

Introduction

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**1 Why Technicians Need to Study
Pharmacology and Therapeutics**

2 Pharmacokinetics

Why Technicians Need to Study Pharmacology and Therapeutics

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PART
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LEARNING OBJECTIVES

After completing this chapter, you should be able to

1. Define the terms *drug*, *medication*, *pharmacology*, and *therapeutics* and explain how they are related to one another and to pharmacy practice
2. Give reasons why it is essential for pharmacy technician students to learn pharmacology
3. Understand how pharmacology applies to the pharmacy technician's duties
4. Relate how the study of pharmacology contributes to professional development
5. Illustrate ways in which the technician's knowledge of pharmacology may be used to provide value to the pharmacist
6. Understand how pharmacology relates to patient safety

A drug is a substance that may be expected to change or influence processes occurring in a living organism. **Medications** (often called **pharmaceuticals**) are drugs that are used in the diagnosis, treatment, or prevention of disease in man or animals. Ancient records and even prehistoric remains indicate that medications of one kind or another have been tried and used by humans for thousands of years.

Pharmacology is the study of drugs, including their origins, properties, actions, and effects on the body.¹ The student of pharmacology learns about the origin of a drug, which may have come from a natural (plant, animal, or mineral) source or have been synthesized in a laboratory (or some combination of both). This leads to knowledge of the properties of the product and what happens when it is placed in or on the body ("administered"). That information then takes the student to an understanding of how the drug should be prepared, administered, and stored. Two aspects of pharmacology that must be considered are *pharmacokinetics*, the study of the body's actions on the drug, and *pharmacodynamics*, the study of the actions of the drug on the body.

Therapeutics is the study of how medications are ultimately used in the diagnosis, treatment, or prevention of disease, including the expected results, dosages, side effects, and toxicities. To appreciate therapeutics, students must become familiar with the basic structures and functions of the body, as well as the disease states for which medications are used.

KEY TERMS AND DEFINITIONS

Drug—a drug is a substance that may be expected to change or influence processes occurring in a living organism.

Homeostasis—state of equilibrium of the internal environment of the body that is maintained by dynamic processes of feedback and regulation.

Medication—a drug that is used in the diagnosis, treatment, or prevention of disease in man or animals.

Pharmaceutical—another term for medication.

Pharmacology—the study of drugs, including their origins, properties, actions, and effects on the body.

Therapeutics—the study of how medications are used in the diagnosis, treatment, or prevention of disease, including the expected results, dosages, side effects, and toxicities.

Toxicology—the study of the harmful effects of substances, including drugs, on the human body and the science of predicting, preventing, and treating these effects.

Practical Benefits of Studying Pharmacology

For the Student

For a student in applied sciences like pharmacy, there are many benefits to studying pharmacology. In detailing the functions of drugs, it touches on many other disciplines to develop a full understanding of the body's role in processing and reacting to them. It can be said that a study of pharmacology helps to explain the body's structure on a microscopic level, drilling down to its anatomical (structural) and physiological (functional) makeup. Pharmacology is closely related to the science of *pathophysiology*—the study of how normal physiological processes are altered by disease.¹ A student of pharmacology learns the adverse affects of chemicals, or poisons, on human beings—a field known as **toxicology**.¹ The student of pharmacology learns about the body's immune system and gains an understanding of all body processes as they relate to one another to produce **homeostasis**—the body's ability to maintain equilibrium, a state of normalcy based on a series of internal regulations.¹

On the Job

The pharmacy technician can frequently apply knowledge of pharmacology on the job. Familiarity with the physical and chemical properties of a drug contributes to the ability to choose the right way to handle and prepare it for use by a physician or patient. It helps the technician understand why a drug is stored in the refrigerator, protected from exposure to light, or kept in a specialized section of the pharmacy (like the one for emergency medications, hazardous drugs, or controlled substances). Having studied pharmacology, the technician has a better grasp of which drugs are usually taken by mouth, which drugs are injected, and which ones are applied directly to the part of the body where they should have an effect, and thus the technician can assist the pharmacist more efficiently. The knowledgeable pharmacy technician knows the right questions to ask (of the pharmacist, the patient, and others) and when to ask them, and can be confident of performing job-related duties correctly.

CASE STUDY

A pharmacy technician begins his workday. He receives a written prescription from a waiting patient, transmits the information into the computer, produces a label for the drug ordered, and begins to fill the prescription. After communicating with the pharmacist regarding the appropriateness of the prescription, the technician selects the drug from the shelf in the pharmacy. To ensure accuracy, he carefully reads the brand name, generic name, dosage form, and strength of the medication. He then counts out the proper amount of tablets to be dispensed to the patient. He affixes a label that he produced upon receiving the prescription, including instructions and precautions for the patient to consider in taking the medication. He then submits the complete order to the pharmacist to be checked.

Finally, the patient arrives to pick up his medication. The pharmacy technician looks up the patient profile stored in the pharmacy database and carefully selects the correct prescription from among a list of current and outdated prescriptions within the patient's profile. He sees that the current medication is on file waiting to be picked up, so he proceeds to deliver it to the patient. The patient then asks a question regarding the side effects of the medication. Discerning that the question is beyond his scope of practice, he informs the patient that he will need to speak with the pharmacist for counseling. Throughout this process, the pharmacy technician has performed a variety of manipulations that are greatly assisted by his knowledge of pharmacology.

Maintaining Professionalism

Pharmacies have been characterized by the high degree of professionalism and strict code of ethics that they maintain. Medications have a dramatic impact on the human body, so those standards are applied to the pharmacy technician who handles and prepares formulations for patient use. Patients need to know that their health is a priority for those to whom they entrust it, including pharmacy personnel. When an individual pharmacy technician demonstrates an understanding of pharmacology, this reflects positively on the department and on pharmacy technicians in general. Knowledge of pharmacology has an overall effect on how the pharmacy technician is perceived as a healthcare provider by both those within the medical community and by the patients who are being served.

Pharmacology and Therapeutics

Patient Safety

For the pharmacy technician, knowledge of pharmacology and therapeutics contributes to the common goal of those in the healthcare field to reduce medical errors and maintain patient safety. Medication errors can have a negative impact on the healthcare community whether or not they cause harm to the patient. The incidence of such errors can be reduced by applying principles of pharmacology.

For instance, a simple shift in the decimal point of the concentration of a common pharmacy stock solution, 0.9% sodium chloride (also known as normal saline), can have a dramatic impact on its effect on the patient. The pharmacological study of isotonicity, hypotonicity, and hypertonicity can reveal the dangers of making such a mistake as it describes how the body's blood cells react to solutions of differing concentrations. Many drugs have similar chemical names but dissimilar uses. For example, the drugs hydroxyzine and hydralazine have very similar names and are often ordered in similar dosages. A pharmacy technician receiving a prescription with directions that it is to be taken every 6 hours when needed for itching can apply knowledge of pharmacology in choosing hydroxyzine, an antihistamine, instead of the similarly named hydralazine (which is used in the treatment of hypertension). The study of the pharmacological processes serves to enlighten the pharmacy technician and thus promote patient safety. The knowledge and application of pharmacology alerts the pharmacy technician to the dramatic impact that pills and other formulations, although comparatively small in size, can have on the body.

Multidisciplinary Interaction and Dialogue

Pharmacy technicians are not often bound by the confines of the pharmacy. The 21st Century approach to healthcare calls for collaboration and dialogue among many departments and individuals. When pharmacy technicians are well informed about pharmacology, they are able to effectively communicate with others involved in patient care—physicians, nurses, pharmacists, radiologists, lab technicians, dieticians and food service workers, as well as patients and their families. They may also be a source of information for healthcare workers who have less experience in handling pharmaceuticals.

For example, not all hospital dieticians and food service workers have extensive training in medication safety. There are some drugs that cannot be taken with certain foods, such as cholesterol-lowering agents (e.g., lovastatin) that use the same metabolic pathways as certain citrus fruits (e.g., grapefruit juice). Administration of these together could cause a patient to experience a breakdown of muscle fibers, which can ultimately result in severe muscle weakness and prolonged kidney damage.

Provides Value to Pharmacist

Throughout the past century, pharmacists have expanded their roles beyond drug preparation and dispensing to encompass a broad range of clinical activities. Pharmacists receive longer and more intense academic and clinical instruction and thus are in a position to have greater influence on patient care but, as a result, may have less time to focus on pharmacy operations and maintenance. The main responsibility of clinical pharmacists in current practice is to maximize the effectiveness of medication, minimize the risk of adverse events, and monitor patient therapy outcomes.

With the evolving role of pharmacists comes increased responsibility and accountability. Every prescription must be scrutinized upon receipt for any discrepancy, even if neglecting to do so would result in no observable reactions. Often pharmacists must interact directly with prescribing physicians and practitioners to ensure that patient safety and health outcomes are met, as part of the normal prescription filling procedure.

Pharmacy technicians who understand the classes, interactions, mechanisms of action, adverse affects, and common side effects of medications can be an invaluable resource to the pharmacist who is focusing on patient care. In a pharmacy where less time is spent teaching and training the pharmacy technician, more time can be devoted to patient care. A cooperative relationship is cultivated within a pharmacy when technicians are knowledgeable in the pharmacological characteristics of drugs, allowing them to work more independently of the pharmacist and thereby increase their trustworthiness and responsibility.

Enables Expanded Role

In healthcare, performance is often assessed by the ability to expand one's role beyond what is outlined in an organization's job description. As healthcare continues to evolve, it is essential that those in the center of the progressive environment continue to adapt and enhance their abilities to meet the many challenges that are presented. Trends in laws and practice standards call for pharmacy technicians and other support personnel to accept greater accountability, thus adding to their responsibilities for patient outcomes. It is therefore necessary for pharmacy technicians to study pharmacology and become familiar with all facets of their field. In order for pharmacy technicians to stay ahead of the ever-changing environment, they must have in-depth knowledge of the drugs that they have a role in dispensing.

In Areas of Direct Patient Contact

Pharmacy technicians often speak with patients and should be familiar with pharmacological terminology and concepts. The pharmacy technician may encounter nicknames or colloquial expressions given to common drugs, such as “sugar pills”—drugs used to treat diabetes—and “water pills”—diuretics used to treat high blood pressure. A situation may also arise in which a patient has multiple disease states. An understanding of pharmacology will help the technician know the difference between the *pain* medication and the *cholesterol* treatment. A solid knowledge of how drugs work within the body can help a technician in deciphering the terms that patients often use to describe their therapy.

Summary

Pharmacology is the study of drugs and their origin, nature, properties, and effects on the human body. A pharmaceutical product—whether taken by mouth or another route—is usually very small compared to the total weight and volume of the human body but can have a large impact on body functions and processes. For this reason, the study of phar-

macology is important for all pursuing a healthcare-related field, especially for pharmacy technicians. Pharmacology helps technicians to be well rounded and provides a source of practical knowledge for daily work in the healthcare setting.

Technicians who compound preparations and assist in filling prescriptions can use knowledge of the properties of the medications they are handling to ensure accuracy and patient safety. Familiarity with pharmacology enables the educated pharmacy technician to play a larger part in the team approach to patient care. Technicians educated in pharmacology can help pharmacists spend more time engaging in activities that relate to positive clinical patient outcomes. Through the study of this science, technicians also make themselves available for greater roles and opportunities both within the pharmacy and the greater realm of allied health. They are better able to fulfill the needs of patients who need skilled individuals to be directly involved in their pharmaceutical care.

Reference

1. Taber CW. *Taber's Cyclopedic Medical Dictionary*. 21st ed. Philadelphia, PA: FA Davis Company; 2009.

Review Questions

1. How do the various aspects of pharmacology relate to one another and directly to patient care?
2. In what ways might a pharmacy technician's lack of knowledge in pharmacology reflect negatively on the individual pharmacy, the profession, and the healthcare community?
3. In what settings might a pharmacy technician use principles of pharmacology?
4. How has the modern healthcare paradigm further expanded the role of the pharmacy technician?
5. How does knowledge of pharmacology contribute to patient safety, communication, and care?

