

SECOND EDITION

# Pharmacology for Nurses

Blaine Templar Smith

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JONES & BARTLETT  
LEARNING

# Pharmacology for Nurses

## The Pedagogy

*Pharmacology for Nurses* drives comprehension through various strategies that meet the learning needs of students while also generating enthusiasm about the topic. This interactive approach addresses different learning styles, making this the ideal text to ensure mastery of key concepts. The pedagogical aids that appear in most chapters include the following:

**CHAPTER 4**

## Central Nervous System Drugs

Dion M. Mayes-Burnett

**KEY TERMS**

|                              |                                |   |                                 |
|------------------------------|--------------------------------|---|---------------------------------|
| Acetylcholine                | Dendrites                      | Narcotic                                      | Parkinson's disease             |
| Afferent                     | Dopamine                       | Nerve processes                               | Peripheral nervous system (PNS) |
| Alzheimer disease            | Efferent                       | Neurodegeneration                             | Pons                            |
| Analgesics                   | Epilepsy                       | Neuromuscular blockers                        | Prostaglandin                   |
| Anesthetic                   | Forebrain                      | Neurons                                       | Salicylates                     |
| Antispasmodics               | Gamma-aminobutyric acid (GABA) | <i>N</i> -methyl-D-aspartate (NMDA)           | Somatic nervous system          |
| Autonomic nervous system     | Glutamate                      | Noiceptive                                    | Spasmolytics                    |
| Axons                        | Hindbrain                      | Noncompetitive antagonist                     | Spasticity                      |
| Brain stem                   | Hypothalamus                   | Nonsteroidal anti-inflammatory drugs (NSAIDs) | Spinal column                   |
| Central nervous system (CNS) | Medulla oblongata              | Opioids                                       | Spinal cord                     |
| Cerebellum                   | Midbrain                       | Parasympathetic nervous system                | Sympathetic nervous system      |
| Cerebrum                     | Muscle relaxant                |   | Thalamus                        |
| COX-2 inhibitors             | Muscle spasm                   |   |                                 |
| Cyclooxygenase (COX)         |                                |   |                                 |

**CHAPTER OBJECTIVES**

At the end of the chapter, the reader will be able to:

1. List the key components that make up the central nervous system (CNS).
2. Describe the function of the CNS.
3. Identify common disorders and diseases of the CNS.
4. List four primary symptoms of Parkinson's disease, Alzheimer disease, and amyotrophic lateral sclerosis.
5. Discuss five myths associated with chronic pain.
6. List three complications associated with narcotic administration.
7. Identify the major drug classes used to treat CNS disorders.
8. Describe the indication and mechanism of action for each of the drug classes used to treat CNS disorders.
9. Discuss the long-term effects of chronic acetaminophen therapy.
10. Describe symptoms of overdose for each class of CNS drug.
11. Explain how each CNS drug acts to alleviate or eliminate symptoms.

## Key Terms

Found in a list at the beginning of each chapter, these items will create an expanded vocabulary. Use the access code at the front of your book to find additional resources online.

## Chapter Objectives

These objectives provide instructors and students with a snapshot of key information they will encounter in each chapter. They serve as a checklist to help guide and focus study.

## Best Practices

Key concept notes reinforce correct methods and techniques and provide information on matters in day-to-day practice.

| TABLE 4-1 Most Common Opioids |            |  |                |                    |
|-------------------------------|------------|--|----------------|--------------------|
| Generic                       | Trade Name | Administration Routes                      | Natural/Other  | Agonist/Antagonist |
| Morphine                      | MS Contin  | Subcut./IM/IV/PO                           | Natural        | Agonist            |
| Codeine                       | Lodine     | PO/IM/Subcut.                              | Natural        | Agonist            |
| Hydromorphone                 | Dilaudid   | Subcut./IM/IV/PO/REC                       | Semi-synthetic | Agonist            |
| Meperidine                    | Demerol    | Subcut./IM/IV/PO/REC                       | Synthetic      | Agonist            |
| Fentanyl                      | Duragesic  | IV/IM/lozenge/buccal tab/transdermal patch | Synthetic      | Agonist            |
| Methadone                     | Dolophine  | Subcut./IM/IV/PO                           | Synthetic      | Agonist            |
| Tramadol                      | Ultram     | PO   | Synthetic      | Agonist            |
| Naloxone                      | Narcan     | Subcut./IM/IV                              | Semi-synthetic | Antagonist         |

a response; agonists mimic the actions of endogenous opioid ligands. The best-known drugs with *mixed* agonist–antagonist activity are the opioids. For example **morphine** is an agonist of opioid receptors, while **naloxone** is an antagonist to **morphine** and other opiate drugs (and therefore a receptor *antagonist*). The drugs **buprenorphine** and **pentazocine** have both agonist and antagonist effects (TABLE 4-1).

Among the class of NSAIDs are COX-2 inhibitors. These drugs are selective in that they directly target COX-2, an enzyme responsible for inflammation and pain, yet have a less severe impact on the gastrointestinal (GI) tract than traditional NSAIDs such as salicylates (**aspirin**). The more benign GI effects of COX-2 inhibitors reduce the risk of peptic ulceration associated with the traditional NSAIDs (Chan et al., 2017; Whittle, 2000), although overall gastrointestinal toxicity of selective COX-2 inhibitors has been questioned (Hima & Venkat, 2016). **Celecoxib** is an example of a COX-2 inhibitor.

Analgesics provide *symptomatic* pain relief but do not alleviate the cause of that pain. The NSAIDs, due to their dual activity, may be beneficial in both regards, as we shall see later in this chapter.

**Acute Versus Chronic Pain**

One person's pain perception may be very different from another person's, but the one commonality is that a sensory pathway spans from the affected organ to the brain. Analgesics work at the level of the nerves, either by blocking the signal from the PNS or by distorting the perception by the CNS. Selecting an appropriate analgesic is achieved with consideration of the risks and benefits to the patient, the type and severity of pain the patient may be suffering, and the risk of adverse effects. The healthcare provider would also want to examine whether the type of pain the patient is experiencing would be categorized as acute or chronic.

Acute pain is self-limiting in duration and includes postoperative pain or pain due to an injury or infection. Given that pain of this type is expected to be short term (usually less than 12 weeks' duration), the long-term side effects of analgesic therapy may be ignored. These patients may be treated with narcotics without concern of possible addiction. One important consideration with patients in severe pain is that they should not be subject to the return of pain. Analgesics should be dosed routinely to ensure constant blood levels of analgesic, rather than waiting to provide patients with appropriate medications until

**Best Practices**

Selecting an appropriate analgesic is achieved with consideration of the risks and benefits to the patient, the type and severity of pain the patient may be suffering, and the risk of adverse effects.

**Best Practices**

Analgesics should be dosed routinely to ensure constant blood levels of analgesic so that pain relief is uninterrupted.

**Best Practices**

The risk of side effects with long-term use of NSAIDs means treatment of chronic pain requires a combination of drugs, lifestyle modifications, and other treatment modalities.

## Critical Thinking Questions

Analyze and evaluate content from each chapter using these end-of-chapter questions.

effects. When the procedure is over, remind the patient not to arise too quickly to avoid possible dizziness due to orthostatic hypotension. Remind patients to call immediately if they experience side effects or notice areas of irritation or increased bleeding, warmth, or swelling at area of injection.

**CHAPTER SUMMARY**

This chapter has explored the CNS, touched briefly on the PNS, and discussed key conditions affecting the CNS as well as the drug classes most commonly used as treatments for specific CNS diseases and disorders. If there is one all-encompassing theme to this chapter, it is the principal necessity to support patients' ability to maintain physiological function and a sense of "normalcy" as they cope with the neurologic disorders for which they are being treated. Whether the problem is pain centered or focused on loss of memory (as in Alzheimer disease), physical capability (as in Parkinson's or ALS disease), or simply a matter of suppressing seizures, the therapeutic goal is the same: manage the condition with the goal of restoring normalcy to the extent possible. Where disease and/or symptom progression is inevitable, the goal becomes maintenance of high function and independence for as long as possible. In such cases (and, indeed, in any CNS disorder), medication is rarely used alone; it is most often supported with multiple adjunct therapies (or sometimes is better regarded as an adjunct to other modalities).

Key concepts include the importance of neurotransmitters such as *dopamine* and *acetylcholine* in brain-centered progressive disorders such as Alzheimer and Parkinson's disease, the function of glutamate and NDMA in memory and cognition, and the central role that prostaglandins play in inflammatory conditions. Management of pain is a challenging objective for the clinician because it is so often performed ineffectually. However, maintaining physiological function and supporting patients' ability to cope with various diseases and symptoms is as important as pain control.

**Critical Thinking Questions**

1. What are the advantages and disadvantages of NSAID analgesia versus opioid analgesia?
2. What distinguishes epilepsy from non-epileptic seizures? Why would therapy for each type of seizure disorder be different?
3. Name three common myths surrounding pain medications. How do these medications potentially affect therapy and clinical response to the patient?
4. In Alzheimer disease, the key diagnostic symptom is dementia; in Parkinson's disease, the most frequent identifying symptom is tremor and changes in gait. How do these differences alter the therapeutic approach to patients with these diseases?
5. What is the principal function of glutamate?
6. What are the roles of prostaglandins in inflammatory diseases? How do NSAIDs affect prostaglandin production?
7. Which of the following medications is most appropriate for a patient with a spinal cord injury who has a history of **benzodiazepine** addiction: **cyclobenzaprine**, **diazepam**, **aspirin**, or **dantrolene**?
8. ALS is a progressive neurodegenerative disease with varied etiology. What are typically the first symptoms seen in the progression of this disease?
9. What are the key symptoms or lab findings that would indicate toxicity in a patient on long-term **acetaminophen** therapy?

## CASE STUDIES

## Case Scenario 1

Ms. Smith, a 78-year-old woman with a history of gastric ulcers and stroke, comes into the clinic following an accident where her car was rear-ended. She is complaining of headache and pain in her neck and shoulders. The nurse takes the patient's vital signs: B/P, 123/68; P, 88; R, 18; T, 98.9. Ms. Smith states that she has allergies to **penicillin** and **codeine**, and has been taking Coumadin since her stroke three years ago. After a brief examination, the physician's assistant tells Ms. Smith that he believes she has whiplash and prescribes her **cyclobenzaprine** and **aspirin**.

## Case Question

1. Is aspirin the best or most appropriate medication that should have been ordered?
  - a. Yes, because it acts both as an anti-inflammatory and a pain medication.
  - b. No, the patient would do better taking ibuprofen because it is less upsetting to the stomach.
  - c. No, the patient should take acetaminophen because she has both a history of peptic ulcers and is currently taking warfarin.
  - d. None of the above.

**Answer: The answer is c.** Because Ms. Smith has a history of ulcers and is receiving anticoagulant therapy post stroke, aspirin should be avoided because it would both increase the anticoagulant effects of the warfarin and increase her risk of gastric ulcers.

## Case Studies

Scenarios encourage active learning and promote critical thinking skills. Students can read about real-life scenarios and analyze each situation presented.

## CASE STUDIES

## Case Scenario 2

Nathaniel, an EMT and girls' soccer coach in Connecticut, was flying home to Tulsa for a visit. When his father, Louis, picked him up at the airport, Nathaniel noticed that Louis seemed different. He didn't think much of it at the time, but as the week progressed, he noticed that his father was frequently confused, had difficulty organizing and planning, and was quite moody when normally he was always laughing and telling jokes. He had always loved making flies for his favorite hobby, fly-fishing, but Nathaniel's mother reported that he no longer made the flies or even went into his workshop anymore. She also stated that she noticed when they watched TV, Louis had difficulty following the plot of any of the shows they were watching.

Nathaniel felt that his father might have some mild dementia, which concerned him because his father was only 58. He made an appointment for his father with his doctor; following examination and testing, Louis was diagnosed with early-stage Alzheimer disease.

## Case Questions

1. Because Louis is relatively young, and has been diagnosed with early-stage Alzheimer disease with what appear to be only mild symptoms, which medication would be **best** to start him on?



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# Dedication

*This book is dedicated to the memory of my mother,  
Joan (Joanna) Lou Templar Smith, PhD (1927–2013),  
my life-long editor and editorial advisor. – Blaine T. Smith*

*Dedicated to my mother as well: the single strongest, most faithful,  
and resilient person I have ever known. – Diane F. Pacitti*



# Contents

|  |           |
|--|-----------|
| Pharmacology for Nurses . . . . .  | ii        |
| Introduction . . . . .   | xxiv      |
| About the Editor . . . . .   | xxv       |
| Contributors . . . . .   | xxvi      |
| Reviewers . . . . .  | xxviii    |
| <b>Section I</b> Pharmacology for Nurses: Basic Principles . . . . .   | <b>1</b>  |
| <b>Chapter 1</b> Introduction to Pharmacology . . . . .  | <b>3</b>  |
| <i>Jean Nicholas, MSN</i>  |           |
| Introduction . . . . .   | 4         |
| Nursing and Pharmacology . . . . .   | 4         |
| Drug Classifications . . . . .   | 5         |
| Drug Names . . . . .   | 5         |
| Prescription and Nonprescription Drugs . . . . .   | 5         |
| Controlled Substances . . . . .  | 5         |
| Sources of Drug Information . . . . .  | 6         |
| QSEN Competencies. . . . .   | 7         |
| Overview of the Nursing Process . . . . .  | 7         |
| Assessment . . . . .   | 8         |
| Nursing Diagnosis. . . . .   | 8         |
| Planning . . . . .   | 8         |
| Intervention . . . . .   | 9         |
| Evaluation . . . . .   | 9         |
| Cultural Aspects of Drug Therapy . . . . .   | 10        |
| Legal–Ethical Aspects of Drug Therapy . . . . .  | 10        |
| Medication Errors. . . . .   | 11        |
| How Often Do Medication Errors Occur? . . . . .  | 11        |
| How Can Medication Errors Be Prevented?. . . . .   | 11        |
| Conclusion: Pharmacology in Nursing Practice . . . . .   | 13        |
| Chapter Summary . . . . .  | 13        |
| References . . . . .   | 13        |
| <b>Chapter 2</b> Introduction to Drug Action: The Interplay of Pharmacodynamics<br>and Pharmacokinetics. . . . . | <b>15</b> |
| <i>Diane F. Pacitti, RPh, PhD</i>  |           |
| Introduction . . . . .   | 16        |
| What Happens After a Drug Is Administered?. . . . .  | 16        |
| Making the Connection: Pharmacology in Clinical Nursing Practice. . . . .  | 17        |

|   |    |
|---|----|
| Pharmacokinetics Versus Pharmacodynamics . . . . .                      | 18 |
| The Relationship Between the Drug and the Body . . . . .                | 18 |
| What Is a Drug? . . . . .   | 18 |
| Advances in New Drug Development: Personalized Medicine . . . . .       | 19 |
| Drug Nomenclature . . . . .   | 19 |
| Chemical Name . . . . .   | 20 |
| Generic Name . . . . .  | 20 |
| Brand Name . . . . .  | 20 |
| The Liver: Anatomical First Stop for Orally Administered Drugs. . . . . | 21 |
| Nursing Considerations . . . . .  | 23 |
| Drug Meet Patient; Patient Meet Drug. . . . .                           | 23 |
| Toxicology. . . . .   | 24 |
| Nursing Considerations . . . . .  | 25 |
| What, Then, Is the Right Dose? . . . . .                                | 25 |
| The Interplay of Pharmacokinetics and Pharmacodynamics . . . . .        | 25 |
| Pharmacodynamics . . . . .  | 26 |
| Pharmacokinetics . . . . .  | 26 |
| Biopharmaceutics . . . . .  | 26 |
| Nursing Considerations . . . . .  | 26 |
| Clinical Pharmacology . . . . .   | 27 |
| Pharmacodynamics . . . . .  | 28 |
| What the Drug Does to the Body . . . . .                                | 28 |
| The Mechanism of Drug Action . . . . .                                  | 29 |
| The Receptor Molecule. . . . .  | 29 |
| The Nature of Ligand-Receptor Interactions: Chemical Bonding            |    |
| Interactions/Forces . . . . .   | 30 |
| Nursing Considerations . . . . .  | 31 |
| The Drug–Receptor Complex . . . . .                                     | 31 |
| The Drug–Receptor Interaction and Therapeutic Response . . . . .        | 33 |
| Types of Receptors . . . . .  | 33 |
| Transmembrane Receptor Activation and Response . . . . .                | 33 |
| Signal Transduction . . . . .   | 33 |
| The Dose-Response Relationship . . . . .                                | 34 |
| Pharmacodynamic Parameters Obtained from the Dose-Response Curve. . .   | 35 |
| Efficacy . . . . .  | 35 |
| Potency . . . . .   | 36 |
| Potency vs. Efficacy: A Source of Confusion . . . . .                   | 36 |
| Nursing Considerations . . . . .  | 36 |
| Limitations of a Dose-Response Curve . . . . .                          | 37 |
| The Drug Activity Profile . . . . .                                     | 37 |
| Pharmacodynamic Parameters Obtained from the Drug Activity Profile. . . | 38 |
| Duration of Action . . . . .  | 38 |
| Onset of Action. . . . .  | 38 |
| Therapeutic Index . . . . .   | 38 |
| Classes of Medications . . . . .  | 39 |
| Agonist Drugs . . . . .   | 39 |
| Mimic Ligand-Receptor Activation Responses . . . . .                    | 39 |
| Antagonist Drugs . . . . .  | 39 |
| Block the Receptor’s Activation Response . . . . .                      | 39 |
| Different Types of Antagonists . . . . .                                | 40 |
| Nursing Considerations . . . . .  | 40 |

|   |    |
|---|----|
| Variability in Pharmacodynamics . . . . .                                 | 41 |
| Pharmacokinetics . . . . .  | 41 |
| How the Body Affects the Drug . . . . .                                   | 41 |
| Overview of the Pharmacokinetic Processes, ADME . . . . .                 | 42 |
| Absorption . . . . .  | 42 |
| Distribution . . . . .  | 42 |
| Metabolism . . . . .  | 43 |
| Elimination . . . . .   | 43 |
| Nursing Considerations . . . . .  | 43 |
| Overview of Pharmacokinetic Terminology . . . . .                         | 43 |
| The Pharmacokinetic Parameters Used to Characterize                       |    |
| the Rate of Drug Movement . . . . .                                       | 43 |
| Nursing Considerations . . . . .  | 43 |
| Pharmacokinetic Studies and Determination of Kinetic Parameters . . . . . | 43 |
| The Plasma Level-Time Curve . . . . .                                     | 43 |
| Rate Processes of Pharmacokinetics . . . . .                              | 44 |
| Zero-Order Rate Process . . . . .   | 44 |
| Nursing Considerations . . . . .  | 44 |
| The First-Order Rate Process . . . . .                                    | 45 |
| Further Explanation of Rate Constants in Pharmacokinetics . . . . .       | 45 |
| Half-Life in Pharmacokinetics . . . . .                                   | 46 |
| Nursing Considerations . . . . .  | 46 |
| Drug Absorption: The “A” in ADME . . . . .                                | 46 |
| The Pharmacokinetics of Oral Absorption . . . . .                         | 47 |
| Bioavailability . . . . .   | 48 |
| Factors Affecting the Rate and Extent of Absorption . . . . .             | 49 |
| Impact of First-Pass Effect on Bioavailability . . . . .                  | 50 |
| Steady-State Drug Levels . . . . .  | 50 |
| Nursing Considerations . . . . .  | 51 |
| Distribution: The “D” in ADME . . . . .                                   | 51 |
| Pharmacokinetics: Rate of Drug Distribution . . . . .                     | 51 |
| Pharmacokinetic Models: Compartmental Model Theory . . . . .              | 52 |
| One-Compartment Model . . . . .   | 52 |
| Multicompartment Model . . . . .  | 53 |
| Volume of Distribution . . . . .  | 54 |
| Drug Binding to Plasma Proteins . . . . .                                 | 55 |
| Competition for Binding Sites . . . . .                                   | 56 |
| Ramifications of Protein Binding on Therapy . . . . .                     | 57 |
| Metabolism: The “M” in ADME . . . . .                                     | 57 |
| Enzyme Reactions in the Liver . . . . .                                   | 58 |
| Metabolism and Liver Blood Flow . . . . .                                 | 58 |
| Drug Interactions Involving Drug Metabolism . . . . .                     | 59 |
| Nursing Considerations . . . . .  | 59 |
| Elimination: The “E” in ADME . . . . .                                    | 59 |
| Biliary Excretion of Drugs . . . . .                                      | 59 |
| Drug Clearance . . . . .  | 60 |
| Glomerular Filtration . . . . .   | 60 |
| Active Renal Secretion . . . . .  | 60 |
| Tubular Reabsorption . . . . .  | 61 |
| Case Study: Making the Connection to Clinical Nursing . . . . .           | 62 |
| Considerations Affecting Drug Delivery: Dosing Frequency,                 |    |
| Timing, and Route . . . . .   | 62 |

|                  |  |           |
|------------------|--|-----------|
|                  | Chronic Medication Use: Long-Term Dosing Regimens . . . . .                          | 63        |
|                  | Chapter Summary . . . . .  | 64        |
|                  | References . . . . .   | 66        |
|                  | External Links . . . . .   | 66        |
| <b>Chapter 3</b> | <b>Medication Administration . . . . .</b>   | <b>67</b> |
|                  | <i>Tara Kavanaugh, RN, MSN, MPH, ANP-BC, FNP-BC, WHNP-BC</i>                         |           |
|                  | Introduction . . . . .   | 68        |
|                  | Before Administering Medications: The Eight Medication “Rights” . . . . .            | 69        |
|                  | Procedures for Administering Medications . . . . .                                   | 70        |
|                  | Which Factors Hamper Safe Medication Administration? . . . . .                       | 70        |
|                  | Systemic Factors in Medication Errors . . . . .                                      | 71        |
|                  | Proper Procedure for Administering All Medications . . . . .                         | 72        |
|                  | Administering Oral Medications . . . . .   | 73        |
|                  | Injecting Medications Safely . . . . .   | 74        |
|                  | Giving Subcutaneous Injections . . . . .   | 74        |
|                  | Preparing the Medication for a Subcutaneous Injection . . . . .                      | 75        |
|                  | Injectable Pens . . . . .  | 76        |
|                  | Rotating Injection Sites for Subcutaneous Injections . . . . .                       | 77        |
|                  | General Guidelines for Subcutaneous Injections . . . . .                             | 77        |
|                  | Intramuscular Injections . . . . .   | 78        |
|                  | Anatomic Locations for Administering Intramuscular Injections . . . . .              | 79        |
|                  | Supplies Needed for Administering Intramuscular Injections . . . . .                 | 81        |
|                  | General Procedure for Administering Intramuscular Injections . . . . .               | 82        |
|                  | Intravenous and Intraosseous Medications . . . . .                                   | 83        |
|                  | IV Medication Safety Issues . . . . .  | 83        |
|                  | Matters of Key Concern When Administering IV Medications . . . . .                   | 84        |
|                  | Administering an IV Medication . . . . .   | 84        |
|                  | Identifying a Site . . . . .   | 84        |
|                  | Inhaled Medications . . . . .  | 86        |
|                  | Proper Procedure for Using a Metered-Dose Inhaler or<br>Dry-Powder Inhaler . . . . . | 86        |
|                  | Delivering Medication with an Inhaler . . . . .                                      | 86        |
|                  | Proper Procedure for Administering a Nasal Spray . . . . .                           | 88        |
|                  | Using a Nebulizer . . . . .  | 89        |
|                  | Preparing for Nebulizer Therapy . . . . .  | 89        |
|                  | Using the Nebulizer . . . . .  | 90        |
|                  | Medication Transfer Across Permeable Tissues . . . . .                               | 90        |
|                  | Administering a Transdermal Patch . . . . .  | 90        |
|                  | Applying Topical Preparations . . . . .  | 92        |
|                  | Vaginal Rings . . . . .  | 93        |
|                  | Administering Vaginal Rings . . . . .  | 93        |
|                  | Administering Rectal Suppositories . . . . .   | 94        |
|                  | Buccal and Sublingual Administration . . . . .                                       | 95        |
|                  | Administering a Sublingual or Buccal Medication . . . . .                            | 96        |
|                  | Medication Errors . . . . .  | 97        |
|                  | What are Medication Administration Errors? . . . . .                                 | 97        |
|                  | Causes and Prevention of Medication Errors . . . . .                                 | 98        |
|                  | Conclusion: Medication Administration in Nursing Practice . . . . .                  | 99        |
|                  | Chapter Summary . . . . .  | 99        |
|                  | Suggested Readings . . . . .   | 99        |
|                  | References . . . . .   | 100       |

|                   |   |            |
|-------------------|---|------------|
| <b>Section II</b> | <b>The Pharmacology of Physiological Systems . . . . .</b>  | <b>103</b> |
| <b>Chapter 4</b>  | <b>Central Nervous System Drugs. . . . .</b>  | <b>105</b> |
|                   | <i>Dion M. Mayes-Burnett, RN</i>  |            |
|                   | Nervous System Physiology . . . . .   | 106        |
|                   | Conditions Affecting CNS Function . . . . .   | 108        |
|                   | Drugs Used for Conditions of the Central Nervous System . . . . .   | 109        |
|                   | Classes of Medications for Treating CNS Disorders . . . . .   | 109        |
|                   | Analgesics and Pain Management . . . . .  | 109        |
|                   | Acute Versus Chronic Pain . . . . .   | 110        |
|                   | Narcotics . . . . .   | 113        |
|                   | Nursing Process . . . . .   | 115        |
|                   | Nonsteroidal Anti-Inflammatory Drugs . . . . .  | 117        |
|                   | Nursing Process . . . . .   | 120        |
|                   | Seizure Disorders and Epilepsy . . . . .  | 121        |
|                   | Anticonvulsants . . . . .   | 122        |
|                   | Valproic Acid . . . . .   | 122        |
|                   | Phenobarbital . . . . .   | 123        |
|                   | Levetiracetam . . . . .   | 123        |
|                   | Phenytoin . . . . .   | 123        |
|                   | Benzodiazepines . . . . .   | 123        |
|                   | Anticonvulsant Side Effects . . . . .   | 124        |
|                   | Nursing Process . . . . .   | 124        |
|                   | Neurodegenerative Diseases. . . . .   | 125        |
|                   | Parkinson’s Disease. . . . .  | 126        |
|                   | Carbidopa–Levodopa . . . . .  | 127        |
|                   | Nursing Process for Carbidopa–Levodopa . . . . .  | 128        |
|                   | Ropinirole . . . . .  | 129        |
|                   | Nursing Process for Ropinirole . . . . .  | 129        |
|                   | Benzotropine . . . . .  | 130        |
|                   | Nursing Process for Benzotropine . . . . .  | 131        |
|                   | Amantadine . . . . .  | 132        |
|                   | Nursing Process for Amantadine . . . . .  | 132        |
|                   | Alzheimer Disease . . . . .   | 133        |
|                   | Nursing Process . . . . .   | 135        |
|                   | Amyotrophic Lateral Sclerosis . . . . .   | 136        |
|                   | Nursing Process . . . . .   | 137        |
|                   | Musculoskeletal Dysfunction . . . . .   | 138        |
|                   | Muscle Relaxants . . . . .  | 138        |
|                   | Specific Drugs and Their Uses . . . . .   | 139        |
|                   | Side Effects and Contraindications . . . . .  | 140        |
|                   | Nursing Process . . . . .   | 140        |
|                   | Local Anesthetics . . . . .   | 141        |
|                   | Specific Drugs and Uses . . . . .   | 142        |
|                   | Nursing Process . . . . .   | 143        |
|                   | Chapter Summary . . . . .   | 144        |
|                   | Suggested Readings . . . . .  | 146        |
|                   | References . . . . .  | 147        |
| <b>Chapter 5</b>  | <b>Autonomic Nervous System Drugs. . . . .</b>  | <b>149</b> |
|                   | <i>William Mark Enlow, DNP, ACNP, CRNA, DCC, Sue Greenfield, PhD, RN,</i><br><i>and Cliff Roberson, DNP, CRNA, APRN</i> |            |
|                   | Introduction . . . . .  | 150        |
|                   | The Three Systems of the ANS. . . . .   | 150        |



|  |     |
|--|-----|
| Anatomy of the Autonomic Nervous System . . . . .                                  | 150 |
| Integration of ANS Systems . . . . .   | 151 |
| Sympathetic Nervous System . . . . .   | 151 |
| Parasympathetic Nervous System . . . . .   | 152 |
| Neurotransmitters in the Autonomic Nervous System . . . . .                        | 153 |
| Adrenergic Receptors . . . . .   | 154 |
| Drugs That Affect the ANS . . . . .  | 154 |
| Adrenergic Agonist Drugs . . . . .   | 156 |
| Nonselective Agents . . . . .  | 156 |
| Selective Adrenergic Agents . . . . .  | 158 |
| Nursing Considerations for Adrenergic Drugs . . . . .                              | 160 |
| Adrenergic Antagonists . . . . .   | 161 |
| Alpha-Adrenergic Antagonists . . . . .   | 161 |
| Selectivity . . . . .  | 162 |
| Nursing Considerations for $\alpha$ -Receptor Antagonists . . . . .                | 164 |
| Beta-Adrenergic Antagonists . . . . .  | 164 |
| Selectivity . . . . .  | 164 |
| Nursing Considerations for $\beta$ -Adrenergic Antagonists . . . . .               | 166 |
| Cholinergic Drugs . . . . .  | 166 |
| Cholinergic Agents . . . . .   | 166 |
| Directly Acting Acetylcholine Receptor Agonist . . . . .                           | 167 |
| Acetylcholinesterase Inhibitors . . . . .  | 167 |
| Nursing Considerations for Cholinergic Agonists . . . . .                          | 169 |
| Nursing Interventions . . . . .  | 169 |
| Cholinergic Antagonists . . . . .  | 170 |
| Clinical Indications for Use . . . . .   | 170 |
| Individual Cholinergic Antagonists . . . . .                                       | 170 |
| Nursing Process for Cholinergic Antagonists . . . . .                              | 171 |
| Nursing Interventions . . . . .  | 172 |
| Chapter Summary . . . . .  | 172 |
| Suggested Readings . . . . .   | 174 |
| References . . . . .   | 174 |
| <b>Chapter 6</b> Cardiovascular Medications . . . . .                              | 175 |
| <i>Diane F. Pacitti, RPh, PhD, and Blaine Templar Smith, RPh, PhD</i>              |     |
| Introduction . . . . .   | 176 |
| The Cardiovascular System . . . . .  | 176 |
| Treatment of High Blood Pressure . . . . .   | 178 |
| What Is High Blood Pressure? . . . . .   | 181 |
| JNC 7: “Older” Guidelines for Treatment of Hypertension . . . . .                  | 181 |
| JNC 8: Updated Guidelines for Treatment of Hypertension . . . . .                  | 181 |
| The Renin–Angiotensin–Aldosterone System (RAAS) . . . . .                          | 181 |
| Direct Renin Inhibitors . . . . .  | 183 |
| Angiotensin-Converting-Enzyme Inhibitors (ACE Inhibitors) . . . . .                | 183 |
| Angiotensin II Receptor Blockers (ARBs) . . . . .                                  | 185 |
| Aldosterone Antagonists (AAs) . . . . .  | 185 |
| The Role of the Autonomic Nervous System<br>in Blood Pressure Regulation . . . . . | 186 |
| Adverse Effects of Beta-Blockers . . . . .   | 190 |
| Blockade of $\alpha_1$ -Receptors . . . . .  | 190 |
| Adverse Effects of Alpha-Blockers . . . . .  | 191 |
| Drug–Drug Interactions . . . . .   | 191 |
| Calcium-Channel Blockers . . . . .   | 191 |
| Adverse Effects of Calcium Channel Blockers . . . . .                              | 191 |

|  |     |
|--|-----|
| Diuretics . . . . .  | 192 |
| Thiazide Diuretics . . . . .   | 194 |
| Loop Diuretics . . . . .   | 194 |
| Potassium-Sparing Diuretics . . . . .  | 195 |
| Hypertensive Emergencies . . . . .   | 195 |
| Cardiac Agents . . . . .   | 197 |
| Coronary Artery Disease . . . . .  | 197 |
| Chest Pain/Angina . . . . .  | 197 |
| Exertional Angina . . . . .  | 197 |
| Variant Angina . . . . .   | 198 |
| Unstable Angina . . . . .  | 199 |
| Antianginal Agents . . . . .   | 199 |
| Nursing Considerations . . . . .   | 200 |
| Hyperlipidemia . . . . .   | 200 |
| Statin Drugs . . . . .   | 201 |
| Fibrates . . . . .   | 201 |
| Niacin . . . . .   | 202 |
| Bile Acid Sequestrants . . . . .   | 203 |
| Congestive Heart Failure . . . . .   | 203 |
| Inotropic Agents . . . . .   | 204 |
| Cardiac Glycosides . . . . .   | 204 |
| Nursing Considerations . . . . .   | 204 |
| Prevention of Thrombosis and Stroke: Anticoagulant Therapy . . . . .         | 205 |
| Anticoagulants . . . . .   | 205 |
| Heparin . . . . .  | 205 |
| Low-Molecular-Weight Heparin . . . . .                                       | 206 |
| Oral Anticoagulants . . . . .  | 207 |
| Warfarin . . . . .   | 207 |
| Direct Thrombin Inhibitors . . . . .   | 209 |
| Direct Factor Xa Inhibitors . . . . .  | 209 |
| Antiplatelet Agents . . . . .  | 210 |
| Antiarrhythmic Agents . . . . .  | 210 |
| Group I Antiarrhythmics: Sodium-Channel Blockers . . . . .                   | 211 |
| Group II Antiarrhythmics: Beta-Blockers . . . . .                            | 212 |
| Group III Antiarrhythmics: Potassium-Channel Blockers . . . . .              | 212 |
| Group IV Antiarrhythmics: Calcium-Channel Blockers . . . . .                 | 213 |
| Group V Antiarrhythmics: Miscellaneous . . . . .                             | 213 |
| Chapter Summary . . . . .  | 213 |
| References . . . . .   | 216 |
| <br>   |     |
| <b>Chapter 7</b>   |     |
| Respiratory Medications . . . . .  | 219 |
| <i>Amy Rex Smith, DNSc, RN, ACNS, BC, and Blaine Templar Smith, RPh, PhD</i> |     |
| Introduction . . . . .   | 220 |
| Assessment of Lung Function . . . . .  | 221 |
| Asthma . . . . .   | 222 |
| Approach to the Treatment of Asthma . . . . .                                | 223 |
| Oral Preventive Medications . . . . .  | 224 |
| Leukotriene-Receptor Antagonists . . . . .                                   | 225 |
| Thromboxane Antagonists . . . . .  | 225 |
| Oral Corticosteroids . . . . .   | 225 |
| Inhaled Preventive Medications . . . . .                                     | 226 |
| Inhaled Corticosteroids . . . . .  | 227 |

|  |     |
|--|-----|
| Inhaled Long-Acting Beta Agonists . . . . .                | 228 |
| Combination Inhalers (Corticosteroid + LABA) . . . . .     | 228 |
| Injected Preventive Therapies . . . . .                    | 229 |
| Monoclonal Antibodies . . . . .                            | 229 |
| Methylxanthines . . . . .                                  | 229 |
| Fast-Acting “Rescue” Medications . . . . .                 | 230 |
| Short-Acting Inhaled Beta Agonists . . . . .               | 230 |
| Anticholinergic Agents . . . . .                           | 231 |
| Intravenous Corticosteroids . . . . .                      | 231 |
| Epinephrine . . . . .                                      | 231 |
| Late-Phase Asthma Treatment: Emergency Room Only . . . . . | 232 |
| Chronic Obstructive Pulmonary Disease . . . . .            | 232 |
| COPD Adjunct Therapies . . . . .                           | 233 |
| Antibiotics . . . . .                                      | 233 |
| Smoking Cessation . . . . .                                | 234 |
| Mucus Reduction . . . . .                                  | 234 |
| Smoking-Cessation Therapy . . . . .                        | 234 |
| Oral Medications for Smoking Cessation . . . . .           | 234 |
| Antidepressants . . . . .                                  | 234 |
| Nicotinic-Receptor Agonists . . . . .                      | 235 |
| Nicotine Replacement Therapies . . . . .                   | 236 |
| Chapter Summary . . . . .                                  | 236 |
| Suggested Readings . . . . .                               | 238 |
| References . . . . .                                       | 238 |

## Chapter 8

|   |     |
|---|-----|
| Pharmacology of the Gastrointestinal Tract . . . . .                                | 241 |
| <i>Jacqueline Rosenjack Burchum, DNSc, FNP-BC, CNE, and Hoi Sing Chung, PhD, RN</i> |     |
| Introduction . . . . .  | 242 |
| The Nursing Care Process . . . . .  | 243 |
| Drugs to Control Gastric Acidity . . . . .  | 244 |
| Antacids . . . . .  | 244 |
| Drug–Drug Interactions . . . . .  | 245 |
| Histamine 2 (H <sub>2</sub> ) Receptor Antagonists . . . . .                        | 245 |
| Drug–Drug Interactions . . . . .  | 246 |
| Proton-Pump Inhibitors . . . . .  | 246 |
| Drug–Drug Interactions . . . . .  | 247 |
| Mucosal Protectants . . . . .   | 247 |
| Drug–Drug Interactions . . . . .  | 248 |
| Drugs to Stimulate Gastrointestinal Motility . . . . .                              | 248 |
| Cholinergic Mimetic Agents . . . . .  | 249 |
| Dopamine (D <sub>2</sub> ) Receptor Blockers . . . . .                              | 249 |
| Drug–Drug Interactions . . . . .  | 249 |
| Drugs to Control Diarrhea . . . . .   | 250 |
| Opioid Agonists . . . . .   | 250 |
| Drug–Drug Interactions . . . . .  | 250 |
| Bismuth Compounds . . . . .   | 250 |
| Octreotide . . . . .  | 251 |
| Drugs to Relieve Constipation . . . . .   | 251 |
| Bulk-Forming Laxatives . . . . .  | 251 |
| Drug–Drug Interactions . . . . .  | 251 |
| Stimulant Laxatives . . . . .   | 252 |
| Drug–Drug Interactions . . . . .  | 252 |

|  |     |
|--|-----|
| Stool Softeners/Surfactants . . . . .                          | 252 |
| Drug–Drug Interactions . . . . .                               | 252 |
| Osmotic Laxatives . . . . .                                    | 253 |
| Drug–Drug Interactions . . . . .                               | 253 |
| Drugs to Treat Irritable Bowel Syndrome . . . . .              | 253 |
| Anticholinergics . . . . .                                     | 253 |
| Serotonin 5-HT Receptor Agonists and Antagonists . . . . .     | 254 |
| Drug–Drug Interactions . . . . .                               | 255 |
| Chloride-Channel Activators . . . . .                          | 255 |
| Drug–Drug Interactions . . . . .                               | 255 |
| Drugs to Control Nausea and Vomiting . . . . .                 | 255 |
| 5-HT <sub>3</sub> Receptor Antagonists . . . . .               | 256 |
| Drug–Drug Interactions . . . . .                               | 256 |
| Corticosteroids . . . . .                                      | 256 |
| Neurokinin-1 (NK <sub>1</sub> ) Receptor Antagonists . . . . . | 256 |
| Drug–Drug Interactions . . . . .                               | 257 |
| Dopamine-Receptor Antagonists . . . . .                        | 257 |
| Drug–Drug Interactions . . . . .                               | 257 |
| Antihistamines and Anticholinergics . . . . .                  | 257 |
| Cannabinoids . . . . .   | 258 |
| Drug–Drug Interactions . . . . .                               | 258 |
| Drugs to Treat Inflammatory Bowel Disease . . . . .            | 258 |
| Aminosalicylates . . . . .                                     | 259 |
| Drug–Drug Interactions . . . . .                               | 259 |
| Glucocorticoids . . . . .                                      | 259 |
| Purine Analogs . . . . .                                       | 260 |
| Drug–Drug Interactions . . . . .                               | 260 |
| Methotrexate . . . . .   | 260 |
| Anti-Tumor Necrosis Factor Therapy . . . . .                   | 261 |
| Anti-Integrin Therapy . . . . .                                | 261 |
| Drug–Drug Interactions . . . . .                               | 262 |
| Bile Acid Therapy for Gallstones . . . . .                     | 262 |
| Drug–Drug Interactions . . . . .                               | 262 |
| Chapter Summary . . . . .                                      | 262 |
| References . . . . .   | 264 |

## Chapter 9 Endocrine System Drugs . . . . . 267

*Karen Crowley, DNP, APRN-BC, WHNP, ANP, Cathi Bodine, RN, BSN, Linda Tenofsky, PhD, ANP-BC, Ashley Pratt, MSN, WHNP-BC, and Sarah Nadarajah, RN, BSN*

|   |     |
|---|-----|
| Introduction . . . . .                        | 268 |
| Endocrine Glands and Their Hormones . . . . . | 268 |
| Hypothalamus . . . . .                        | 269 |
| Pituitary . . . . .                           | 270 |
| Pineal Gland . . . . .                        | 270 |
| Thyroid . . . . .                             | 271 |
| Parathyroid . . . . .                         | 272 |
| Thymus . . . . .                              | 272 |
| Pancreas . . . . .                            | 272 |
| Adrenal Glands . . . . .                      | 273 |
| Reproductive Glands . . . . .                 | 275 |
| Treating Endocrine Conditions . . . . .       | 275 |
| Diabetes Mellitus . . . . .                   | 275 |
| Insulin . . . . .                             | 275 |

|  |            |
|--|------------|
| Nursing Process . . . . .                              | 276        |
| Oral and Injectable Hypoglycemic Medications . . . . . | 279        |
| Nursing Process . . . . .                              | 281        |
| <b>Thyroid Disorders . . . . .</b>                     | <b>282</b> |
| Thyroid Hormone Replacement . . . . .                  | 283        |
| Nursing Process . . . . .                              | 283        |
| Thyroid Hormone Suppression . . . . .                  | 285        |
| Nursing Process . . . . .                              | 285        |
| <b>Polycystic Ovary Syndrome (PCOS) . . . . .</b>      | <b>286</b> |
| Nursing Process . . . . .                              | 289        |
| <b>Adrenal Disorders . . . . .</b>                     | <b>289</b> |
| Adrenal Insufficiency . . . . .                        | 290        |
| Nursing Process . . . . .                              | 290        |
| Hypercortisolism (Cushing Disease) . . . . .           | 291        |
| Nursing Process . . . . .                              | 292        |
| Hyperaldosteronism (Conn Disease) . . . . .            | 293        |
| <b>References . . . . .</b>                            | <b>297</b> |

## Chapter 10 Medications for Eye and Ear Disorders . . . . . 301

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|   |            |
|---|------------|
| <b>Introduction . . . . .</b>   | <b>302</b> |
| <b>Medications for Ophthalmic Disorders . . . . .</b>                 | <b>302</b> |
| <b>Proper Instillation of Topical Ophthalmic Medication . . . . .</b> | <b>303</b> |
| Drops . . . . .   | 303        |
| Ointments . . . . .   | 303        |
| <b>Glaucoma . . . . .</b>   | <b>303</b> |
| <b>Beta Blockers . . . . .</b>  | <b>305</b> |
| Therapeutic and Adverse Effects . . . . .                             | 306        |
| Drug Interactions . . . . .   | 307        |
| <b>Miotics . . . . .</b>  | <b>307</b> |
| <b>Carbonic Anhydrase Inhibitors . . . . .</b>                        | <b>308</b> |
| Therapeutic and Adverse Effects . . . . .                             | 308        |
| Drug Interactions . . . . .   | 309        |
| <b>Alpha-Adrenergic Agonists . . . . .</b>                            | <b>309</b> |
| Therapeutic and Adverse Effects . . . . .                             | 310        |
| Drug Interactions . . . . .   | 310        |
| <b>Prostaglandin Analogs . . . . .</b>                                | <b>310</b> |
| Therapeutic and Adverse Effects . . . . .                             | 311        |
| Adverse Drug Reactions . . . . .                                      | 311        |
| <b>Chronic Dry or Bloodshot Eyes . . . . .</b>                        | <b>311</b> |
| <b>Ocular Lubricants . . . . .</b>                                    | <b>312</b> |
| Therapeutic and Adverse Effects . . . . .                             | 312        |
| Drug Interactions . . . . .   | 312        |
| <b>Ophthalmic Vasoconstrictors . . . . .</b>                          | <b>312</b> |
| Therapeutic and Adverse Effects . . . . .                             | 312        |
| Drug Interactions . . . . .   | 313        |
| <b>Corticosteroids . . . . .</b>                                      | <b>313</b> |
| Therapeutic and Adverse Effects . . . . .                             | 313        |
| Drug Interactions . . . . .   | 314        |
| <b>Ophthalmic Antibiotics . . . . .</b>                               | <b>314</b> |
| Therapeutic and Adverse Effects . . . . .                             | 316        |
| Drug Interactions . . . . .   | 316        |
| <b>Drugs Used in Treating Otic Disorders . . . . .</b>                | <b>316</b> |



|   |   |
|---|---|
| Prevention Begins at Birth . . . . .  | 317   |
| Acute Otitis Media . . . . .  | 317   |
| Choosing an Antibacterial Agent . . . . .   | 318   |
| Treatment for Antibiotic-Resistant AOM . . . . .  | 320   |
| Pharmacodynamics . . . . .  | 320   |
| Therapeutic and Adverse Effects . . . . .   | 321   |
| Drug Interactions . . . . .   | 321   |
| Otitis Media with Effusion . . . . .  | 321   |
| Otitis Externa and Its Management . . . . .   | 321   |
| Prevention . . . . .  | 322   |
| Treatment . . . . .   | 322   |
| Topical Medications . . . . .   | 322   |
| Systemic Treatment . . . . .  | 323   |
| Fungal Otitis Externa (Otomycosis) . . . . .  | 323   |
| Treatment . . . . .   | 323   |
| Analgesics . . . . .  | 324   |
| Chapter Summary . . . . .   | 324   |
| References . . . . .  | 326   |
| <br>  |   |
| <b>Chapter 11</b>   | <b>Pharmacology of the Genitourinary System . . . . . 329</b> |
|   | <i>Diana M. Webber, DNP, APRN-CNP</i>                         |
| Introduction . . . . .  | 330   |
| Urinary Tract Infections . . . . .  | 330   |
| Complicated UTI in Adults . . . . .   | 332   |
| Complicated UTI in Pediatric Patients . . . . .   | 332   |
| Medications for Treatment of Uncomplicated UTI (Cystitis) . . . . .   | 333   |
| Trimethoprim-Sulfamethoxazole . . . . .   | 333   |
| Nitrofurantoin . . . . .  | 334   |
| Fosfomycin Trometamol . . . . .   | 334   |
| Second-Line Agents for UTI . . . . .  | 334   |
| Beta-Lactam Agents . . . . .  | 335   |
| Non-Antimicrobial Biological Mediators for Prevention of Uncomplicated<br>Recurrent Cystitis . . . . .                | 335   |
| Cranberry Juice, Capsules, or Tablets . . . . .   | 335   |
| Topical/Local Estrogen . . . . .  | 336   |
| Vaccines and Probiotic Application . . . . .  | 336   |
| Treatment of Complicated UTI . . . . .  | 336   |
| <i>Candida albicans</i> Vaginitis (Vaginal Yeast Infection) . . . . .   | 336   |
| Benign Hyperplasia of the Prostate . . . . .  | 337   |
| Medications for the Treatment of BPH . . . . .  | 338   |
| Antimuscarinic Agents (Tolterodine) . . . . .   | 338   |
| Selective $\alpha_1$ -Adrenoreceptor Antagonists (Alfuzosin, Prazosin, Doxazosin,<br>Tamsulosin, Terazosin) . . . . . | 338   |
| 5- $\alpha$ -Reductase Inhibitors (Finasteride, Dutasteride) . . . . .  | 339   |
| PDE-5 Inhibitors (Tadalafil) . . . . .  | 339   |
| Erectile Dysfunction . . . . .  | 339   |
| Medications for the Treatment of ED . . . . .   | 340   |
| PDE-5 Inhibitors (Sildenafil, Tadalafil, Vardenafil) . . . . .  | 340   |
| Alprostadil . . . . .   | 341   |
| Sexually Transmitted Infections . . . . .   | 341   |
| Sexually Transmitted Viral Infections . . . . .   | 342   |

|   |     |
|---|-----|
| HPV, Genital Warts, and Cervical Cancer . . . . .   | 342 |
| Herpes and HIV Infections . . . . .                 | 342 |
| Sexually Transmitted Bacterial Infections . . . . . | 343 |
| Sexually Transmitted Parasitic Infections . . . . . | 344 |
| Female Hormonal Contraception . . . . .             | 347 |
| Estrogen Analogs . . . . .                          | 348 |
| Progestins . . . . .                                | 350 |
| Testosterone . . . . .                              | 350 |
| Pharmacodynamics . . . . .                          | 350 |
| Delivery System Comparison . . . . .                | 351 |
| Oral Hormonal Contraceptives . . . . .              | 351 |
| Transdermal Contraceptive System . . . . .          | 351 |
| Vaginal Rings . . . . .                             | 351 |
| Implants . . . . .                                  | 352 |
| Intrauterine Device . . . . .                       | 352 |
| Emergency Contraception . . . . .                   | 352 |
| Urinary Incontinence . . . . .                      | 353 |
| Chapter Summary . . . . .                           | 354 |
| References . . . . .                                | 358 |

### Section III Special Conditions and Supplemental Areas . . . . . 361

|  |     |
|--|-----|
| Chapter 12 Drugs Associated with Pregnancy, Labor and Delivery,<br>and Lactation . . . . . | 363 |
| <i>Jean Nicholas, MSN</i>  |     |
| Introduction . . . . .   | 364 |
| FDA Pregnancy Categories . . . . .   | 364 |
| Medication Use on a Preconception Basis and in Early Pregnancy . . . . .                   | 365 |
| Physiological Changes in Pregnancy . . . . .   | 365 |
| Use of Nonprescribed and Illicit Drugs . . . . .   | 367 |
| Patient Emotions Around Medication Use . . . . .   | 368 |
| Common Conditions Arising in Pregnancy . . . . .   | 368 |
| Constipation . . . . .   | 368 |
| Diabetes Mellitus . . . . .  | 368 |
| Heartburn . . . . .  | 369 |
| Nausea and Vomiting in Pregnancy . . . . .   | 369 |
| Hypertension in Pregnancy . . . . .  | 370 |
| Group B Streptococcal Infection . . . . .  | 370 |
| Human Immunodeficiency Virus . . . . .   | 371 |
| Neoplastic Disease . . . . .   | 371 |
| Drugs Used During Labor . . . . .  | 372 |
| Preterm Labor . . . . .  | 372 |
| Tocolytic Medications . . . . .  | 372 |
| Labor Induction . . . . .  | 373 |
| Analgesia/Anesthesia . . . . .   | 374 |
| Drugs Used During the Postpartum Period . . . . .  | 375 |
| Drugs Administered During Lactation . . . . .  | 375 |
| Chapter Summary . . . . .  | 376 |
| References . . . . .   | 377 |

|                   |  |            |
|-------------------|--|------------|
| <b>Chapter 13</b> | <b>Pharmacology in Dermatologic Conditions</b> . . . . .                                       | <b>379</b> |
|                   | <i>Diana Webber, DNP, APRN-CNP</i>   |            |
|                   | <b>Introduction</b> . . . . .  | <b>380</b> |
|                   | Topical Administration . . . . .   | 381        |
|                   | Systemic Administration . . . . .  | 382        |
|                   | Intralesional Administration . . . . .   | 382        |
|                   | <b>Physiological Factors Affecting Transdermal Medication Administration</b> . . . . .         | <b>383</b> |
|                   | <b>Acne Medications: An Example of Delivery Systems</b> . . . . .                              | <b>383</b> |
|                   | <b>Pharmacology of Topical Acne Medication</b> . . . . .                                       | <b>385</b> |
|                   | Benzoyl Peroxide . . . . .   | 385        |
|                   | Salicylic Acid . . . . .   | 385        |
|                   | Tretinoin . . . . .  | 385        |
|                   | <b>Pharmacology of Systemic Acne Medications</b> . . . . .                                     | <b>386</b> |
|                   | Tetracyclines . . . . .  | 386        |
|                   | Isotretinoin . . . . .   | 386        |
|                   | Hormonal Medications . . . . .   | 387        |
|                   | <b>Pharmacology of Intralesional Injection Acne Treatment</b> . . . . .                        | <b>388</b> |
|                   | Intralesional Steroid Injection . . . . .  | 388        |
|                   | <b>Atopic Dermatitis</b> . . . . .   | <b>388</b> |
|                   | <b>Pharmacology of Topical Preparations for AD</b> . . . . .                                   | <b>389</b> |
|                   | Triamcinolone Acetonide . . . . .  | 389        |
|                   | Emollient Ointment . . . . .   | 389        |
|                   | <b>Bacterial Skin Infections</b> . . . . .   | <b>390</b> |
|                   | <b>Antifungal Preparations</b> . . . . .   | <b>391</b> |
|                   | <b>Pharmacology of Common Antifungal Medications</b> . . . . .                                 | <b>391</b> |
|                   | Ketoconazole 2% Cream . . . . .  | 391        |
|                   | Terbinafine . . . . .  | 392        |
|                   | <b>Chapter Summary</b> . . . . .   | <b>393</b> |
|                   | <b>References</b> . . . . .  | <b>396</b> |
| <br>              |  |            |
| <b>Chapter 14</b> | <b>Pharmacology of Psychotropic Medications</b> . . . . .                                      | <b>397</b> |
|                   | <i>Christopher Footit, RN, CS</i>  |            |
|                   | <b>Introduction</b> . . . . .  | <b>398</b> |
|                   | <b>Delusional Disorders (Psychoses): Schizophrenia and Antipsychotic Medications</b> . . . . . | <b>398</b> |
|                   | <b>Antipsychotic Medications</b> . . . . .   | <b>399</b> |
|                   | First-Generation Antipsychotics (FGAs) . . . . .   | 399        |
|                   | Second-Generation Antipsychotics . . . . .   | 401        |
|                   | <b>Depression and Anxiety</b> . . . . .  | <b>403</b> |
|                   | <b>Monoamine Oxidase Inhibitors</b> . . . . .  | <b>406</b> |
|                   | Adverse Reactions . . . . .  | 406        |
|                   | Drug–Drug Interactions . . . . .   | 407        |
|                   | Prescribing Considerations . . . . .   | 407        |
|                   | <b>Tricyclic Antidepressants (TCAs)</b> . . . . .  | <b>408</b> |
|                   | Adverse Reactions . . . . .  | 409        |
|                   | Drug–Drug Interactions . . . . .   | 409        |
|                   | Prescribing Considerations . . . . .   | 409        |
|                   | <b>SSRIs and SNRIs</b> . . . . .   | <b>409</b> |
|                   | Adverse Reactions . . . . .  | 410        |
|                   | Drug–Drug Interactions . . . . .   | 411        |
|                   | Prescribing Considerations . . . . .   | 412        |

|   |     |
|---|-----|
| Buspirone . . . . .   | 412 |
| Adverse Reactions . . . . .   | 412 |
| Drug–Drug Interactions . . . . .  | 412 |
| Benzodiazepines . . . . .   | 412 |
| Adverse Reactions . . . . .   | 413 |
| Drug–Drug Interactions . . . . .  | 413 |
| Prescribing Considerations . . . . .  | 413 |
| Bipolar Disorder . . . . .  | 414 |
| Mood Stabilizers . . . . .  | 414 |
| First-Line Medications: Lithium, Valproic Acid, and Carbamazepine . . . . .       | 414 |
| Lamotrigine . . . . .   | 415 |
| Antipsychotic Drugs in Bipolar Disorder . . . . .                                 | 416 |
| Prescribing Considerations for Drugs Used To Treat Bipolar Disorder . . . . .     | 416 |
| Attention-Deficit Disorder and Attention-Deficit/Hyperactivity Disorder . . . . . | 416 |
| Stimulant Medications . . . . .   | 417 |
| Adverse Effects . . . . .   | 418 |
| Drug–Drug Interactions . . . . .  | 418 |
| Nonstimulant Medications . . . . .  | 418 |
| Adverse Reactions . . . . .   | 419 |
| Drug–Drug Interactions . . . . .  | 420 |
| Prescribing Considerations for Drugs Used for ADD/ADHD . . . . .                  | 420 |
| Sleep Disorders . . . . .   | 421 |
| Sleep Hypnotic Drugs . . . . .  | 421 |
| Adverse Reactions . . . . .   | 422 |
| Drug–Drug Interactions . . . . .  | 423 |
| Other Sleep Aids . . . . .  | 423 |
| Prescribing Considerations for Sleep Aids . . . . .                               | 423 |
| Chapter Summary . . . . .   | 423 |
| References . . . . .  | 427 |

## Chapter 15

|  |     |
|--|-----|
| Pharmacology of Anesthetic Drugs . . . . .       | 429 |
| <i>Dwayne Accardo, DNP, CRNA, APN</i>            |     |
| Introduction . . . . .                           | 430 |
| Types of Anesthesia . . . . .                    | 430 |
| Local and Topical Anesthesia . . . . .           | 431 |
| Adverse Effects . . . . .                        | 434 |
| Inhalational Anesthesia . . . . .                | 434 |
| Drugs Used for Inhalational Anesthesia . . . . . | 435 |
| Nitrous Oxide . . . . .                          | 435 |
| Isoflurane . . . . .                             | 436 |
| Desflurane . . . . .                             | 437 |
| Sevoflurane . . . . .                            | 437 |
| Intravenous Anesthetics . . . . .                | 437 |
| Induction Anesthetics . . . . .                  | 438 |
| Propofol . . . . .                               | 438 |
| Ketamine . . . . .                               | 438 |
| Etomidate . . . . .                              | 439 |
| Barbiturates . . . . .                           | 440 |
| Anesthetic Adjuncts . . . . .                    | 441 |
| Benzodiazepines . . . . .                        | 441 |
| Opioids . . . . .                                | 441 |

|   |            |
|---|------------|
| Nonanesthetic Adjuncts . . . . .                                | 445        |
| Muscle Relaxants . . . . .                                      | 446        |
| Acetylcholinesterase Inhibitors . . . . .                       | 447        |
| Anticholinergic Drugs . . . . .                                 | 447        |
| Antiemetics . . . . .   | 448        |
| Chapter Summary . . . . .                                       | 448        |
| References . . . . .  | 450        |
| <br>  |            |
| <b>Chapter 16</b> Pharmacology of Antimicrobial Drugs . . . . . | <b>453</b> |
| <i>Blaine Templar Smith, RPh, PhD</i>                           |            |
| Introduction . . . . .  | 454        |
| Antibacterials . . . . .  | 455        |
| Sulfonamides . . . . .  | 455        |
| Drug Interactions and Contraindications . . . . .               | 458        |
| Nursing Considerations . . . . .                                | 458        |
| Tetracyclines . . . . .   | 459        |
| Nursing Considerations . . . . .                                | 460        |
| $\beta$ -Lactam Antibiotics . . . . .                           | 460        |
| Mechanism of Action . . . . .                                   | 462        |
| Penicillins . . . . .   | 462        |
| Drug Interactions and Contraindications . . . . .               | 464        |
| Nursing Implications . . . . .                                  | 464        |
| Cephalosporins . . . . .  | 465        |
| Drug Interactions and Contraindications . . . . .               | 466        |
| Nursing Implications . . . . .                                  | 466        |
| Carbapenems . . . . .   | 466        |
| Drug Interactions and Contraindications . . . . .               | 467        |
| Nursing Considerations . . . . .                                | 467        |
| Monobactams . . . . .   | 468        |
| Drug Interactions and Contraindications . . . . .               | 468        |
| Nursing Considerations . . . . .                                | 468        |
| Beta-Lactamase Inhibitors . . . . .                             | 468        |
| Drug Interactions and Contraindications . . . . .               | 468        |
| Aminoglycosides . . . . .                                       | 468        |
| Drug Interactions and Contraindications . . . . .               | 470        |
| Nursing Considerations . . . . .                                | 471        |
| Macrolides . . . . .  | 471        |
| Drug Interactions and Contraindications . . . . .               | 472        |
| Nursing Considerations . . . . .                                | 472        |
| Quinolones and Fluoroquinolones . . . . .                       | 472        |
| Drug Interactions and Contraindications . . . . .               | 474        |
| Nursing Considerations . . . . .                                | 474        |
| Lincosamides . . . . .  | 474        |
| Drug Interactions and Contraindications . . . . .               | 475        |
| Nursing Considerations . . . . .                                | 475        |
| Vancomycin . . . . .  | 476        |
| Drug Interactions and Contraindications . . . . .               | 476        |
| Nursing Considerations . . . . .                                | 476        |
| Newer Anti-Infective Drugs for Resistant Infections . . . . .   | 477        |
| Drug Interactions and Contraindications . . . . .               | 478        |
| Quinupristin/Dalfopristin . . . . .                             | 478        |
| Linezolid . . . . .   | 478        |



|   |            |
|---|------------|
| Nursing Considerations . . . . .  | 479        |
| Quinupristin/Dalfopristin . . . . .                                       | 479        |
| Linezolid . . . . .   | 479        |
| <b>Antitubercular Drugs . . . . .</b>                                     | <b>479</b> |
| Drug Interactions and Contraindications . . . . .                         | 480        |
| Isoniazid (INH) . . . . .   | 480        |
| Ethambutol . . . . .  | 480        |
| Ethionamide . . . . .   | 480        |
| Pyrazinamide (PZA) . . . . .  | 480        |
| Rifampin . . . . .  | 480        |
| Streptomycin . . . . .  | 480        |
| Nursing Considerations . . . . .  | 480        |
| Isoniazid . . . . .   | 480        |
| Ethambutol . . . . .  | 481        |
| Ethionamide . . . . .   | 481        |
| Pyrazinamide . . . . .  | 481        |
| Rifampin . . . . .  | 481        |
| Streptomycin . . . . .  | 481        |
| <b>Antifungal Agents . . . . .</b>  | <b>481</b> |
| Drug Interactions and Contraindications . . . . .                         | 483        |
| Nursing Considerations . . . . .  | 483        |
| <b>Antiparasitic Agents . . . . .</b>                                     | <b>484</b> |
| <b>Protozoal Infections . . . . .</b>                                     | <b>484</b> |
| <b>Antiprotozoal Medications . . . . .</b>                                | <b>484</b> |
| Drug Interactions and Contraindications . . . . .                         | 484        |
| Nursing Considerations . . . . .  | 487        |
| <b>Anthelmintic Agents . . . . .</b>                                      | <b>487</b> |
| Drug Interactions and Contraindications . . . . .                         | 488        |
| Nursing Considerations . . . . .  | 488        |
| <b>Antivirals . . . . .</b>   | <b>488</b> |
| <b>Anti-Herpesvirus Agents . . . . .</b>                                  | <b>490</b> |
| <b>Anti-Influenza Agents . . . . .</b>                                    | <b>492</b> |
| <b>Anti-Hepatitis Agents . . . . .</b>                                    | <b>492</b> |
| <b>Antiretroviral Agents . . . . .</b>                                    | <b>496</b> |
| <b>Nucleoside Reverse Transcriptase Inhibitors (NRTIs) . . . . .</b>      | <b>497</b> |
| Drug Interactions and Contraindications . . . . .                         | 497        |
| Nursing Considerations . . . . .  | 498        |
| <b>Non-Nucleoside Reverse Transcriptase Inhibitors (NNRTIs) . . . . .</b> | <b>499</b> |
| Drug Interactions and Contraindications . . . . .                         | 499        |
| Nursing Considerations . . . . .  | 499        |
| <b>Protease Inhibitors (PIs) . . . . .</b>                                | <b>499</b> |
| Drug Interactions and Contraindications . . . . .                         | 501        |
| Nursing Considerations . . . . .  | 501        |
| <b>Entry Inhibitors (EI) . . . . .</b>                                    | <b>501</b> |
| <b>Integrase Strand Transfer Inhibitors (ISTIs) . . . . .</b>             | <b>501</b> |
| <b>Chapter Summary . . . . .</b>  | <b>503</b> |
| <b>References . . . . .</b>   | <b>506</b> |
| <b>Glossary . . . . .</b>   | <b>509</b> |
| <b>Index . . . . .</b>  | <b>525</b> |

# Introduction

*Pharmacology for Nurses* is an earnest attempt to provide a fundamentally solid yet quickly learnable foundation from which to teach nursing pharmacology courses. It was created to provide an alternative pharmacology textbook for nurses to those previously available. There is a tendency for nursing pharmacology textbooks to be either overly complex or overly simplified for the needs of nursing students. This is not to say comprehensive pharmacology textbooks are not of value. It is a simple fact of the education paradigm that pharmacology must be a component of nursing education, but there is insufficient time to delve into the details of each topic during the regular curriculum. Therefore, the authors recognized a need for a “core” pharmacology textbook that not only provides a solid foundation for nurses but also is compatible with the realities of course constraints encountered in any curriculum.

The textbook is divided into three major sections. The first section provides the general information needed to

make the student comfortable with both how pharmacology fits into professional nursing and the mathematical foundation on which later sections are based. The second section is intended to provide basic pharmacology and is arranged by organ or physiologic system. The reader’s previous understanding of physiology is usually assumed, so physiology review is minimized in order to more directly address common systems of drug receptors utilized for medical interventions. The third section is dedicated to the physiologic systems that, though regularly encountered in practice, are not considered primary systems.

After reading this textbook, presumably in association with pharmacology courses offered, it is hoped the essentials for capable professional nursing practice will be afforded, while offering a nonintimidating presentation of the topic. It is our hope that this instills a true interest in pursuing more in-depth pharmacology education as situations inevitably present themselves in everyday professional nursing practice.

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# SECTION I

# Pharmacology for Nurses: Basic Principles



# Introduction to Pharmacology

Jean Nicholas

## KEY TERMS

Assessment  
Controlled substances  
Drug classification

Drug name  
Goals  
Medication errors

Nursing diagnoses  
Nursing process  
Pharmacology

Prescription drugs

## CHAPTER OBJECTIVES

At the end of the chapter, the reader will be able to:

1. Discuss how drugs are classified.
2. Differentiate between *brand* versus *generic* drug names.
3. List the five steps of the nursing process.
4. Identify categories of controlled substances.
5. Name two sources for obtaining drug information.
6. Discuss legal and ethical responsibilities of the nurse when administering medication.
7. Define *medication error*.

## Introduction

In modern health care, there is an increasing reliance on medication therapy to manage illness and disease, to slow progression of disease, and to improve patient outcomes. Medications offer a variety of potential benefits to the patient: relief of symptoms, support for necessary physiological processes, and destruction of toxic substances or organisms that cause disease, to name a few. Yet medications also have the potential to do harm, even when administered properly—and the harm is likely to be exacerbated if medications are administered incorrectly. The administration of drugs introduces opportunity to affect either remedy or harm.

As the persons most often charged with administering medications to patients, nurses can minimize any harm associated with medications by carrying out this task with few, if any, errors (Institute of Medicine [IOM], 2007). A 2007 IOM (now the National Academy of Science) report on medication safety, titled *Preventing Medication Errors*, emphasized the urgency of reducing medication errors, improving communication with patients, continually monitoring for medication errors, providing clinicians with decision-support and information tools, and improving and standardizing medication labeling and drug-related information (IOM, 2007).

If one of nursing's primary roles is the safe administration of medications, it is important to realize that this requires knowing not only how to correctly administer medications to patients, but also how to determine whether the intended effects are achieved and whether any adverse, or unintended, effects have occurred. Without adequate understanding of drugs and their effects on the body, nurses are unable to meet their professional and legal responsibilities to their patients. This text will provide the reader with that knowledge.

## Nursing and Pharmacology

**Pharmacology** is the study of the actions of drugs, incorporating knowledge from other interrelated sciences, such as

pharmacokinetics (how the body absorbs, distributes, metabolizes, and excretes a drug) and pharmacodynamics (a drug's mechanism of action and effect on an organism). Knowledge of the various drug classes enables the nurse to understand how drugs work in the body, to achieve the therapeutic (intended) effects, and to anticipate and recognize the potential side effects (unintended or unavoidable) or toxicities. To understand the pharmacology of drugs, and related information, such as drug interactions and side effects, it is important to understand drugs' mechanisms of action, at the *molecular* level. Rather than merely understanding a drug's actions, interactions, side effects and dosage requirements, the nurse should strive to understand the process behind these elements of drug administration. This requires at least a fundamental understanding of drug–drug receptor interactions, even if at an elementary “lock and key” level. Only then will drug effects, interactions, and side effects, and the logic behind dosing regimens, reveal a complete picture. Chapter 2 continues this discussion in depth.

The value of this knowledge in nursing cannot be overemphasized. The nurse's role as caretaker puts the nurse in the position of being closest to the patient and best able to assess both the patient's condition prior to use of a medication as well as the patient's response to the medication—two key components of appropriate medical therapy. Clearly, under these circumstances, it is ideal for the nurse to have a solid, in-depth understanding of when, how, and for whom medications are best used, and what the expected response is when specific pharmaceutical therapies are implemented.

At the most basic level, nurses must learn the various diagnostic and therapeutic classes of medications; recognize individual drug names, both trade and generic; know about the applications and availability of prescription and nonprescription medications, a particularly the restrictions regarding controlled substances; and be familiar with sources, both printed and online, where the nurse may obtain specific information about





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particular drugs, including dosage, interactions, and contraindications.

### Drug Classifications

Drugs are classified by how they affect certain body systems, such as the use of *bronchodilators* for respiratory conditions; by their therapeutic use, such as *antinausea*; or based on their chemical characteristics, such as *beta-blockers*. Many may fit into more than one **drug classification** due to the various effects that they exert in the body. Because drugs in the same *class* have many features in common, categorizing them in these ways helps nurses become familiar with many of the drugs they are administering. For example, although there are many types of angiotensin-converting-enzyme inhibitors, they have many common side effects.

### Drug Names

Nurses must know both the *trade* name of a drug, which is assigned by the pharmaceutical company that manufactures the drug, and the *generic* name, which is the official **drug name** and is not protected by trademark. When a manufacturer receives a patent for a new drug, this means that no other company can produce the drug until the patent expires. Once this patent has expired, other companies may manufacture the drug with a different trade name but equivalent chemical makeup. Some companies choose to use the generic name only—for example, **lisinopril** is now manufactured by many different drug companies. Generic names are not capitalized.



Drugs may be prescribed and dispensed by either trade name or generic name, as generic drugs are considered equivalent in most cases. Generic drugs are typically less expensive than trade-name drugs.

### Prescription and Nonprescription Drugs

In the United States, consumers have two ways to legally access drugs. One is to obtain a *prescription* for the drug from a licensed provider, such as a physician, dentist, or nurse practitioner; the other is to purchase drugs that do *not* require a prescription on an *over-the-counter (OTC)* basis. Some drugs previously available only by prescription have now become available OTC. Thus, it is essential for the nurse to gather information about the patient's use of both **prescription drugs** and OTC medications, as some combinations of different types of drugs can affect the actions and toxicities of either. Various drug laws regulate these ways of acquiring drugs.

### Controlled Substances

The Comprehensive Drug Abuse Prevention and Control Act was passed in 1970 and

#### Best Practices

Nurses are required to keep controlled substances in secure, locked locations, administering them only to patients with valid prescriptions or physician's orders.

regulates the manufacturing and distribution of substances with a potential for abuse—examples include narcotics, hallucinogens, stimulants, depressants, and anabolic steroids. These **controlled substances** are categorized by schedule (Schedules I–V), based on their therapeutic use and potential for abuse (**TABLE 1-1**). The Drug Enforcement Agency (DEA) enforces the law and requires all individuals and companies that handle controlled substances to provide storage security, keep accurate records, and include the provider number assigned by the DEA on all prescriptions for controlled substances. Schedule I drugs have a high potential for abuse and the potential to create severe psychological and/

or physical dependence; and in most cases, Schedule I drugs are illegal substances. Therefore, Schedule I drugs are not dispensed, except in rare instances of specific scientific or medical research. No refills can be ordered on Schedule II drugs; instead, providers must write a new prescription.

Nurses are required to keep controlled substances locked in a secure room or cabinet, administering them only to patients with valid prescriptions or physician's orders. Nurses must maintain accurate records of each dose given and the amount of each controlled substance on hand, and must report any discrepancies to the proper authorities.

### Sources of Drug Information

With Internet access readily available for personal as well as professional use, obtaining drug information is easy. For the beginning student, however, access to a pharmacology textbook is helpful for learning and understanding the therapeutic uses of drugs. Drug reference guides are helpful when looking up a specific drug and the nursing implications of administering that agent. Drug information can be obtained through authoritative sources such as *American Hospital Formulary Service*, published by the American Society of Health-System Pharmacists ([www.ahfs.org](http://www.ahfs.org)).



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**TABLE 1-1** Controlled Substances Categories Designated by the U.S. Government

| Schedule | Dispensing Requirements  | Examples   |
|----------|--|--|
| I        | Drugs not approved for medical use, except specific protocols: high abuse potential.   | LSD, marijuana, heroin, gamma-hydroxybutyrate (Ecstasy)  |
| II       | Drugs approved for medical use: high abuse potential. Must be kept in locked safe. No refills without a new prescription.                    | Opioid analgesics (e.g., codeine, morphine, hydromorphone, methadone, oxycodone), central nervous system stimulants (e.g., cocaine, amphetamine), depressants (e.g., barbiturates—pentobarbital) |
| III      | Less potential for abuse than Schedule I or II drugs but may lead to psychological or physical dependence. Prescription expires in 6 months. | Anabolic steroids; mixtures containing small amounts of controlled substances, such as codeine   |
| IV       | Some potential for abuse. Prescription expires in 6 months.  | Benzodiazepines (e.g., diazepam, lorazepam), other sedatives (e.g., phenobarbital), some prescription appetite suppressants (e.g., mazindol)   |
| V        | Written prescription requirements vary with state law.   | Antidiarrheal drugs containing small amounts of controlled substances (e.g., Lomotil)  |



ahfsdruginformation.com); *Tarascon Pharmacopoeia*, published by Jones & Bartlett Learning; or *Drug Facts and Comparisons*, published by Lippincott Williams & Wilkins/Wolters Kluwer. These resources are updated periodically. *The Physicians' Desk Reference* is published yearly and includes pharmaceutical manufacturers' package inserts for specific drugs. Nurses can also obtain package inserts from the dispensing pharmacy—this is helpful when a drug is relatively new and information is not readily available from other resources.

Online resources and mobile applications include Micromedex and Lexicomp, both of which are searchable databases offering drug information, drug interactions, drug identification tools, medical calculators, and patient counseling information.

Continuing education about drug therapy is an essential part of professional nursing. Reading current peer-reviewed journal articles, which often include information about drug therapy for specific conditions, should be part of every nurse's professional development.

## QSEN Competencies

The Quality and Safety Education for Nurses (QSEN) project, developed by the American

Association of Colleges of Nursing, identified six competencies to prepare nurses with the knowledge, skills, and attitude needed to improve workplace quality and safety within healthcare systems. These competencies are as follows:

- Patient-centered care
- Teamwork and collaboration
- Evidence-based practice
- Quality improvement
- Safety
- Informatics

## Overview of the Nursing Process

The **nursing process** is a systematic, rational, and continuous method of planning, providing, and evaluating individualized nursing care to optimize the administration of medications. The nursing process involves critical thinking throughout each of its five steps: assessment, nursing diagnosis, planning and establishing goals or outcomes, intervention, and evaluation. Administering medications involves much more than the psychomotor skill of preparing and giving medications; the nurse must use cognitive skills throughout the nursing process to ensure patient safety during drug therapy. The QSEN competencies, especially safety and patient-centered care, are woven into the framework of the nursing process.

### Best Practices

Continuing education about drug therapy is an essential part of professional nursing.





## Assessment

**Assessment** involves collecting subjective and objective data from the patient, significant others, medical records (including laboratory and diagnostic tests) and others involved in the patient's care. These data may affect whether a medication should be given as ordered, or whether a provider's order should be questioned and confirmed. In addition, in the assessment step the nurse gathers data about the drug(s) that he or she is responsible for administering and monitoring. Assessment is ongoing throughout the entire nursing process, as patients' conditions may change. Nurses must continually monitor drug effects, both therapeutic and unintended. A complete medication history and nursing physical assessment are parts of the assessment step.

## Nursing Diagnosis

The second step of the nursing process involves clustering the data gathered during the assessment, analyzing it for patterns, and making inferences about the patient's potential or actual problems. **Nursing diagnoses**, as developed by the North American Nursing Diagnosis Association (NANDA), are statements of patient problems, potential problems, or needs. This text will address nursing diagnoses that pertain more specifically to drug therapy. Some examples of selected diagnoses follow:

- Patient has a knowledge deficit related to drug therapy and reasons for use; need for follow-up tests and office visits
- Patient is at risk for injury related to adverse effects of medication
- Patient is at risk for falls related to various anticipated or unanticipated side effects of medications
- Diarrhea (or constipation) related to side effects of medications
- Ineffective health maintenance related to inability to make appropriate judgments or to lack of resources

## Planning

Once the data have been analyzed and nursing diagnoses identified, the planning phase

begins. During this phase, **goals** and outcome criteria are formulated. Nurses will prioritize identified needs, keeping patient comfort and safety as top priorities. The planning step incorporates the QSEN competency of patient-centered care. Patients are seen as full partners in the planning process and the goals recognize the patient's preferences and values. In *patient* terms, the goals and outcome criteria identify the expected behaviors or results of drug therapy. For example, the patient may be expected to and agree to do the following:

- List the steps for correctly drawing up his or her insulin dosage
- Demonstrate the correct technique for self-administration of a medication patch
- Verbalize the most common side effects of a medication
- Report pain relief of at least 3 on a scale of 10 within 30 minutes

Goals are usually broad statements for achievement of more specific outcome criteria. A timeline is often included so that there can be realistic achievement of goals. During the planning phase, the nurse must familiarize himself or herself with any special information or equipment needed to administer a medication. If knowledge attainment by the patient is the goal, appropriate patient teaching materials must be obtained. Because many medications are administered by the patient himself or herself (or the family), teaching is an important part of the nursing process for drug therapy.



## Intervention

The intervention (or implementation) phase of the nursing process involves carrying out the planned activities, being mindful that ongoing assessment of the patient is needed before every intervention. For example, perhaps a patient has a laxative ordered daily but has been having loose stools all night. The nurse will need to assess this patient's current condition (i.e., complaint of loose stools) and decide how to proceed with the intervention (e.g., withhold the medication and notify the prescriber). Here, the nurse will value the patient as expert on his or her own health and symptoms, in conjunction with objective assessment. As this example illustrates, interventions for drug therapy involve not only the actual administration of medications, but also observation of the effects of the medications, as well as provision of additional measures to optimize the effects of certain medications, such as increased fluid intake to promote bowel elimination or reduce fever.

During the intervention process, the nurse encounters a variety of points at which he or she is required to make assessments and decisions about whether to proceed. Certain medications, such as antihypertensive or cardiac drugs, will require specific actions at the time of administration, such as measuring blood pressure or heart rate. If the identified parameters for these vital signs are not met, the medication may not be given.



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Clearly, nurses require specific skills related to the intervention decision-making process. While these skills will not be enumerated in detail in this chapter, in general they include the following elements:

- Knowing and following correct procedures for confirming whether the medication is appropriate for the patient
- Knowing and following correct procedures for administering medications via different routes (oral, injection, intravenous, and so forth)
- Having the ability to identify and avoid factors that contribute to errors

## Evaluation

The evaluation phase of the nursing process is a continuous process of determining progress toward identified goals. For some medications, the response can be identified quickly—for example, relief of pain following administration of an analgesic, again, utilizing patient-centered care as an approach to the evaluation. For other medications, the response is slower and must be monitored on an ongoing basis. A newly prescribed antihypertensive medication, for example, may require follow-up visits to the clinician's office for blood pressure checks and assessment of side effects. Evaluation may involve reviewing pertinent laboratory and other diagnostic tests, observing patient performance of a learned procedure, or interviewing patients and significant others about the effects of their medications.

Documentation is an essential component of all phases of the nursing process. Specific guidelines for documentation of medication administration and related teaching are prescribed by state nursing practice statutes and The Joint Commission (formerly the Joint Commission on Accreditation of Healthcare Organizations).

Patient- and drug-specific variables affect the nursing process as it relates to drug therapy. Factors such as the patient's age, physical condition (e.g., renal or liver impairment),

### Best Practices

Documentation is an essential component of all phases of the nursing process.

psychological/mental ability to self-administer medication, and educational level are integral parts of the nurse's knowledge base for safe medication administration.

The nursing process is a dynamic tool used to enhance the quality of patient care. Each step involves critical thinking to provide individualized, safe, effective, and thoughtful patient care. Use of this process enables nurses to incorporate safe administration and monitoring of drug therapy into the overall plan of care for each patient, whatever the setting.

## Cultural Aspects of Drug Therapy

As the United States becomes increasingly culturally diverse, nurses administering and monitoring medications must be aware of how various cultural beliefs and practices affect health care, particularly the use of medications. In addition, physical differences may affect how certain cultural or ethnic groups respond to specific medications. For many years, research on drugs was carried out using only white male subjects. Thus, the medications' effects on females or nonwhite males could not be accurately predicted, but rather were determined only by observing patient outcomes. Response to drug therapy is highly individualized, and nurses must be careful not to assume an eventual successful or failed

response just because a patient appears to belong to a certain ethnic or cultural group.

Examples of cultural considerations affecting nursing care in drug therapy include pain response, belief in traditional "healers" versus belief in the medication's effectiveness for restoring health, use of herbal remedies, ability to communicate effectively with healthcare providers, and compliance with long-term drug therapy. A careful nursing assessment will include cultural beliefs and practices that may impact drug therapy. Nurses are encouraged to learn about cultural and ethnic groups commonly encountered in the healthcare settings of their practices.

## Legal-Ethical Aspects of Drug Therapy

The legal responsibilities of nurses for medication administration are defined in state nurse practice acts and healthcare organization policies and procedures. The Eight Rights of Medication Administration, discussed in detail in Chapter Three, form the basis of safe drug therapy (Bonsall, 2011). These eight rights, briefly, ensure that (1) the right drug is given to (2) the right patient at (3) the right dose via (4) the right route at (5) the right time, for (6) the right reasons, with (7) the right documentation, to obtain (8) the right response. Some clinicians and institutions include two additional rights: right education (correctly educating the patient in therapeutic effects of the drug as well as expected side effects) and right to refuse (the patient or responsible party has the right to refuse medication administration). Most **medication errors** result from the failure to follow one of these "rights." Beyond maintaining awareness of these Eight Rights, nurses must possess the cognitive and psychomotor skills required to safely administer medication and monitor the effects.

Ethical aspects of nursing care were identified by the American Nurses Association (ANA) in the 2001 *Code of Ethics* (ANA, 2001). These guidelines provided

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A careful nursing assessment will include cultural beliefs and practices that may impact drug therapy.



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ethical principles to be adhered to by every professional nurse. The Code included principles recommending that nurses (1) respect the dignity of all patients, regardless of ethnicity, socioeconomic status, or specific health problem; (2) participate in activities to support maintenance of their professional competence; (3) protect patients' privacy and confidentiality; and (4) make a commitment to providing quality patient care in every setting.

Since the original *Code of Ethics* was released, the ANA has added more provisions, along with interpretive statements. The 2015 *Code of Ethics for Nurses with Interpretive Statements* comprised nine provisions (ANA, 2015):

1. Respect for human dignity
2. Primacy of patient interests
3. Protection of patient privacy and confidentiality
4. Authority, accountability, and responsibility for nursing practice
5. Duty to self and others
6. Maintaining an ethical environment
7. Contributions through research and scholarly inquiry
8. Health as a universal right
9. Articulation and assertion of nursing values

## Medication Errors

Medication errors are a daily occurrence in many healthcare facilities, sometimes resulting in serious—even fatal—consequences. It should be the goal of every healthcare professional to be aware of the potential for errors and to strive for prevention of these problems. Errors can occur during the prescribing, dispensing, administration, or documentation phases of medication administration. Thus, the error may be detected by the pharmacist, physician, nurse, or other staff, such as the person transcribing the order to the patient's medication administration record (MAR). The ECRI Institute noted in their Top 10 Patient Safety Concerns for 2017 list that information management in electronic health records, unrecognized patient deterioration,

and implementation and use of clinical decision support were the top three causes for medical errors. Opioid administration and management of new oral anticoagulants were medication-specific concerns on the list (ECRI Institute, 2017).

### How Often Do Medication Errors Occur?

Medication errors have the potential to occur at numerous times during the complex delivery process, but their actual incidence is difficult to quantify. The reason the frequency of medication administration errors is difficult to calculate is because error rates vary depending on the method of measurement used to assess the errors (McBride-Henry & Foureur, 2006). The most accurate way to measure the occurrence of medication administration errors is through direct observation of practice (Barker, Flynn, & Pepper, 2002; Barker, Flynn, Pepper, Bates, & Mikel, 2002; Keers, Williams, Cooke, & Ashcroft, 2013b; Thomas & Peterson, 2003); self-reported data underrepresents true error rates (Nanji, Patel, Shaikh, Seger, & Bates, 2016). Two observational studies discovered that medication administration error rates in acute care settings varied between 14.9% (Tissot et al., 2003) and 32.4% (Schneider, Cotting, & Pannatier, 1998), with medication error rates for intravenous medications being significantly higher during the preparation (26%) and administration (34%) stages (McBride-Henry & Foureur, 2006; Keers, Williams, Cooke, & Ashcroft, 2013b; Wirtz, Taxis, & Barber, 2003). Observed medication administration demonstrated errors in nearly one out of every five doses (Barker, Flynn, Pepper, et al., 2002). Of note, studies primarily target inpatient care; thus, medication errors occurring in nursing homes or ambulatory surgery centers (and other outpatient care facilities) are not captured in the data (Makary & Daniel, 2016).

### How Can Medication Errors Be Prevented?

In 2003, the Institute for Safe Medication Practices (ISMP) identified several key areas



## Best Practices

Many medication errors occur during times of a patient transfer—for example, when a patient is being transferred from intensive care to a patient unit, from an inpatient unit to an outpatient facility or home, or from the care of one provider to another.

of focus for error prevention. Many errors occur during patient transfer—for example, when a patient is being transferred from intensive care to a patient unit, from an inpatient unit to an outpatient facility or home, or from the care of one provider to another. Medication reconciliation forms are now being used in many facilities to prevent medications from being omitted during transfers and to prompt physicians to review existing medication orders when transferring care. Bedside rounds, in which

the nurse coming onto the succeeding shift accompanies the nurse going off-shift, are another helpful means of communicating medication changes. Nurses must be vigilant to ensure that these tools are utilized properly if they are to be effective in preventing errors.

Another area of focus is patient identification. Recent technological advances have been developed to reduce medication error rates by better associating patient and medication identities. Special patient wrist bracelets with bar-coding that require nurses to scan the bracelet before administering a medication are now being used, which facilitates matching the “right drug” to the “right patient.” Every nurse should develop the habit of verifying patients’ identities by asking each to state his or her name and date of birth. Photo identification can be used for nonverbal patients.

Environmental factors may also contribute to errors. Increased workload, working with acutely ill patients, distractions while preparing and administering medications, problems with medicine supply and storage, and nurse/staff fatigue have all been noted to lead to a higher number of errors (Anderson & Townsend, 2010; Keers, Williams, Cooke, & Ashcroft, 2013a).

The ISMP continues to identify areas of best practice. They released the 2016–2017 Targeted Medication Safety Best Practices for Hospitals, which consists of 11 medication-specific practices for



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hospital-based and other healthcare settings, targeting areas in which there continue to be harmful and fatal errors (ISMP, 2016). Nurses should be active on committees and in professional organizations that are looking at these practice issues.

Hospitals and other providers have worked with pharmaceutical companies to reduce errors caused by similarly named drugs. Nurses should assess the patient and know why a patient is receiving a particular medication. They must carefully read medication labels, compare the labels to the prescribed order, and follow guidelines for proper use. For example, a medication label may say, “Do not crush.”

Finally, all nurses must be responsible for maintaining and updating their knowledge of the medications they administer and the equipment they use. Patient teaching is also a key to preventing errors. An informed patient will question his or her nurse if the medication looks different from the usual “pill.” In some cases, a generic version of a drug could have been substituted; in other cases, an error might be prevented.

## Conclusion: Pharmacology in Nursing Practice

Given the central role of medical therapy in modern health care, the need for nurses to have a solid foundation in pharmacology is profound. Understanding how a drug acts in the body, how the body acts on the drug, and anticipating potential positive and adverse effects of drugs is tantamount if nurses are to knowledgeably administer drugs to patients. Recognizing drug actions based on knowledge of pharmacology enables the nurse to anticipate whether changes in patient symptoms indicate drugs are having its intended or adverse effects, whether medications are acting as drugs or poisons—“pharmacons.” The act of administering medications is where the theory of medicine is put into practice. It is also where the general understanding of human biochemistry manifests in the reality that all people are different. Nurses are tasked with identifying how these differences may affect the use of a medical therapy in a patient and with determining the actions necessary to ensure the therapy’s success. By learning about pharmacology, nurses can equip themselves to make sure that the tools of medicine are used appropriately to heal illness and relieve distress in their patients.

### CHAPTER SUMMARY

- Pharmacology is the study of the actions of drugs, incorporating knowledge from other sciences.
- Drugs are classified based on their action or effect on the body or by their chemical characteristics.
- Nurses must be familiar with both generic and trade names of drugs.
- Controlled substances are categorized based on their potential for abuse and their prescribed uses.
- Drug information is available from many sources; nurses should familiarize themselves with reliable tools to gain knowledge of drug therapy.
- The five steps of the nursing process—assessment, nursing diagnosis, planning and goal setting, intervention, and evaluation—are a key part of safe drug administration.
- The success of drug therapy may vary because of cultural beliefs or ethnic differences.

- Nurses must follow legal and ethical guidelines for drug administration.
- Nurses must be aware of the potential for medication errors, working to provide a safe environment for drug therapy.

### Critical Thinking Questions

1. What is pharmacology?
2. List three characteristics of a medicine used as a basis for drug classification.
3. Discuss the rationale for nurses knowing both generic and trade names of drugs.
4. What is an example of a Schedule II drug? What are the prescriptive limitations placed on such a drug?
5. Describe the five steps of the nursing process.
6. Identify at least three factors that can contribute to medication errors.

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