin, used to reduce the formation of blood clots, is taken from the intestinal linings of cattle and pigs.

Iron, iodine, calcium, sodium chloride (salt), magnesium hydroxide (milk of magnesia), and magnesium sulfate (Epsom salts) are examples of minerals used in drug therapy. They are derived from rocks and crystals.

Many drugs are made, or synthesized, in the laboratory through chemical processes. Sulfonamide drugs such as *Bactrim* and *Septra,* for example, are frequently used in the treatment of urinary tract infections. An advantage of synthetic drugs is that they are generally less expensive than nonsynthetic drugs because they are produced in mass volume. Biotechnology and genetic engineering combine DNA material from different organisms, making new drugs and drug products available. Insulin and vaccines can be produced this way. Humulin® insulin is a genetically engineered drug used in the treatment of diabetes mellitus.

DRUG USES [LO 1-2]

The study of drug uses will give you an understanding of one phase of healthcare, drug therapy. The four most familiar uses of drugs relate to disease: prevention, treatment, diagnosis, and cure. Three types of drugs have other uses: **contraceptives**, used for the prevention of pregnancy; drugs to promote health maintenance; and palliative drugs.

Disease prevention involves the administration of drugs, such as vaccines, that inoculate the body against disease microorganisms. Health maintenance helps patients maintain or enhance their current levels of health. Drugs such as vitamins and minerals are given to help keep the body healthy and strong or to keep the body systems functioning normally.

Treating disease means relieving the symptoms while the body's natural disease-fighting mechanisms do their work. Aspirin and antihistamines are examples of drugs used to treat disease symptoms. An antihistamine such as *Benadryl* is an example of a drug used to treat allergy symptoms or motion sickness. Aspirin is used to treat fever and pain. Curing disease often means eliminating disease-causing microorganisms. Antibiotics such as erythromycin and penicillin are drugs given to cure a disease such as pneumonia.

Diagnostic drugs are considered drugs because they are chemical substances used to diagnose or monitor a patient's condition. A diagnostic

drug may have side effects and adverse reactions just like any other drug. For example, radiopaque dye (a contrast medium that shows up on fluoroscopes or x-rays) is administered to detect gallbladder malfunctions. A radiopaque dye such as iodine may cause anaphylaxis, an immediate, severe, and frequently fatal reaction, in a patient previously sensitized to the chemical (iodine). It is therefore important to ask patients if they have a shellfish allergy, which indicates a predisposition to an iodine allergy.

The prevention of pregnancy is possible with the use of contraceptives, drugs that control fertility.

Drugs often have more than one use. The drug promethazine hydrochloride (*Phenergan*), for example, is used in a variety of ways. It can control allergic reactions, treat motion sickness, induce sleep, and prevent vomiting after surgery. Some drugs have the ability to prevent as well as cure or treat disease.

Palliative drugs are used to improve the quality of life but not cure or treat the disease. They are generally used in terminal illness such as cancer. Most frequently analgesics are used for pain management in these illnesses. Hospice has been instrumental in helping healthcare professionals realize that opioid dosing frequently exceeds the dose used in other conditions or surgery.

DRUG STANDARDS [LO 1-3]

Drugs differ widely in strength, quality, and purity, depending on how they are manufactured. To control these differences, certain rules or **standards** have been set up that products must meet. Drug standards are required by law. The law states that all preparations called by the same drug name must be of a uniform strength, quality, and purity. A drug prepared in Indiana must meet the same standards for strength, quality, and purity as the same drug prepared in California or New Jersey. Because of drug standards, physicians who order penicillin, for example, can be sure that patients anywhere in the country will get the same basic substance from the pharmacist. Drug standards also help doctors prescribe accurate dosages and predict the results.

Drugs for which standards have been developed are listed in a special reference book called the *United States Pharmacopeia/National Formulary (USP/NF).* The *USP/NF* is recognized by the U.S. government as the official list of drug standards, which are enforceable by the U.S. Food and Drug Administration.

Since 1975, USP has engaged in a program to include all drug substances and, to the extent possible, all drug products in the United States. The book is updated regularly, and a new edition is published every five years to keep the information up to date.

DRUG NAMES [LO 1-4]

All drugs have more than one name. In fact, most have four: a chemical name, a generic name, an official name, and one or more brand or trade names.

The **chemical name** describes the chemical composition and molecular structure of the drug. Acetylsalicylic acid is an example of a chemical name.

The **generic name** is the official nonproprietary name assigned by the manufacturer with the approval of the United States Adopted Names (USAN) Council. The generic name is simpler than the chemical name. For example, aspirin is the generic name for acetylsalicylic acid.

The official name is usually the same as the generic name.

Also known as the trade or proprietary name, the **brand name** is the name under which the drug is sold by a specific manufacturer. The name is owned by the drug company, and no other company may use it. The symbol® to the right of the name shows that its use is restricted. A drug that is manufactured

Table 1.1 Five Top Generic- versus Brand-Name Drugs (with Pronunciation and Classification)

Generic Name	Brand Name	Classification
paroxetine hydrochloride (pah-rox-eh-teen high-droh-klor-eyed)	Paxil	Antidepressant (selective serotonin reuptake inhibitor)
escitlopram oxalate (eh-sye-tal-oh-pram ahk-se-layt)	Lexapro	Antidepressant (selective serotonin reuptake inhibitor)
hydrocodone bitartrate with acetaminophen (high-droh-koh-dohn bye-tar-trayt with ah-set-ah-min-oh-fen)	Vicodin	Narcotic analgesic
alprazolam (al-prayz-oh-lam)	Xanax	Antianxiety
tramadol hydrochloride (tram-ah-dol high-droh-klor-eyed)	Ultram	Analgesic

by several companies may be known by several different brand names. For example, the drug with the generic name nitroglycerin is sold by several manufacturers under such brand names as *Nitro-Bid, Nitrong,* and *Nitrostat. Bufferin* is an example of a brand, proprietary, or trade name for aspirin.

Brand-Name Drugs versus Generic-Name Drugs

Most drugs are known to the general public by their brand names. *Dimetane* and *Dimetapp* are much more familiar-sounding to someone who is not in the profession than is the name brompheniramine. But you and your fellow health workers must be familiar with both the brand and generic names of many drugs. First, a physician may prescribe a drug by a generic name or a brand name. Because several brand names may exist for the same ingredient, such as acetaminophen, physicians are encouraged to order drugs by their generic names. In fact, state and federal governments now permit, encourage, and in some cases mandate that the consumer be given the generic form when buying prescription drugs. Another reason for using generic names is that doing so avoids confusion among similar brand names. A prescription written for a generic product allows the pharmacist to choose among nonbranded drugs available from several companies. Generic drugs are therapeutically equivalent to and much cheaper than brand-name drugs.

Another reason for knowing the generic name is that drugs often have several brand names but only one generic name. If you learn the generic names, you can organize information about several brand-name drugs in your mind. Of course, it is not possible to memorize all the generic and brand names for medications, but you should try to become familiar with both names of the drugs you handle daily in your work.

Where this book mentions specific drugs, generic names are given first and are not capitalized. Brand names are capitalized, italicized, and shown in parentheses following the generic names. Only one or two common brand names are given in each case. Keep in mind that many other brand-name products may be available. Refer to Table 1.1 for the top five selling generic- and brand-name drugs with pronunciation and classification.

DRUG REFERENCES [LO 1-5]

Several reference books or computer websites provide useful information about drugs on the market. Doctors, nurses, and others in the health occupations often refer to them when planning and administering drug

Table 1.2 Information in a Drug Reference

- *Description*—what the drug is made of.
- *Action*—how the drug works.
- *Indications*—what conditions the drug is used for.
- *Interactions*—undesirable effects produced when drugs are taken with certain foods or with other drugs.
- *Contraindications*—conditions under which the drug should not be used.
- *Precautions*—specific warnings to consider when administering drugs to patients with specific conditions or diseases.
- *Side effects/adverse reactions*—unintended and undesirable effects.
- *Dosage and administration*—correct dose for each possible route of administration.
- *How supplied*—how the drug is packaged and stored.
- *Nursing implications*—medication education to be given and care provided.

therapy. Drug references can help you understand why and how a particular drug is administered. For each drug, see Table 1.2 for the information included in each drug reference.

Computer websites are rapidly becoming the most popular way to check information on drugs. Websites include:

- www.rxlist.com
- www.fda.gov
- www.safemedication.com
- www.drugdigest.com

Learning how to use the drug references will help you meet the new responsibilities of health workers in administering medications.

A common reference book is the *Physicians' Desk Reference (PDR®),* which is available in many health facilities. The *PDR®* gives information about the drug products of major pharmaceutical companies. It is useful for checking the description, clinical pharmacology, mechanism of **action**, **indications**, **contraindications**, warnings, **precautions**, **adverse reactions**, overdosage, dosage and administration, and how the product is supplied.

The *United States Pharmacopeia Dispensing Information (USPDI)* is another drug reference, first published in 1980 in three volumes. It provides pharmacists and other healthcare workers with easy-to-follow information about official drugs and products. You will find Volume II useful, as this volume is written in nontechnical language that is easy for patients to understand. It is called *Advice for the Patient.* Volume III is the "Orange Book," *Approved Drug Products and Legal Requirements.* This volume includes state and federal requirements for prescribing and dispensing drugs. These volumes are updated each month in the *USPDI Update.*

Another valuable reference is the *Handbook of Nonprescription Drugs,* published by the American Pharmaceutical Association. It deals with over-the-counter information in general categories. Pharmacology textbooks and articles in nursing and other professional journals are also helpful sources of information. Some healthcare facilities keep their own reference lists of the drugs they use most often.

Another reference is the *American Hospital Formulary Service (AHFS) Information Book.* It contains an objective overview, in outline form, of almost every drug available in the United States. This book is updated yearly, and information is easily located with just one index at the back of the book.

In addition, there are many Nursing Drug Reference books on the market, many available as convenient handbooks. These nursing drug books similarly

cover the action, uses, dose and route, adverse effects, contraindications, and precautions of the drug but also focus on nursing considerations, interventions, and patient teaching. Many individuals who are administering medications find it extremely helpful to have the nursing interventions listed, such as monitoring a temperature, measuring intake and output, or encouraging the patient to drink fluids.

No one text is a complete source for all the drug information necessary for the administering of medications. Therefore, it is important that you gather information from the various sources and select the drug reference source that you feel best meets your needs when you administer medications and provide patient and family teaching about those medications.

Understanding and Using the PDR®

The current edition of the *Physicians' Desk Reference (PDR®)* contains five sections that are color-coded and contain specific information. The first section is the Manufacturers' Index and is printed on gray pages. This section lists all the pharmaceutical manufacturers that participate in the *PDR®*. Participating manufacturers provide their addresses and phone numbers and show their products along with their corresponding page numbers. The second section is the Brand and Generic Name Index, which is printed on white pages and lists drugs by both their brand and generic names and the page numbers they are listed on. Section three is the Product Category Index, which is printed on gray pages and lists the products by prescribing category. The Product Identification Guide comprises section four. This section provides color photos of the actual size of drugs arranged alphabetically by the manufacturer. These color photos will help you easily identify drugs.

Section five contains Product Information and is also printed on white pages. In this section, you will find detailed information on each drug such as the brand and generic name, description, clinical pharmacology, indications, contraindications, warnings, precautions, adverse reactions, dosage and administration, and lastly how supplied. The "description" of the drug lists its origin and chemical composition. The "clinical pharmacology" states the effect a drug has on the body and the process by which the drug produces this effect. The diseases or conditions for which a drug is given are listed in the "indications and usage" section. The reasons a specific drug should not be given are included in the "contraindications" section. The potential dangers of a drug are listed under the drug "warnings." The "precautions" state possible undesirable effects a drug may have. Side effects of a drug are listed under "adverse reactions." Under "dosage and administration," you will learn the usual amount of a drug to be given to adults and children and the recommended times for administration. The possible drug forms and their dosages are included in the "how supplied" section.

After understanding the various sections of the *PDR®,* you will be able to look up information on any drug. For example, if the drug you want to give is *Tylenol,* look it up in the white pages or section two (Brand and Generic Name Index). The phonetic spelling is given for the brand name along with the generic name (acetaminophen). The route of administration, such as "for oral use," is also listed. Generally, the manufacturer's name appears in parentheses after the drug name, followed by one or two page numbers. The first page number refers to the Product Identification page number, which provides an actual-size color photo of the drug. The second page number refers to the Product Information page number, which provides all prescribing information.

You may also look for a specific drug by knowing its classification. The blue pages, or Product Category Index, provide the prescribing category. For example, look up antibiotics and you will find a variety of antibiotics such as penicillin.

Other features in the *PDR*® include a list of poison control centers, U.S. Food and Drug Administration agencies, drug information centers, and herb–drug interactions.

Now that you have learned the various sections of the *PDR*® and how to look up drug information, you have all of the information needed to safely administer a drug to your patient.

Coping with Technical Language

A problem with many drug references is that they are written in complex language. They use medical terms that may be unfamiliar, especially to new students. The descriptions of drugs assume that the reader has a background in anatomy, physiology, diseases, and pharmacology.

An important aim of this book is to help you learn enough about anatomy, physiology, diseases, and pharmacology to understand what you find in different drug references. You will learn important technical terms, basic principles to help you understand how drugs work, and basic information about various diseases to understand why a particular drug is prescribed.

Coping with Changing Information

Information about drugs is constantly changing. New drugs appear all the time, and old drugs are taken off the market. Drug research turns up better ways of using drugs and administering them. Belimumab (*Benlysta*), approved by the FDA in 2011, is the first drug approved to treat systemic lupus erythematosus since 1955. Propoxyphene HCL *(Darvon)* was recently taken off the market as an analgesic. This means that drug references quickly can become outdated. Some reference publishers such as the *PDR*® send out regular supplements with information updates. These updates should be checked along with the drug reference. Another place to look for current information on drug administration is package inserts. These are printed sheets of information inside the boxes in which drugs are packaged. Package inserts contain the same information that is provided in the *PDR*®.

This text will help you cope with changing information on drugs. After studying the various chapters, you will know general principles about groups or classifications of drugs. Any new information that becomes available should then fit easily into your general understanding of drugs.

PREPARING YOUR OWN DRUG CARDS [LO 1-5]

Because there are so many drugs and so much information exists about them, no one can expect to keep all of the important facts constantly in mind. Although drug cards can be purchased from college or local bookstores, many health workers in a variety of settings and students find it useful to prepare 5 × 7 index cards containing information about the drugs they use most often in their work. Some students may also prefer to develop a drug file or cards on the computer. Drug cards save time because healthcare workers can find the information more quickly in their card files than in a huge drug reference. Of course, the information on the cards must be updated regularly to remain current. Drug cards can be designed according to your own needs whether they are done on cards or on the computer. They should include this information:

Drug name, both generic and brand.

Drug classification, or the group a drug belongs to, such as analgesics (pain relievers), antipyretics (fever reducers), antacids, laxatives, and so on (you will learn the basic drug classifications in later chapters).

Forms in which the drug is available (tablets, capsules, etc.).

Action, or how the drug interacts with the organs or systems that it is supposed to affect.

Uses of the drug.

Side effects and adverse reactions.

Drug interactions.

Signs of drug poisoning (toxicity).

Route of administration.

Dosage range and usual adult dose.

Special instructions for giving the medication, including the interventions required (for example, what to tell the patient about expected side effects, precautions, etc.).

A note on where you got your information (specific drug reference, package insert, etc.).

A sample drug card is shown in Figure 1.1. Beginning with Chapter 6, you will find tables at the ends of chapters listing representative drugs in the major drug categories. These tables can serve as a guide for what to include on your drug cards or drug file. As you study the drugs in Chapters 6 through 19, make a habit of preparing drug cards or a drug file for the medications you expect to be giving in your health facility.

Figure 1.1
Sample drug card.

Drug
Acetaminophen (*Tylenol*).

Action
Blockade of prostaglandin stimulation of the central nervous system. Increases peripheral blood flow and sweating.

Uses
Fever reduction, temporary relief of mild or moderate pain.

Doses
Adults and teenagers 325–500 mg oral every 3–4 hours, 650 mg oral every 4–6 hours, 1000 mg oral every 6 hours as needed.

Side Effects
Yellow eyes or skin (rare); bloody or black stools; pain in side and lower back; skin rash, hives, or itching; sores, ulcers, or white spots on the lips or mouth; sore throat; sudden decrease in the amount of urine; unusual bleeding or bruising; unusual tiredness or weakness.

Drug Interactions
Barbiturates, carbamazepine (*Tegretol*), hydantoins, rifampin (*Rifadin*), and sulfinpyrazone may reduce the therapeutic effects and increase the hepatotoxic effects of acetaminophen. Caffeine may increase the analgesic effect of acetaminophen.

Nursing Implications
Instruct patient not to exceed 4 g daily; monitor for acute signs of liver toxicity such as yellow discoloration of skin and eyes, dark urine, itching, and clay-colored stools.

DRUG LEGISLATION [LO 1-6]

The U.S. government regulates the composition, uses, names, labeling, and testing of drugs. Since the early 1900s, many laws have been passed to enforce the official drug standards and to protect the public from unreliable and unsafe drugs. Federal agencies have been set up to see that these laws are followed. Table 1.3 lists the major drug laws and their enforcing agencies.

The first law, the Pure Food and Drug Act, was passed in 1906. This law states that only drugs listed in the *USP/NF* may be prescribed and sold, because these

Table 1.3 Major Drug Laws

Legislative Act	Enforcement Agency
Pure Food and Drug Act of 1906 Approves *USP/NF* and requires that drugs meet official standards Requires labeling of medicines containing morphine and other narcotics Amendment of 1912 prohibits making false claims about health benefits of a drug	**None**
Food, Drug, and Cosmetic Act (FDCA) of 1938 (replaced the 1906 act) Regulates content and sale of drugs and cosmetics Requires accurate labeling and warnings against unsafe use Requires government review of safety studies before selling new drugs Amendment of 1952 allows certain drugs to be dispensed by prescription only and refilled only on a doctor's order; also recognizes OTC drugs as drugs that do not require a prescription Amendment of 1962 requires proof of effectiveness and safety before marketing new drugs and full information on advantages, side effects, contraindications Certain drugs must carry a warning label indicating possible side effects or if drug may be habit-forming Certain drugs must carry the label "Caution: Federal law prohibits dispensing without a prescription."	**Food and Drug Administration (FDA)** Under Department of Health and Human Services Can investigate manufacturers, withdraw approval of drugs, control shipment and testing Enforces FDCA by prosecuting offending firms and seizing goods Drug manufacturers must register with FDA and report to FDA all adverse reactions resulting from use of their products Reviews studies of safety and effectiveness of new drugs
Drug Regulation and Reform Act of 1978 Permits briefer investigation of new drugs, allowing consumers earlier access	**FDA**
Orphan Drug Act of 1983 Speeds up drugs' availability for patients with rare diseases	**FDA**
Drug Price Competition and Patent Term Restoration Act of 1984 Permits generic drug companies to prove bioequivalence without duplicating costly clinical trials done by original drug manufacturer Gives longer patent protection for new drugs	**FDA**
AIDS Test for Blood of 1985 Approves the first enzyme-linked immunosorbent assay (ELISA) test kit to screen for antibodies to HIV Protects patients from infected donors	**FDA**
Childhood Vaccine Act of 1986 Requires patient information on vaccines Gives the FDA permission to make necessary recalls	**FDA**

Table 1.3 *(concluded)*

Legislative Act	Enforcement Agency
Controlled Substances Act of 1990 (original 1970) Identifies and regulates manufacture and sale of narcotics and dangerous drugs Provides research into drug abuse, prevention, and dependence Provides funding for education on drug abuse, rehabilitation, and law enforcement Classifies drugs into Schedules I–V according to medical usefulness and possible abuse (Table 1.4)	**Drug Enforcement Administration (DEA)** Under Department of Justice May punish violators by fines, imprisonment, or both
Nutrition Facts of 1992 Requires basic-serving nutritional information on the nutrition label of most prepackaged food	**United States Department of Agriculture (USDA)**
Nutrition Facts of 2003 Includes trans-fat content in food on the nutrition label	**USDA**
Food Allergen Labeling and Consumer Protection Act of 2004 Requires labeling food if it contains a protein from common allergy-causing foods, such as peanuts, soybeans, cow's milk, eggs, fish, crustacean shellfish, nuts, and wheat	**FDA**
Patriot Improvement and Reauthorization Act of 2005 (Combat Meth Act) Restricts the sale of over-the-counter products containing pseudoephedrine and ephedrine Makes these products available only by purchase through a pharmacy	**Congress**

drugs meet the required standards. Various amendments to this act regulate prescriptions, require testing of new drugs, and call for complete information about drug effects and dangers. The Food, Drug, and Cosmetic Act (FDCA) of 1938, which replaced the 1906 act, spells out additional regulations concerning purity, strength, effectiveness, safety, labeling, and packaging of drugs. It also states that the federal government must review safety studies on new drugs before they can be put on the market. This provision was added after more than 100 deaths resulted from a poorly tested and mislabeled sulfanilamide product. This solution had been marketed as an "elixir" without investigating its toxicity. The FDCA is enforced by the Food and Drug Administration (FDA). Since 1962, the FDA has required proof that new drugs are effective as well as safe.

Another important law is the Controlled Substances Act of 1990 (original 1970), also known as the Comprehensive Drug Abuse Prevention and Control Act. It identifies the drugs that are dangerous or subject to abuse, such as narcotics, depressants, and stimulants. This law strictly regulates the manufacture and distribution of controlled substances. It clearly stipulates that possession of a controlled substance is unlawful without a prescription. This law provides research into preventing drug abuse and drug dependence. It also provides for treatment and rehabilitation of drug abusers. It further improves the administration and regulation of the manufacture, distribution, and dispensing of controlled substances.

Controlled substances are grouped into five categories, or schedules, each with its particular restrictions, as shown in Table 1.4. There is a Schedule VI in some states. Drugs with the highest abuse potential are placed in Schedule I.

Table 1.4 Drug Classifications under the Controlled Substances Act of 1990 (Original 1970)

Drugs	Characteristics	Examples
Schedule I drugs	High potential for abuse, severe physical and psychological dependence No accepted medical use To be used for research only Not to be prescribed; unsafe in treatment	Alfentanil, fenethylline, hashish, heroin, lysergic acid diethylamide (LSD), marijuana, methaqualone (*Quaalude*), peyote, psilocybin
Schedule II drugs	High potential for abuse, severe physical and psychological dependence Acceptable medical uses, with restrictions Dispensed by prescription only No refills without new written prescription from physician	Amphetamines, cocaine, meperidine HCl (*Demerol*), methadone, methylphenidate hydrochloride (*Ritalin*), morphine, opium, pentobarbital (*Nembutal*), anabolic steroids, hydromorphone hydrochloride (*Dilaudid*)
Schedule III drugs	Moderate potential for abuse, high psychological dependence, low physical dependence Acceptable medical uses By prescription only; may be refilled five times in 6 months if authorized by physician	Barbiturates, butabarbital (*Butisol*), glutethimide (*Doriden*), secobarbital (*Seconal*), *Tylenol* with codeine, *Vicodin*
Schedule IV drugs	Lower potential for abuse than Schedule III drugs; limited psychological and physical dependence Acceptable medical uses By prescription only; may be refilled five times in 6 months if authorized by physician	Chloral hydrate (*Noctec*), chlordiazepoxide (*Librium*), diazepam (*Valium*), flurazepam HCl (*Dalmane*), oxazepam (*Serax*), phenobarbital, lorazepam (*Ativan*), meprobamate (*Equanil*), pentazocine HCl (*Talwin*), alprazolam (*Xanax*)
Schedule V drugs	Low potential for abuse Acceptable medical uses OTC narcotic drugs, but sold only by registered pharmacists; buyer must be 18 years and show ID	Cough syrups with codeine, e.g., guaifenesin (*Naldecon DX*) and *Cheracol* with codeine, diphenoxylate HCl with atropine sulfate (*Lomotil*[a]), *Novahistine* expectorant, *Parepectolin*
Schedule VI drugs	Some states such as North Carolina have adopted a Schedule VI	Marijuana is the only drug in this schedule; it has limited medicinal use by prescription in certain situations

[a] *Requires a prescription.*

Source: DEA, U.S. Department of Justice. Check with your local DEA office for current regulations.

They have no accepted medical use in the United States. Drugs with the lowest abuse potential are placed in Schedule V. You need to be aware that these classifications are flexible. Occasionally, drugs may be added to a schedule or changed from one schedule to another without new legislation. A record is kept of each time a controlled substance is sold and of the amount. There are restrictions on how prescriptions can be refilled. All prescriptions must be signed in ink or sent electronically. Oral emergency orders for Schedule II substances may be filled, but the physician must provide a written prescription within 72 hours.

Pharmacists must carefully follow the rules outlined in the Controlled Substances Act. Violation of the law is punishable by fine or imprisonment or both. The agency that enforces this act is the Drug Enforcement Administration (DEA).

Table 1.5 Drug Categories

- **Controlled substances.** These are drugs that have special restrictions as to who can prescribe and sell them and how often they can be prescribed.
  Example: Narcotic
- **Over-the-counter (OTC) drugs.** These can be bought and sold without a prescription.
  Example: Aspirin
- **Prescription drugs.** These drugs are also called legend drugs. These are drugs that require a doctor's prescription (either oral or written) to be bought and sold.
  Example: Lipitor

Caution Drug Warning

The FDA voluntarily asked manufacturers of prescription acetaminophen to discontinue making the 500-mg dose and make only the 325-mg dose. The rationale is that it will decrease the incidence of liver disease, liver transplantation, and even death.

Prescribers must also follow the law in prescribing controlled substances. They need a special license from the DEA for each office from which they practice and must inform the DEA of any changes in employment. They are given one tax stamp and number for each license. This number, called the DEA number, must be shown on any prescription for controlled substances.

To keep a supply of controlled substances in an office or a health facility, the staff must fill out special order forms and records. These forms show how many controlled substances are being kept at the facility, as well as who received doses of the drugs and how unused doses were disposed of. A physical inventory of all controlled substances in the office must be made every two years. (You will learn about these forms in Chapter 5.) See Table 1.5 for categories of drugs.

YOU AND THE LAW [LO 1-7]

As a member of the healthcare team, you are responsible for knowing the laws controlling drug use and the names of the regulatory agencies, such as the Federal Trade Commission (FTC) and the Consumer Product Safety Commission. The latter commission enforces the Poison Prevention Packaging Act (PPPA), which mandates "childproof" drug packaging. Claiming ignorance of the law will not stand up in court if you are ever accused of irresponsible handling and administration of drugs.

How can you be sure you understand the law? As a first step, study carefully Tables 1.3 and 1.4. These tables summarize a great deal of information about federal drug laws. Be aware that the specific drugs under each schedule in the Controlled Substances Act may change. Your health facility will have an up-to-date list of controlled substances from the DEA. Get copies of federal drug laws from the library or from the FDA.

As a next step, study the laws of your state. State laws regulate such things as who may give medications, what kinds of training and supervision are required, who may keep the records, and who may take prescriptions over the phone.

Your own health agency will also have regulations for you to follow. There will be special rules, for example, if your agency receives Medicaid or Medicare funds. You should also be aware of the lines of authority in your agency—in other words, who is in charge of what and who supervises whom. You will then be able to go to the right person when you have a legal question about giving a certain drug.

Knowing the law helps protect you from errors and possible lawsuits. But there is a more important benefit—the safety of your patient. By showing your awareness of drug laws, you help educate your patients. You also gain their cooperation in following the law. Drug laws are designed to protect the public. Members of the public depend on your example and your support.

Healthcare for Today and Tomorrow — Lower-Cost Drug Issues

With the soaring cost of prescription medications and with more and more people having computers and Internet capabilities, patients are searching the Internet to obtain their medications at a lower cost. However, some drug-dispensing websites are not legitimate and may even sell contaminated products, incorrect doses, or nothing at all. The Food and Drug Administration (FDA) suggests checking with the National Association of Boards of Pharmacy to safeguard drug purchases on the web. You can also go to Internet Pharmacy (www.preNAPLEX.com) and click on Accreditation Programs and then VIPPS to find a VIPPS-certified pharmacy. You should advise patients to avoid sites that do not provide a company name, address, and phone number. Encourage your patients to always talk to their healthcare professional before using any medication for the first time.

Legal and Ethical Issues — Substituting Drugs

Although the physician or prescriber retains the prerogative to require the dispensing of a particular brand-name drug, every state has a drug substitution law that either mandates or may permit a drug substitution by the pharmacist. The prescriber may give permission to substitute the drug ordered by either checking the "may substitute" box or writing "may substitute" on the prescription. If the prescriber has an objection to a drug substitution, the prescriber will write "do not substitute" or "dispense as written." Some states have a mandatory substitution law to dispense a less expensive drug, and the prescriber must write "medically necessary" to ensure that the more costly brand-name drug is dispensed. Because you care for patients and hand them prescriptions, you need to be informed on the laws for drug substitution.

Summary

Learning Outcome	Summary Points
1.1 Define terms to understanding the administration of medications.	• *Pharmacology* is the study of drugs and their uses. • *Pharmacodynamics* is the study of how the body responds to drugs. • *Pharmacokinetics* is the absorption, distribution, metabolism, and excretion of drugs. • *Anatomy* is the study of body parts. • *Physiology* is the science that deals with the function of cells, tissues, and organs of living organisms. • *Pathology* is the study of how drugs change the course of disease. • A *drug* is a chemical substance used in the diagnosis, treatment, cure, or prevention of a disease. • A *therapeutic effect* is the desired or predicted physiological response the drug causes. • *Side effects* are a drug's desirable or undesirable effects apart from the primary reason for giving the drug.
1.2 List the major sources and uses of drugs.	• The major drug sources are plants, animals, minerals, and chemicals, or synthesized drugs. An example of a plant source is the wildflower purple foxglove, from which digitalis is made. Insulin is extracted from an animal source, cattle and pigs. Sodium chloride is derived from a mineral drug source, rocks. *Bactrim* and *Septra* are synthetic drugs made from chemical sources. • Prevention, treatment, diagnosis, cure, contraceptive, health maintenance, and palliative are the seven uses of drugs.
1.3 Define *drug standards,* indicating how they are determined and why they are necessary.	• Drug standards are certain rules that products must meet. Drug standards are required by law. • The law states that all preparations called by the same drug name must be of uniform strength, quality, and purity. • Drug standards are necessary because drugs differ in strength, quality, and purity. All preparations called by the same drug name must be of uniform strength, quality, and purity.
1.4 List the names by which drugs are known.	• The *chemical name* describes the chemical composition and molecular structure of the drug. • The *generic name* is the official, nonproprietary name assigned by the drug manufacturer with the approval of the United States Adopted Names (USAN) Council. • The *official name* is usually the same as the generic name. • The *brand* or *trade name,* also known as the *proprietary name,* is the name under which the drug is sold by a specific manufacturer.

Learning Outcome	Summary Points
1.5 List drug references, explain how to use at least one, and make a drug card.	• *Physicians' Desk Reference (PDR®)* • *United States Pharmacopeia Dispensing Information (USPDI)* • *Handbook of Nonprescription Drugs* • Many of these drug references contain the drug description along with the action, indication, interactions, contraindications, precautions, side effects/adverse reactions, dosage, and administration, as well as how they are supplied. Look at the designated area for the specific information needed (e.g., Dosage). • The drug name, classification, action, use, dose, interactions, and side effects should be included on the drug card.
1.6 List the major drug laws and their main features.	• Orphan Drug Act of 1983, which speeds up drugs' availability for patients with rare diseases • Nutrition Facts of 1992, which requires that nutritional information be on the nutrition label of packages of food • Drug Regulation and Reform Act of 1978, which permits a briefer investigation of new drugs
1.7 List the federal agencies that enforce drug laws and the importance of enforcing them.	• Food and Drug Administration (FDA) • Drug Enforcement Administration (DEA) • Knowing the laws helps health workers protect themselves from errors and possible lawsuits, provide patient education, and enhance patient safety.

Chapter 1 Review

Define each of the terms listed below.

1. (LO 1-1) Drug _____

2. (LO 1-1) Pharmacology _____

3. (LO 1-1) Anatomy _____

4. (LO 1-1) Physiology _____

5. (LO 1-3) Drug standards _____

6. (LO 1-5) *PDR*® _____

7. (LO 1-3) *USP/NF* _____

8. (LO 1-7) Congress _____

9. (LO 1-1) Pharmacokinetics _____

Answer the following questions in the spaces provided.

10. (LO 1-2) Name four sources of drugs, and give an example of a drug that comes from each source.

Source	Example

11. (LO 1-2) Name the seven therapeutic uses of drugs. Give examples.

Use	Example

12. (LO 1-6) Name the three major drug laws and the agencies that enforce them.

Law and Date	Enforcing Agency

13. (LO 1-7) Differentiate between these legal classifications for drugs.

OTC drugs _____

_____

_____

_____

Prescription drugs _____

_____

_____

_____

Controlled substances _____

_____

_____

_____

From Column 2, select the term or phrase that best matches each item in Column 1.

	Column 1	Column 2
_____	14. (LO 1-2) Chemical name	a. *Bufferin*
_____	15. (LO 1-4) Generic name	b. aspirin
_____	16. (LO 1-4) Brand name	c. acetylsalicylic acid
_____	17. (LO 1-5) *PDR*®	d. contains information about drug products provided by pharmaceutical companies
_____	18. (LO 1-4) USAN	e. same as generic name
_____	19. (LO 1-4) Official name	f. system that adopts generic names

Match the drugs to their schedules or classes as spelled out in the Controlled Substances Act of 1990 (original 1970) (LO 1-7).

	Schedule	Drugs
_____	20. I	a. *Seconal, Doriden, Tylenol* with codeine
_____	21. II	b. opium, morphine, *Demerol,* amphetamines, *Dilaudid*
_____	22. III	c. cough syrup with codeine, *Lomotil, Novahistine* expectorant
_____	23. IV	d. *Librium, Valium,* phenobarbital, *Noctec, Dalmane*
_____	24. V	e. heroin, hashish, LSD, peyote, alfentanil

Multiple Choice—Circle the correct letter.

25. (LO 1-6) Which of the following major drug laws speeds up drugs' availability for patients with rare diseases?
    a. Drug Regulation and Reform Act of 1978
    b. Orphan Drug Act of 1983
    c. Pure Food and Drug Act of 1906
    d. Food, Drug, and Cosmetic Act (FDCA) of 1938

26. (LO 1-5) What information is covered in a drug reference book?
    a. Type of doctors who can prescribe the drug
    b. Interactions with the drug
    c. Which healthcare workers can administer the drug
    d. Color of the drug

27. (LO 1-2) What are two uses of drugs?
    a. Produce side effects and adverse reactions
    b. Change the genetic and chemical makeup of the body
    c. Prevent and treat disease
    d. Test the knowledge and skill of the healthcare worker

28. (LO 1-3) Who requires the use of drug standards?
    a. Hospitals
    b. Patients
    c. Physicians
    d. The law

29. (LO 1-4) Which of the following drugs is listed by a generic name?
    a. Acetylsalicylic acid
    b. Bufferin
    c. Nitro-Bid
    d. Nitrostat

Chapter 1 Case Studies

30. You want to understand the sources of drugs before you administer them. What are the four sources of drugs? Your patient has been prescribed *Metamucil,* digitalis, insulin, *Bactrim,* and iron. What are these drugs, and what are their sources? _____

31. Nitroglycerin is prescribed by the healthcare provider, and *Nitrostat* was dispensed by the pharmacy. The patient tells you he is confused and wants to know what the difference means. What should you tell him? _____

Critical Thinking

Respond to the following questions in the spaces provided.

32. (LO 1-7) Janie has just been hired for a new job in a nursing home. She wants to make sure that she knows what she is and is not allowed to do with regard to giving medications. What advice would you give her?

_____

_____

_____

33. (LO 1-7) Why do we have drug standards and drug laws?

_____

_____

_____

Applications

Obtain a current copy of the *PDR*® and a medical dictionary from your school, nursing unit, or clinic. Use them to answer the questions that follow.

34. You are giving Mr. Jones regular-strength *Tylenol* every few hours after surgery. You would like to know something more about the drug, so you consult the *PDR*®. *Tylenol* is a brand or trade name. Find the section in the *PDR*® that lists drugs alphabetically by brand names. What color are the pages?

_____

35. Look up *Tylenol* in the section you turned to in question 34. How many different forms of *Tylenol* are listed there? _____ Is there a small diamond to the left of any *Tylenol* form? If so, the diamond means there is a photograph of the drug in the Product Identification section. Find the photograph.

36. Using the page number given for *Tylenol* tablets, look them up in the Product Information section. The generic name is listed just after the word *Tylenol.* What is it? _____

You may want to do the next activity as a collaborative learning activity. Each student should gather all drug information from a different drug reference; then students meet collaboratively and compare and contrast information.

37. You have an order to give Mrs. Lopez her daily *Cardizem* and to provide her with the education necessary for her to begin taking this medication at home. Consulting the various drug reference sources available to you, compare and contrast the advantages and disadvantages of these resources; discuss clinical situations for which each source might be the best one to consult.