CHAPTER 1

INTRODUCTION TO PHARMACOLOGY: CONCEPTS AND CONNECTIONS

Learning Outcomes

1. Identify key events in the history of pharmacology.

   Suggested Classroom Activity: Make a timeline with students to demonstrate how the science of pharmacology has progressed in the past 200 years.

   Suggested Clinical Activity: Discuss future developments in pharmacology with the pharmacist at a clinical site.

2. Compare and contrast the terms *drug*, *pharmacology*, and *pharmacotherapy*.

   Suggested Classroom Activity: Using the examples of water, vitamin C, and natural hormones, discuss how a patient may be confused about the difference between a substance for everyday use or one that naturally occurs in the body, and how these substances change when used in drug therapy.

   Suggested Clinical Activity: Have students ask a nurse at a clinical site for an example of how pharmacotherapy made a difference in a patient's health.

3. Explain the importance of pharmacotherapy to clinical nursing practice.

   Suggested Classroom Activity: Have students discuss various ways of finding up-to-date drug therapy information. Suggestions include reference books, evidence-based internet sites, ongoing clinical education, and pharmacists.

   Suggested Clinical Activity: Have students ask a nurse at a clinical site how he or she learns about new drugs and their indications, side effects, and common dosages.

4. Using specific examples, explain the difference between the pharmacologic and therapeutic methods of classifying drugs.

   Suggested Classroom Activity: Go to the FDA Orange Book website. Engage students in using the website to search for various drugs. Use the FAQ link to demonstrate how to stay updated on new drugs.

   Suggested Clinical Activity: Have students compare and contrast medication therapy used for patients who have the same disease state, but are being treated with different drugs. Compare the drug's pharmacologic and therapeutic classifications.

5. Identify the advantages of using prototype drugs to study pharmacology.

   Suggested Classroom Activity: Have students use the textbook to locate a prototype drug. Discuss how it is easily identifiable and what important nursing considerations are listed for each prototype.

Suggested Clinical Activity: Have students look at a medication administration record for an assigned patient. Determine which drugs are prototypes and which are not and compare them, noting similarities and differences.

6. Classify drugs by their chemical, generic, and trade names.

   Suggested Classroom Activity: Have students look at popular generics such as acetaminophen, aspirin, and ibuprofen. Have them identify popular trade names for these drugs. Then look at which products may represent a combination of drugs.

   Suggested Clinical Activity: Have students take a drug history from a patient. Discuss if the patients identify their medications by generic or trade names. Have students discuss how this could lead to possible medication errors.

7. Discuss the rationale for a pharmaceutical company receiving exclusivity for the marketing of a new drug.

   Suggested Classroom Activity: Using internet pharmacy sites, compare and contrast the differences between prices for trade and generic drugs.

   Suggested Clinical Activity: Have students interview a pharmacist regarding the changes that occur when a pharmaceutical company's period of exclusivity for the manufacture of a drug expires.

8. Analyze possible differences between generic drugs and their trade-name equivalents.

   Suggested Classroom Activity: Give examples of drugs that may be available to the patient in both trade and generic names. Suggestions include ibuprofen, loratadine, and pseudoephedrine. Discuss what could change the bioavailability of the drug.

   Suggested Classroom Activity: Have students role-play a scene in which a patient asks a nurse if generic substitutions are safe, and how the nurse would respond. Role-play another scene where the patient asks the nurse about using an overseas internet pharmacy.

   Suggested Clinical Activity: Have students interview a hospital pharmacist to find out what the law in their state is regarding substitution of generic drugs. Ask how the pharmacist discusses the use of generic drugs with the prescriber.

   Suggested Clinical Activity: Have students interview a neighborhood pharmacist about insurance reimbursement for generic drugs.

9. Explain how a biosimilar drug differs from its reference product.

   Suggested Classroom Activity: Have students interview a hospital pharmacist to determine how often a biosimilar versus its trade-name drug is prescribed.

   Suggested Classroom Activity: Have students investigate the online site for the drug Zarxio to determine how the drug is marketed as a biosimilar.

Suggested Clinical Activity: Have students interview a prescriber to discuss the pros and cons a prescriber might consider when choosing between a biosimilar or a trade-name drug for a given patient.

10. Identify the responsibilities of the nurse in drug administration as part of an interprofessional team.

    Suggested Classroom Activity: Have students review the core responsibilities for safe drug administration and discuss how each concept can prevent medication errors.

    Suggested Classroom Activity: Have students work in small groups and interview each other. Have them identify differences in their own demographics that would influence safe drug therapy.

    Suggested Clinical Activity: Have students shadow a nurse in a hospital or clinic setting who is assigned to administer medications. Have students observe how the nurse checks to make sure the medications are correct for that patient, if the drugs are dispensed in trade or generic names, what checks the nurse completes before dispensing the medication, and what teaching the nurse offers the patient about the medication.

Key Concepts

1. Over 3.6 billion prescriptions are dispensed each year in the United States, with the number rapidly increasing.
2. Pharmacology, now a key aspect of nursing care, started with early man using plants and herbs to relieve disease symptoms. Many early remedies were accidental discoveries.
3. The first "prescriptions" were written in the year 3000 BC by the Babylonians. The Chinese recorded the first volume of plant remedies in the year 2700 BC.
4. Pharmacology was probably viewed as magic and superstition during the Dark Ages. There is very little recorded data from the Dark Ages.
5. Pharmacology first began to be practiced as a science in the 17th century, and the first text with the word *pharmacology* was published in 1693.
6. During the 19th century, chemists were able to make remarkable progress in separating specific substances and the first active drugs such as morphine, colchicine, curare, cocaine, and other early drugs were discovered from their natural plant products.
7. Pharmacology was first recognized as a discipline in Estonia in 1847. In the United States, the first pharmacology department was at the University of Michigan in 1890.
8. The 20th century saw great progress and development of new drugs. We are now able to synthesize drugs from "scratch" in the laboratory.
9. A drug is any substance that is taken to prevent, cure, or reduce symptoms of a medical condition.

10. The word *pharmacology* came from the Greek *pharmakon,* which means "medicine" or "drugs," and *logos,* which means "study."

11. The subject of pharmacology is expansive and involves understanding what a drug is given for, how it is administered, where it travels in the body, the actual response it produces, and how it is eliminated.

12. Pharmacotherapy or pharmacotherapeutics is the application of drugs for the purpose of disease prevention and treatment.

13. Over 11,000 trade-name, generic, and combination agents are available, each with its own application, interactions, side effects, and actions.

14. Many drugs have more than one use. They may be prescribed for more than one disease, and many produce multiple effects in the body.

15. Patient factors that can cause drugs to elicit a different response are age, gender, race, body mass, health status, and genetics.

16. Staying current and up to date with new drugs is critical for the patient and healthcare provider. Proper application of a drug can improve quality of life, whereas an improperly applied drug can cause disability or even death.

17. Many people believe that there are perfect drugs and that the perfect drug should and can always be selected for the patient.

18. The perfect or ideal drug is effective, can be given at low doses, works quickly, has no adverse effects, can be taken conveniently, can be taken infrequently, is inexpensive, is quickly eliminated from the body, and does not interact with other medications or food.

19. There is no such thing as a perfect drug. Drugs that are used most often are ones that are close to the perfect drug profile. Drugs that have a profile that strays furthest from the perfect drug profile are used infrequently.

20. Conditions for which drugs are approved are called *indications*. All prescription drugs have at least one indication and some have multiple indications.

21. Some drugs are used for conditions for which they do not have an approved indication; this is called an *unlabeled* or *off-label use*.

22. The U.S. Food and Drug Administration (FDA) publishes a document called the *Approved Drug Products with Therapeutic Equivalence Evaluations*," which is also called the "Orange Book." This document currently lists over 11,000 approved drugs. The list includes both prescription and nonprescription drugs.

23. Drugs are categorized in two ways: a therapeutic classification and a pharmacologic classification.

24. The therapeutic classification is based on how the drug is used in treating a specific disease.

25. The pharmacologic classification is based on the mechanism of drug action or how the drug produces its effects in the body.

26. Drugs may also have multiple therapeutic and pharmacologic classifications that are dependent on the clinical use of the drug.

27. The prototype drug is usually the first and best understood drug in its class, but sometimes the prototype may be a new or more clinically useful drug.

28. By learning about the prototype drug, nurses can understand the depth, actions, and adverse effects of other drugs in the same class.

29. Drugs are identified by multiple names, which can be confusing to both the patient and healthcare provider.

30. Chemical names are assigned by using standard nomenclature established by the International Union of Pure and Applied Chemistry (IUPAC). Each drug has only one chemical name. Drugs can be named and classified by a portion of their chemical structure, known as the chemical group name.

31. Generic names are assigned by the U.S. Adopted Names Council. Generic names are usually less complicated and are easier to remember than chemical names. Each drug has only one generic name.

32. Trade names are also called *proprietary*, *product*, or *brand names*. The trade name is assigned by the pharmaceutical company and is usually short and easy to remember.

33. The FDA grants pharmaceutical companies exclusive rights to name and market a drug for a fixed number of years after a New Drug Application is approved, allowing the company to recoup the cost of research and development.

34. When this exclusivity expires, competing companies may sell a generic equivalent drug. They may give it a different trade name, which the FDA must approve.

35. Combination drugs are drugs with more than one active generic ingredient.

36. Because of the potential confusion with trade names, it is important for the nurse to identify drugs by their generic names.

37. Some states in the United States allow the pharmacist to routinely substitute a generic drug when the prescription calls for a trade-name drug. In other states, pharmacists must dispense prescriptions as written or obtain approval before providing a generic substitution. Many pharmacies provide lists of generic drugs.

38. Pharmaceutical companies often lobby aggressively against laws that might restrict the routine use of certain trade-name drugs. They claim that there is a difference between a trade-name drug and its generic equivalent and that switching to a generic may be harmful to the patient.

39. Consumer advocates argue that generic substitutions should always be permitted because they provide cost savings to the patient.

40. Bioavailability is defined by the Federal Food, Drug, and Cosmetic Act as the rate and extent to which the active ingredient is absorbed from a drug product and then becomes available at the site of the drug action to produce the desired effects.

41. Bioavailability may be affected by formulation, inert ingredients, and tablet compression. All of these factors can affect the absorption and/or distribution of the drug.

42. Bioavailability is measured by the time it takes for the drug to exert its effect; it is also known as *onset time*. Bioavailability may differ between trade and generic drugs.

43. Online sites may allow patients to purchase drugs at substantial savings. However, the danger of doing so is that the drugs may be sold from other countries and these countries may not have the same quality control standards as the United States. These drugs may be harmful or not effective. The nurse must help patients understand the differences and the potential dangers.

44. Biologics, drugs made by living cells, are complex and require many years of research to develop and test. The effectiveness and safety of biosimilar drugs is comparable to that of FDA-approved biologic products. A biosimilar is not an exact, duplicate copy of the original medication and should not be called a generic.

45. Biosimilars are usually less expensive than their reference drugs (the original biologic) and must have the same route of administration, dosage forms, and mechanism of action.

46. The nurse is expected to understand the pharmacotherapeutic principles for all medications received by each patient.

47. The nurse's responsibilities include knowledge and understanding of what drug is ordered; name (generic and trade) and drug classification; intended or proposed use; effects on the body; contraindications; special considerations, such as how age, gender, weight, body fat distribution, genetic factors, and pathophysiologic states affect pharmacotherapeutic response; and expected and potential adverse events.

48. The nurse must also know why the drug has been prescribed for this particular patient; how the drug is supplied by the pharmacy; how the drug is to be administered, including dose ranges; and what nursing process considerations related to the drug apply to this patient

49. A major goal in studying pharmacology is to eliminate medication errors and to limit the number and severity of adverse drug events.

50. Knowledge of pharmacology is an ongoing, lifelong process that builds as a nurse is in practice and chooses specific clinical areas.

Learning prototypes, recognizing key similarities in generic names, and always looking up unknown or new drugs will help build this knowledge base.

Pharmacology: Connections to Nursing Practice, 5e

Answers for Resource Website

Chapter 1

Answers to Critical Thinking Questions in Making the Patient Connection

1 A therapeutic classification describes what the drug is treating. These drugs are often identified by the prefix *anti*- such as antiseizure, anti-inflammatory, and antihypertensive. The pharmacologic classification describes how the drug acts within the body. A drug's pharmacologic classification is more specific than a therapeutic classification.

2 A barbiturate is the pharmacologic classification for a major sedative. A macrolide is the pharmacologic classification for a major type of antibiotic. Although the words *birth control pills* don't begin with *anti*, this classification describes what the drug is being used for (anti-conception). A barbiturate is the pharmacologic classification for a major sedative. A macrolide is the pharmacologic classification for a major type of antibiotic. Although the words "birth control pills" do not begin with "anti," this classification describes what the drug is being used for (anti-conception). Laxatives denotes a therapeutic classification of drugs that enhance peristalsis to cause bowel emptying. Folic acid antagonists are antimetabolites and have highly specific therapeutic uses such as the treatment of some autoimmune disorders such as rheumatoid arthritis, and in the treatment of some cancers. An antianginal agent is the therapeutic class of drugs that treat chest pain."

3 A prototype drug is a member of a category that best represents the group as a whole. A prototype is representative of a group, classification, or category. By learning about a prototype drug, students can apply this knowledge to the actions and adverse effects of other drugs in the same class.

4 The nurse is a critical member of the healthcare team and has tremendous responsibility for a patient's drug therapy. The nurse not only administers medication but also closely monitors the patient for the desired outcome and adverse effects. Nurses provide patients with essential drug-related education.

Answers to Additional Case Study

1 Although generic drugs are less expensive than their trade-name equivalent, they may vary in their bioavailability. In most cases, this difference does not affect the therapeutic effect of the drug and therefore can be safely substituted. However, in certain critical situations, the onset time of the drug may be extremely important. In such situations, such as heart attack, stroke, or shock syndromes, generic forms of a medication may not be recommended.

2 To be safe, you should advise Sarah to talk with her healthcare provider or nurse practitioner about using generics. Explain how important it is for her to inform her healthcare providers that her income status is limited. This information will assist the prescriber in determining the best and most cost-effective treatment modalities for her.

Answer to Connection Checkpoint 1.1

Exenatide (Byetta) is derived from the saliva of the Gila monster lizard. It is used to treat type 2 diabetes and is under study as a treatment for obesity. Captopril (Capoten) was developed from a peptide found in the venom of a South American viper and is used to treat hypertension. Hyaluronic acid is present naturally in body tissues such as the eyes and joints, but for medicinal uses, it is extracted from rooster combs or grown in bacterial solutions. It has a variety of uses including in skin creams, for eye surgeries and plastic surgery (e.g., lip "plumping" injections), and to treat joint conditions.

Answer to Connection Checkpoint 1.2

Anticoagulant, central nervous system agent, analgesic, and antipyretic describe therapeutic classifications. Salicylate is a pharmacologic classification.

Answer to Patient Safety Question

A potentially dangerous drug interaction may occur if paroxetine (Paxil) and St. John's wort are taken concurrently. Symptoms such as headache, sweating, confusion, and agitation may occur and may worsen, with hypertension and hyperpyrexia occurring. The patient should be taught to stop taking the St. John's wort while using paroxetine and to consult with his or her healthcare provider before taking any over-the-counter medication.

DECISION-MAKING CASE SUMMARIES

PHARMACOLOGY #1: ANXIETY AND INSOMNIA

CASE NAME	OVERVIEW	MAJOR CASE DECISIONS
Kiyoko Saito Marilyn Jensen Javier Molina Tamicka Denson	Kiyoko Saito is a 71-year-old female suffering from generalized social anxiety disorder. She has been prescribed 25 mg atenolol. Marilyn Jensen is a 56-year-old female suffering from moderate persistent sleep maintenance insomnia. She has been prescribed 1 mg eszopiclone. Javier Molina is a 44-year-old male suffering from panic attacks. He has been prescribed 5 mg alprazolam, which he quit taking 2 days ago because he no longer experiences panic attacks. He is experiencing withdrawal symptoms. Tamicka Denson is a 28-year-old female suffering from generalized anxiety disorder. She has been taking 10 mg escitalopram daily for one week and is worried that the medication is not relieving her symptoms.	1. Prioritizing client treatment 2. Adjusting medication dose or usage based on client needs, such as trying to become pregnant 3. Providing client teaching related to drug-drug interactions 4. Identifying side effects of medications 5. Selecting topics for client teaching related to liver health 6. Providing client teaching related to dietary interactions with medications 7. Providing client teaching related to new medication schedule and dosage 8. Recommending inpatient care for clients with difficulty understanding the medication process

Estimated Case Length:
Difficulty Level: Medium

Learning Objectives:

- Prioritize nursing care for clients in need of pharmacological intervention for anxiety or insomnia.
- Provide client teaching related to side effects, drug-drug interactions, and dietary restrictions for drugs used to treat anxiety or insomnia.
- Provide client teaching related to medications and pregnancy for drugs used to treat anxiety or insomnia.
- Administer medications to clients experiencing symptoms related to anxiety or insomnia.
- Advocate for effective care of clients with anxiety or insomnia.

Questions	Correct Answers
1. Prioritizing client care is essential to decreasing complications. Which client requires the most immediate treatment?	*Mr. Javier Molina, presenting with hallucinations, vomiting, severe abdominal cramps, sweating, and tremors*
2. Which of the following presents the most likely reason for Mr. Molina's symptoms?	*Withdrawal from alprazolam*
3. After administering medication to Mr. Molina, you continue your assessment of Mrs. Denson. During your client interview, Tamicka informs you that in addition to all her other worries, her husband and his family are pressuring her to start trying to get pregnant. This is adding to her worries. What if she can't get pregnant? What if the baby has deformities or disabilities? What if she develops gestational diabetes? What if she won't be a good mother? What if her medication	*Continue with the current dose of escitalopram.* *Stop administration of all drugs.* *Discontinue use of escitalopram and prescribe sertraline 50 mg daily.*

harms her baby? Based on this new information, you consult with the physician and present Tamicka with several options related to her medication. Which of the following options would you include? Select all that apply.	
4. Mrs. Denson has decided to switch her medication to sertraline. What client teaching do you need to provide her related to her use of aspirin for headaches?	*Concomitant use of aspirin with sertraline can increase the risk of bleeding.*
5. You are responsible for teaching each client about the potential side effects of their prescribed medications. Which of the following provides an accurate match between the medication and the side effects?	*Eszopiclone: headache, tachycardia, dry mouth, nausea, dizziness*
6. You are providing client teaching about the importance of liver health for each client's respective medication. Which client is LEAST in need of this teaching?	*Mrs. Saito, who has been prescribed atenolol*
7. Which of the clients will need education regarding dietary interactions with their medication? Select all that apply.	*Ms. Jensen will need education about the interaction of eszopiclone with high-fat meals.* *Mrs. Denson will need education about the interaction of sertraline with grapefruit.*

8. After Mr. Molina's symptoms have abated, you discuss with him the importance of maintaining his prescription regimen because of the withdrawal symptoms that occur when alprazolam is abruptly discontinued. Mr. Molina informs you that he thinks his panic attacks are under control, and he wants to discontinue use of the alprazolam. Therefore, the physician prescribes 50 mg carbamazepine tid and 10 mg clonazepam daily at bedtime. What is the most important client teaching you need to provide Mr. Molina?	*Medication dosage schedule*
9. Based on Mr. Molina's apparent confusion about his new medication dosage schedule, what recommendation might you give to advocate for his adequate care?	*Mr. Molina should be admitted to an inpatient medical facility that can oversee his alprazolam weaning process.*