PHLEBOTOMY

Worktext and Procedures Manual

5th Edition

Robin S. Warekois
Richard Robinson
Pamela B. Primrose

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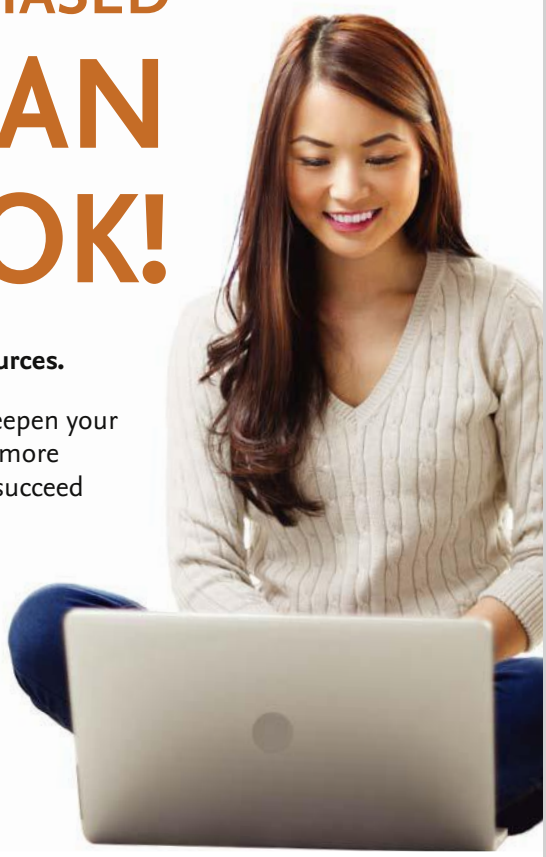

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5th Edition

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Acknowledgments

The fifth edition of *Phlebotomy: Worktext and Procedures Manual* would not be the valuable teaching tool that we have designed it to be without the dedication and help of many people. Our reviewers continue to provide important insights into the best ways to communicate concepts based on their own classroom experience. Pam Primrose has been extraordinarily helpful on this edition, bringing her expertise as Consulting Educator to every chapter. The team at Elsevier, including Kristin Wilhelm and Joanne Scott, have made our work on this revised edition easier and made our book better. We thank them heartily.

Robin S. Warekois
Richard Robinson
Pamela B. Primrose

Preface

The successful practice of phlebotomy requires a combination of highly skilled technique, wide knowledge of the current healthcare environment, and a sympathetic approach to patients of all ages, backgrounds, and medical conditions. We have designed *Phlebotomy: Worktext and Procedures Manual,* fifth edition, to provide a complete introduction to the practice of phlebotomy in all its aspects. We believe its emphasis on procedures, its up-to-date and thorough professional information, and its comprehensive approach to the many situations encountered by the modern phlebotomist make it a unique and valuable offering in the field of phlebotomy training.

WHO WILL BENEFIT FROM THIS BOOK?

Phlebotomy: Worktext and Procedures Manual, fifth edition, is suitable for phlebotomy certification programs, medical technologist and medical laboratory technician programs, medical assisting programs, and nurse training. No prior training in phlebotomy is assumed. The text may also be used by experienced phlebotomists, allied health professionals, or nurses seeking to expand or update their training in phlebotomy.

WHY IS THIS BOOK IMPORTANT TO THE PROFESSION?

Students, above all, learn by doing. Teaching phlebotomy technique is at the heart of this book, and we have therefore designed it as a worktext for both the classroom and the laboratory. Each major skill in phlebotomy, from handwashing to venipuncture to preparing a blood smear, is shown and described in step-by-step, fully illustrated procedures. We believe these will provide the student with an invaluable visual tool for understanding the essentials of the techniques before, during, and after their practical laboratory experience.

In addition to thorough training in the skills of phlebotomy, this text provides an introduction to development of skills beyond blood collection with a chapter on point-of-care testing. In this way, phlebotomy students can begin their training as multiskilled health professionals ready for the challenges of the modern healthcare workplace.

ORGANIZATION

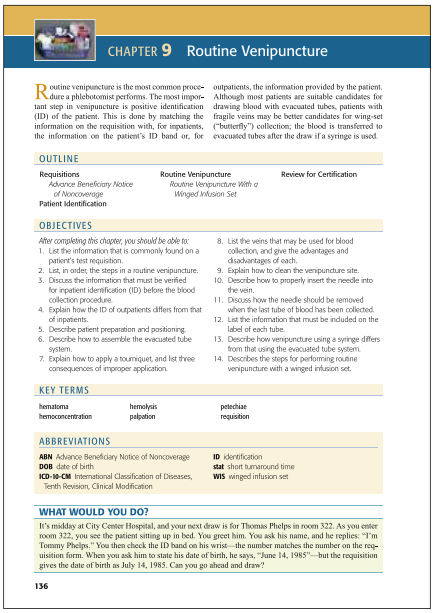
The text is divided into five units. Unit 1 provides an introduction and general information needed for working in a healthcare facility. Unit 2 covers the basics needed to study phlebotomy, from medical terminology to anatomy and physiology. Unit 3 features the various methods of specimen collection, including venipuncture, dermal puncture, arterial blood collection, and special procedures. Unit 4 presents specimen handling, processing, and point-of-care testing. Unit 5 concludes the text with a section on professional issues. Individual units and chapters may be taught in the sequence chosen by the instructor. Numerous *Flash Forward* and *Flashback* notes help the student connect and recall material from different chapters. A comprehensive index is provided to allow quick access to any topic.

DISTINCTIVE FEATURES AND LEARNING AIDS

Phlebotomy courses are offered in a variety of settings. *Phlebotomy: Worktext and Procedures Manual,* fifth edition, provides the essential learning tools students need to succeed in each of them. Because we believe that students learn best when they know the "why" as well as the "how," we explain the reasoning behind the clinical information they must learn to become successful phlebotomists.

This approach is strengthened by key features of each chapter, including the following:

- Detailed **Objectives, Key Terms, Abbreviations**, and **Study Questions** serve as a study guide for students and provide instructors with the framework for regular assignments.



CHAPTER 9 Routine Venipuncture

Routine venipuncture is the most common procedure a phlebotomist performs. The most important step in venipuncture is positive identification (ID) of the patient. This is done by matching the information on the requisition with, for inpatients, the information on the patient's ID band or, for outpatients, the information provided by the patient. Although most patients are suitable candidates for drawing blood with evacuated tubes, patients with fragile veins may be better candidates for wing-set ("butterfly") collection; the blood is transferred to evacuated tubes after the draw if a syringe is used.

OUTLINE

Requisitions
Advance Beneficiary Notice of Noncoverage
Patient Identification
Routine Venipuncture
Routine Venipuncture With a Winged Infusion Set
Review for Certification

OBJECTIVES

After completing this chapter, you should be able to:

1. List the information that is commonly found on a patient's test requisition.
2. List, in order, the steps in a routine venipuncture.
3. Discuss the information that must be verified for inpatient identification (ID) before the blood collection procedure.
4. Explain how the ID of outpatients differs from that of inpatients.
5. Describe patient preparation and positioning.
6. Describe how to assemble the evacuated tube system.
7. Explain how to apply a tourniquet, and list three consequences of improper application.
8. List the veins that may be used for blood collection, and give the advantages and disadvantages of each.
9. Explain how to clean the venipuncture site.
10. Describe how to properly insert the needle into the vein.
11. Discuss how the needle should be removed when the last tube of blood has been collected.
12. List the information that must be included on the label of each tube.
13. Describe how venipuncture using a syringe differs from that using the evacuated tube system.
14. Describes the steps for performing routine venipuncture with a winged infusion set.

KEY TERMS

hematoma
hemoconcentration
hemolysis
palpation
petechiae
requisition

ABBREVIATIONS

ABN Advance Beneficiary Notice of Noncoverage
DOB date of birth
ICD-10-CM International Classification of Diseases, Tenth Revision, Clinical Modification
ID identification
stat short turnaround time
WIS winged infusion set

WHAT WOULD YOU DO?

It's midday at City Center Hospital, and your next draw is for Thomas Phelps in room 322. As you enter room 322, you see the patient sitting up in bed. You greet him. You ask his name, and he replies: "I'm Tommy Phelps." You then check the ID band on his wrist—the number matches the number on the requisition form. When you ask him to state his date of birth, he says, "June 14, 1985"—but the requisition gives the date of birth as July 14, 1985. Can you go ahead and draw?

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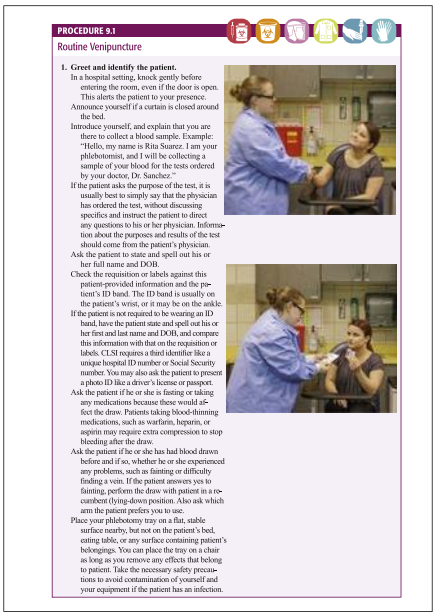
- **Boxes, Tables,** and **Figures** summarize key information and illustrate difficult concepts.
- Each major skill in phlebotomy is shown and described in step-by-step, fully illustrated **Procedures.**



PROCEDURE 9.1

Routine Venipuncture

1. Greet and identify the patient.
In a hospital setting, knock gently before entering the room, even if the door is open. This alerts the patient to your presence.
Announce yourself if a curtain is closed around the bed.
Introduce yourself, and explain that you are there to collect a blood sample. Example: "Hello, my name is Rita Suarez. I am your phlebotomist, and I will be collecting a sample of your blood for the tests ordered by your doctor, Dr. Sanchez."
If the patient asks the purpose of the test, it is usually best to simply say that the physician has ordered the test, without discussing specifics and instruct the patient to direct any questions to his or her physician. Information about the purposes and results of the test should come from the patient's physician.
Ask the patient to state and spell out his or her full name and DOB.
Check the requisition or labels against this patient-provided information and the patient's ID band. The ID band is usually on the patient's wrist, or it may be on the ankle.
If the patient is not required to be wearing an ID band, have the patient state and spell out his or her first and last name and DOB, and compare this information with that on the requisition or labels. CLSI requires a third identifier like a unique hospital ID number or Social Security number. You may also ask the patient to present a photo ID like a driver's license or passport.
Ask the patient if he or she is fasting or taking any medications because these would affect the draw. Patients taking blood-thinning medications, such as warfarin, heparin, or aspirin may require extra compression to stop bleeding after the draw.
Ask the patient if he or she has had blood drawn before and if so, whether he or she experienced any problems, such as fainting or difficulty finding a vein. If the patient answers yes to fainting, perform the draw with patient in a recumbent (lying-down position. Also ask which arm the patient prefers you to use.
Place your phlebotomy tray on a flat, stable surface nearby, but not on the patient's bed, eating table, or any surface containing patient's belongings. You can place the tray on a chair as long as you remove any effects that belong to patient. Take the necessary safety precautions to avoid contamination of yourself and your equipment if the patient has an infection.

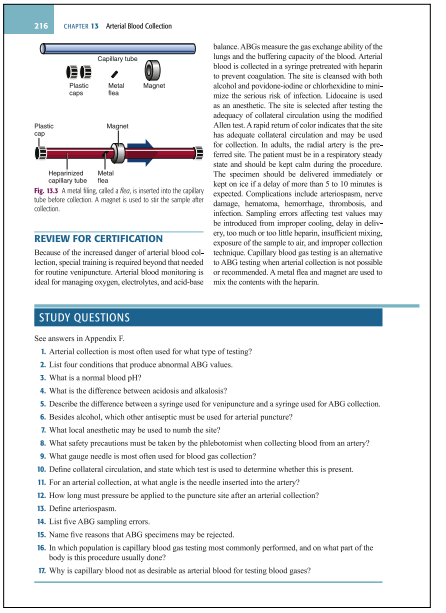


Fig. 13.3 A metal filing, called a *flea*, is inserted into the capillary tube before collection. A magnet is used to stir the sample after collection.

REVIEW FOR CERTIFICATION

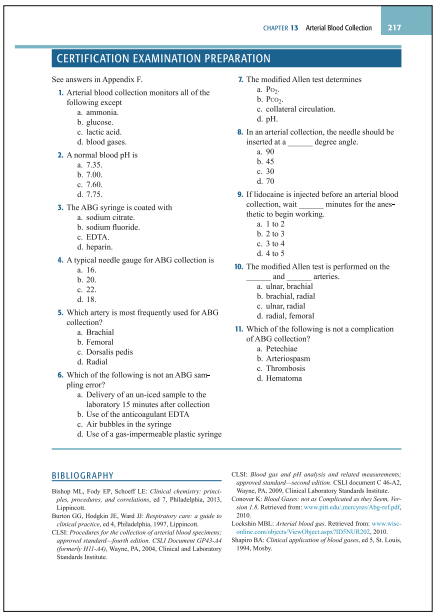
Because of the increased danger of arterial blood collection, special training is required beyond that needed for routine venipuncture. Arterial blood monitoring is ideal for managing oxygen, electrolytes, and acid-base balance. ABGs measure the gas exchange ability of the lungs and the buffering capacity of the blood. Arterial blood is collected in a syringe pretreated with heparin to prevent coagulation. The site is cleansed with both alcohol and povidone-iodine or chlorhexidine to minimize the serious risk of infection. Lidocaine is used as an anesthetic. The site is selected after testing the adequacy of collateral circulation using the modified Allen test. A rapid return of color indicates that the site has adequate collateral circulation and may be used for collection. In adults, the radial artery is the preferred site. The patient must be in a respiratory steady state and should be kept calm during the procedure. The specimen should be delivered immediately or kept on ice if a delay of more than 5 to 10 minutes is expected. Complications include arteriospasm, nerve damage, hematoma, hemorrhage, thrombosis, and infection. Sampling errors affecting test values may be introduced from improper cooling, delay in delivery, too much or too little heparin, insufficient mixing, exposure of the sample to air, and improper collection technique. Capillary blood gas testing is an alternative to ABG testing when arterial collection is not possible or recommended. A metal flea and magnet are used to mix the contents with the heparin.

STUDY QUESTIONS

See answers in Appendix F.

1. Arterial collection is most often used for what type of testing?
2. List four conditions that produce abnormal ABG values.
3. What is a normal blood pH?
4. What is the difference between acidosis and alkalosis?
5. Describe the difference between a syringe used for venipuncture and a syringe used for ABG collection.
6. Besides alcohol, which other antiseptic must be used for arterial puncture?
7. What local anesthetic may be used to numb the site?
8. What safety precautions must be taken by the phlebotomist when collecting blood from an artery?
9. What gauge needle is most often used for blood gas collection?
10. Define collateral circulation, and state which test is used to determine whether this is present.
11. For an arterial collection, at what angle is the needle inserted into the artery?
12. How long must pressure be applied to the puncture site after an arterial collection?
13. Define arteriospasm.
14. List five ABG sampling errors.
15. Name five reasons that ABG specimens may be rejected.
16. In which population is capillary blood gas testing most commonly performed, and on what part of the body is this procedure usually done?
17. Why is capillary blood not as desirable as arterial blood for testing blood gases?

- **Review for Certification and Certification Exam Preparation** allow students to assess their progress toward preparedness for the certification exam.



CERTIFICATION EXAMINATION PREPARATION

See answers in Appendix F.

1. Arterial blood collection monitors all of the following except
   a. ammonia.
   b. glucose.
   c. lactic acid.
   d. blood gases.
2. A normal blood pH is
   a. 7.35.
   b. 7.00.
   c. 7.60.
   d. 7.75.
3. The ABG syringe is coated with
   a. sodium citrate.
   b. sodium fluoride.
   c. EDTA.
   d. heparin.
4. A typical needle gauge for ABG collection is
   a. 16.
   b. 20.
   c. 22.
   d. 18.
5. Which artery is most frequently used for ABG collection?
   a. Brachial
   b. Femoral
   c. Dorsalis pedis
   d. Radial
6. Which of the following is not an ABG sampling error?
   a. Delivery of an un-iced sample to the laboratory 15 minutes after collection
   b. Use of the anticoagulant EDTA
   c. Air bubbles in the syringe
   d. Use of a gas-impermeable plastic syringe
7. The modified Allen test determines
   a. Po_2.
   b. Pco_2.
   c. collateral circulation.
   d. pH.
8. In an arterial collection, the needle should be inserted at a _____ degree angle.
   a. 90
   b. 45
   c. 30
   d. 70
9. If lidocaine is injected before an arterial blood collection, wait _____ minutes for the anesthetic to begin working.
   a. 1 to 2
   b. 2 to 3
   c. 3 to 4
   d. 4 to 5
10. The modified Allen test is performed on the _____ and _____ arteries.
    a. ulnar, brachial
    b. brachial, radial
    c. ulnar, radial
    d. radial, femoral
11. Which of the following is not a complication of ABG collection?
    a. Petechiae
    b. Arteriospasm
    c. Thrombosis
    d. Hematoma

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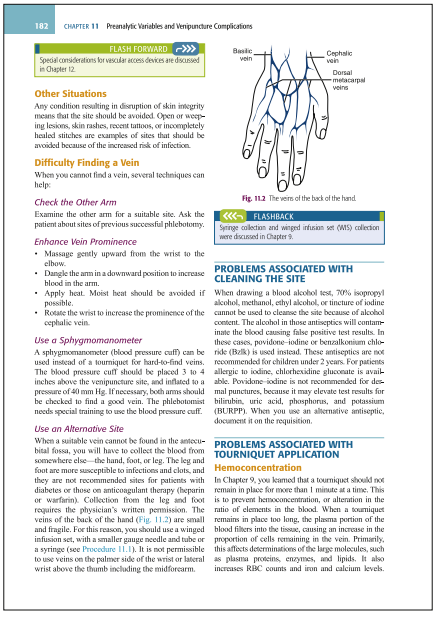
- **Flashbacks and Flash Forwards** directly link students to material they have encountered before or will cover in more depth in the future.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FLASH FORWARD
Special considerations for vascular access devices are discussed in Chapter 12.

Other Situations
Any condition resulting in disruption of skin integrity means that the site should be avoided. Open or weeping lesions, skin rashes, recent tattoos, or incompletely healed stitches are examples of sites that should be avoided because of the increased risk of infection.

Difficulty Finding a Vein
When you cannot find a vein, several techniques can help:

Check the Other Arm
Examine the other arm for a suitable site. Ask the patient about sites of previous successful phlebotomy.

Enhance Vein Prominence
- Massage gently upward from the wrist to the elbow.
- Dangle the arm in a downward position to increase blood in the arm.
- Apply heat. Moist heat should be avoided if possible.
- Rotate the wrist to increase the prominence of the cephalic vein.

Use a Sphygmomanometer
A sphygmomanometer (blood pressure cuff) can be used instead of a tourniquet for hard-to-find veins. The blood pressure cuff should be placed 3 to 4 inches above the venipuncture site, and inflated to a pressure of 40 mm Hg. If necessary, both arms should be checked to find a good vein. The phlebotomist needs special training to use the blood pressure cuff.

Use a Alternative Site
When a suitable vein cannot be found in the antecubital fossa, you will have to collect the blood from somewhere else—the hand, foot, or leg. The leg and foot are more susceptible to infections and clots, and they are not recommended sites for patients with diabetes or those on anticoagulant therapy (heparin or warfarin). Collection from the leg and foot requires the physician's written permission. The veins of the back of the hand (Fig. 11.2) are small and fragile. For this reason, you should use a winged infusion set, with a smaller gauge needle and tube or a syringe (see Procedure 11.1). It is not permissible to use veins on the palmer side of the wrist or lateral wrist above the thumb including the midforearm.

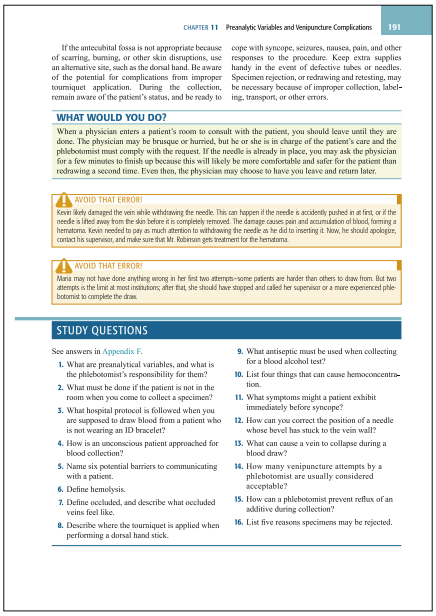
Fig. 11.2 The veins of the back of the hand.

FLASHBACK
Syringe collection and winged infusion set (WIS) collection were discussed in Chapter 9.

PROBLEMS ASSOCIATED WITH CLEANING THE SITE
When drawing a blood alcohol test, 70% isopropyl alcohol, methanol, ethyl alcohol, or tincture of iodine cannot be used to cleanse the site because of alcohol content. The alcohol in those antiseptics will contaminate the blood causing false positive test results. In these cases, povidone–iodine or benzalkonium chloride (BzlK) is used instead. These antiseptics are not recommended for children under 2 years. For patients allergic to iodine, chlorhexidine gluconate is available. Povidone–iodine is not recommended for dermal punctures, because it may elevate test results for bilirubin, uric acid, phosphorus, and potassium (BURPP). When you use an alternative antiseptic, document it on the requisition.

PROBLEMS ASSOCIATED WITH TOURNIQUET APPLICATION
Hemoconcentration
In Chapter 9, you learned that a tourniquet should not remain in place for more than 1 minute at a time. This is to prevent hemoconcentration, or alteration in the ratio of elements in the blood. When a tourniquet remains in place too long, the plasma portion of the blood filters into the tissue, causing an increase in the proportion of cells remaining in the vein. Primarily, this affects determinations of the large molecules, such as plasma proteins, enzymes, and lipids. It also increases RBC counts and iron and calcium levels.

- **Clinical Tips** offer students pearls of wisdom they can use in the clinical setting.
- **What Would You Do?** boxes offer students real-life scenarios that challenge them to apply what they are learning to difficult workplace situations. We believe these scenarios will resonate with students as they learn about the nuances of their profession and will provide the grist for lively discussions in class.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If the antecubital fossa is not appropriate because of scarring, burning, or other skin disruptions, use an alternative site, such as the dorsal hand. Be aware of the potential for complications from improper tourniquet application. During the collection, remain aware of the patient's status, and be ready to cope with syncope, seizures, nausea, pain, and other responses to the procedure. Keep extra supplies handy in the event of defective tubes or needles. Specimen rejection, or redrawing and retesting, may be necessary because of improper collection, labeling, transport, or other errors.

WHAT WOULD YOU DO?
When a physician enters a patient's room to consult with the patient, you should leave until they are done. The physician may be brusque or hurried, but he or she is in charge of the patient's care and the phlebotomist must comply with the request. If the needle is already in place, you may ask the physician for a few minutes to finish up because this will likely be more comfortable and safer for the patient than redrawing a second time. Even then, the physician may choose to have you leave and return later.

AVOID THAT ERROR!
Kevin likely damaged the vein while withdrawing the needle. This can happen if the needle is accidently pushed in at first, or if the needle is lifted away from the skin before it is completely removed. The damage causes pain and accumulation of blood, forming a hematoma. Kevin needed to pay as much attention to withdrawing the needle as he did to inserting it. Now, he should apologize, contact his supervisor, and make sure that Mr. Robinson gets treatment for the hematoma.

AVOID THAT ERROR!
Maria may not have done anything wrong in her first two attempts—some patients are harder than others to draw from. But two attempts is the limit at most institutions; after that, she should have stopped and called her supervisor or a more experienced phlebotomist to complete the draw.

STUDY QUESTIONS
See answers in Appendix F.
1. What are preanalytical variables, and what is the phlebotomist's responsibility for them?
2. What must be done if the patient is not in the room when you come to collect a specimen?
3. What hospital protocol is followed when you are supposed to draw blood from a patient who is not wearing an ID bracelet?
4. How is an unconscious patient approached for blood collection?
5. Name six potential barriers to communicating with a patient.
6. Define hemolysis.
7. Define occluded, and describe what occluded veins feel like.
8. Describe where the tourniquet is applied when performing a dorsal hand stick.
9. What antiseptic must be used when collecting for a blood alcohol test?
10. List four things that can cause hemoconcentration.
11. What symptoms might a patient exhibit immediately before syncope?
12. How can you correct the position of a needle whose bevel has stuck to the vein wall?
13. What can cause a vein to collapse during a blood draw?
14. How many venipuncture attempts by a phlebotomist are usually considered acceptable?
15. How can a phlebotomist prevent reflux of an additive during collection?
16. List five reasons specimens may be rejected.

- In addition to these chapter features, a comprehensive **Glossary** is found at the end of the book, along with appendices, including one listing **Spanish phrases** important in phlebotomy. Finally, a **Mock Certification Exam** provides students with the opportunity to test themselves at the end of the course as they prepare for certification.

NEW TO THIS EDITION

A new edition offers the opportunity to both update and improve. We have taken advantage of this opportunity in *Phlebotomy: Worktext and Procedures Manual,* 5th edition. Every chapter has been reviewed and updated as needed while maintaining the approach and features that made earlier editions successful.

- **Safety protocols and equipment** undergo continual change. For this edition, we have captured those changes, with revised procedures, discussions, illustrations, and guidelines throughout the book to reflect the most current guidelines from OSHA, CLSI, and other governmental and professional organizations.
- **Avoid That Error!** boxes provide students with additional clinical scenarios that challenge their understanding, encourage them to think about how to avoid errors, and what to do when errors are made.
- **Procedural Videos** accessed through the Evolve website include 28 videos that show important skills, including venipuncture and capillary collection.

ANCILLARIES

For the Instructor

With the fifth edition, we are offering several assets.

TEACH

- **TEACH Lesson Plan Manual,** available via Evolve: Provides instructors with customizable lesson plans and lecture outlines based on learning objectives. With these valuable resources, instructors will save valuable preparation time and create a learning environment that fully engages students in classroom preparation. The lesson plans are keyed chapter-by-chapter and are divided into 50-minute units. In addition to the lesson plans, instructors will have unique lecture outlines in PowerPoint with lecture notes, thought-provoking questions, and unique ideas for lectures.

For the Instructor

- **Test Bank:** An ExamView test bank of approximately 500 multiple-choice questions that feature rationales, cognitive levels, and page number references to the text. The test bank can be used for class reviews, quizzes, or exams.
- **Image Collection:** All of the images from the book are available as .jpg files and can be downloaded into PowerPoint presentations. These can also be used during lecture to illustrate important concepts.
- **Competency Checklists:** All of the competency checklists from the book are available as PDFs to be printed and used electronically.
- **TEACH assets** containing lesson plans mapping all content to chapter objectives, PowerPoint slide presentations, student handouts, and answer keys.
- **Correlation Guides** map text content to Medical Assisting and NACCLS competencies.

For the Student

- **Procedural Videos:** 28 video clips showing "real-life" examples of how to perform a variety of skills such as venipuncture, capillary collection, and hematologic testing.
- **Mock Certification Exams:** Provide additional practice with timed sample certification-style tests.
- **Audio Glossary:** Definitions of the key terms in the text, with audio pronunciations.
- **Interactive Exercises:** Drag-and-drop exercises and flashcards to help reinforce new vocabulary.

Procedure Photo Credits

Procedure 4.1

Steps 1, 3, 4, 5, 6 from Proctor DB et al: *Kinn's the medical assistant: An applied learning approach*, ed. 13, St. Louis, 2017, Elsevier.

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Step 6 from Stepp CA, Woods MA: *Laboratory procedures for medical office personnel*, Philadelphia, 1998, Saunders.

Procedure 14.1

Step 1 from Leahy JM, Kizilay PE: *Foundations of nursing practice: a nursing process approach*, Philadelphia, 1998, Saunders.

Procedure 15.1

Steps 1, 2, 3 from Stepp CA, Woods MA: *Laboratory procedures for medical office personnel*, Philadelphia, 1998, Saunders.

Procedure 15.2

Step 1 from Bonewit-West K: *Clinical procedures for medical assistants*, ed. 10, St. Louis, 2018, Elsevier.

Procedure 17.1

Step 1 courtesy Zack Bent. From Garrels M: *Laboratory and diagnostic testing in ambulatory care*, ed. 4, St. Louis, 2019, Elsevier.

Step 2 from Chester GA: *Modern medical assisting*, Philadelphia, 1999, Saunders.

Icons Used in This Book

The Occupational Safety and Health Administration (OSHA) standards must be followed when performing most of the procedures presented in this text. Icons have been incorporated into the procedures to assist in following these standards. An illustration of each icon, along with its description, is given here.

HAND HYGIENE is an important medical aseptic practice and is crucial in preventing the transmission of pathogens in the medical office. The phlebotomist should perform hand hygiene frequently, using the proper technique. When performing venipuncture procedures, the hands should always be cleaned before and after patient contact, before applying and after removing gloves, and after contact with blood or other potentially infectious materials. In some institutions, an alcohol-based agent may be preferred, but CLSI guidelines indicate that it should not be used as a substitute for hand washing.

Clean disposable *GLOVES* should be worn if the phlebotomist anticipates hand contact with blood and other potentially infectious materials, mucous membranes, and contaminated articles or surfaces.

Appropriate *PROTECTIVE CLOTHING,* such as gowns, aprons, and laboratory coats should be worn when gross contamination can reasonably be anticipated during performance of a task or procedure.

FACE SHIELDS or *MASKS,* in combination with *EYE PROTECTION DEVICES,* must be worn whenever splashes, spray, spatter, or droplets of blood or other potentially infectious materials may be generated, posing a hazard through contact with eyes, nose, or mouth.

Infectious waste must be placed in *BIOHAZARD CONTAINERS* that are closeable, leak-proof, and suitably constructed to contain the contents during handling, storage, transport, or shipping. The containers must be labeled or color coded and closed before removal to prevent the contents from spilling.

Used disposable syringes, needles, lancets, and other sharp items must be placed in puncture-resistant *SHARPS CONTAINERS* located as close as practical to the area in which the items were used.

Contents

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UNIT 1
Introduction to Phlebotomy

CHAPTER 1 Introduction to Phlebotomy

The modern phlebotomist is a professional trained to draw blood who has a variety of job skills and personal characteristics, including communication skills, organizational skills, and compassion. After initial training, the phlebotomist may become certified by one or more professional organizations. Continuing education courses keep the phlebotomist up to date on the latest changes in techniques and regulations in the field. The phlebotomist must also be aware of important legal issues, including patient confidentiality, informed consent, and Health Insurance Portability and Accountability Act (HIPAA) regulations.

OUTLINE

OBJECTIVES

After completing this chapter, you should be able to:

1. Define phlebotomy.
2. List at least five job skills that are important for phlebotomists to have, and explain why each is important.
3. Describe the major duty of phlebotomists, and discuss four other responsibilities that are important.
4. List six personal qualities and attributes that characterize a professional, and explain how phlebotomists demonstrate these qualities.
5. Differentiate accreditation and certification.
6. Identify professional organizations with an interest in phlebotomy.
7. Explain why informed consent and confidentiality are important legal issues for phlebotomists.

KEY TERMS

accreditation
approval
certification
continuing education units (CEUs)
informed consent
phlebotomy
protected health information
standards

ABBREVIATIONS

ACA American Certification Agency for Healthcare Professionals
AMT American Medical Technologists
ASCLS American Society for Clinical Laboratory Science
ASCP American Society for Clinical Pathology
ASPT American Society of Phlebotomy Technicians
CEUs continuing education units
CPT certified phlebotomy technician

HIPAA Health Insurance Portability and Accountability Act
NAACLS National Accrediting Agency for Clinical Laboratory Sciences
NHA National Healthcareer Association
NPA National Phlebotomy Association
PBT phlebotomy technician by AMT
PHI Protected health information
RPT registered phlebotomy technician

WHAT WOULD YOU DO?

You've been hired by Central Hospital for your first job as a phlebotomist. You start next Monday, but first you need to read the employee handbook, which includes a description of personal characteristics for the successful phlebotomist. Dependability? Check—you've been holding down a steady job for more than 2 years. Positive attitude? Check—your nickname at the warehouse is "Can do." Professional appearance? Uh-oh—no piercings, no visible tattoos, no artificial nails. You've got them all. When Monday rolls around, what should you do? Forget about the job? Tell your supervisor, "This is me—deal with it"? What would you do?

WHAT IS PHLEBOTOMY?

Phlebotomy is the practice of drawing blood. The word *phlebotomy* is derived from the Greek *phlebo-*, which means "vein," and *-tomy,* which means "to make an incision." Phlebotomy is an ancient profession, dating back at least 3500 years to the time of the ancient Egyptians. The earliest phlebotomists drew blood in an attempt to cure disease and maintain the body in a state of wellness. In Europe during the Middle Ages, barber-surgeons performed bloodletting to balance the four humors, or bodily fluids, because an imbalance of the humors was thought to underlie disease. The familiar stripes on the barber's pole date from this period, with red symbolizing blood and white symbolizing bandages. Early phlebotomists' tools included lancets (called *fleams*) and suction cups (Fig. 1.1), and they used ornate ceramic bowls to collect the blood. Phlebotomists also applied leeches to patients' skin for hours at a time to remove blood. Today, removal of a prescribed volume of blood ("therapeutic phlebotomy") is used to treat a small number of blood disorders.

MODERN PHLEBOTOMY

Modern phlebotomy shares little more than a name with these ancient practices. Today, phlebotomy is performed primarily for diagnosis and monitoring treatment of a patient's disease condition. Blood is collected from veins by inserting a needle attached to a collection device. Blood can also be collected by capillary puncture of the skin using a lancet. It involves highly developed and rigorously tested procedures and equipment, all meant to ensure the safety and comfort of the patient and the integrity of the sample collected.

Job Skills and Training

1. Today's phlebotomist is highly trained and uses a variety of skills in the workplace. Training programs require either a high school diploma or general equivalency development (GED) diploma.

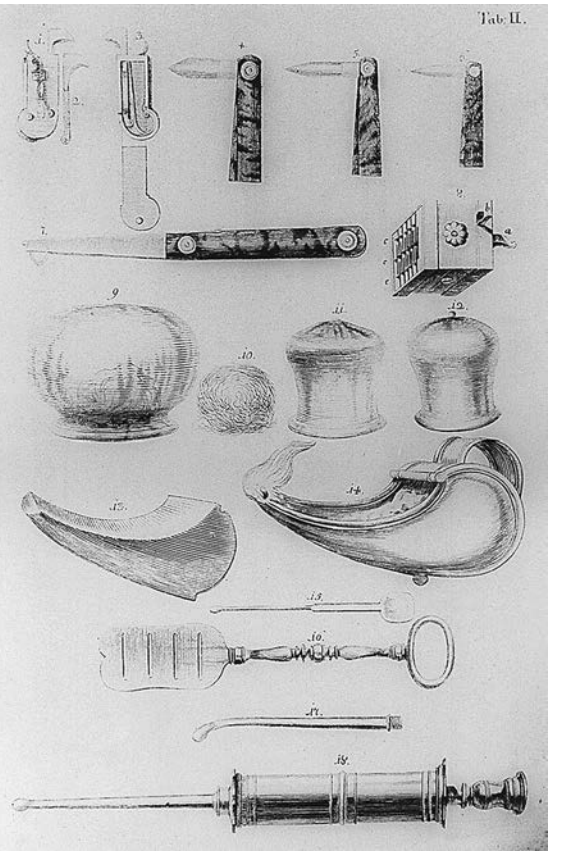

Fig. 1.1 Tools of the earliest phlebotomists. (From Brambilla GA: *Instrumentarium chirurgicum.* Vienna, Matthias Andreas Schmidt, 1781. Courtesy U.S. National Library of Medicine, History of Medicine Division, Bethesda, Md.)

Training programs are available through community colleges, technical training schools, or hospitals. Technical skills are required to collect specimens for analysis, and developing these skills will constitute a large part of your training. A phlebotomist also needs to be highly organized and detail-oriented to deal with the large number of samples that may be collected in a short time, while ensuring that each sample is properly labeled and correctly handled. To do the job correctly, the phlebotomist must learn the requirements for collection, handling, processing, and storage of specimens, as well as other departmental policies and procedures.

The successful phlebotomist is able to prioritize multiple tasks and match his or her pace to the volume of work. Equally important are interpersonal skills. As a phlebotomist, you will spend a large part of your working day interacting with people, including patients, their families, and medical personnel. Another important job skill is being able to handle stress. A phlebotomist must occasionally deal with difficult patients, fainting patients, malfunctioning equipment, or demands for immediate action. As your technical skills increase, these situations will become less stressful, but the job will always carry some stress. Being able to cope with this in a calm, professional manner is vital to being a successful phlebotomist.

Job Duties

The principal purpose of phlebotomy is to obtain blood samples, at the request of a physician or a qualified healthcare professional, such as a nurse practitioner, for analysis in the laboratory. Performing these duties correctly ensures that patients receive prompt and complete medical care. Failure to perform these duties correctly can lead to significant adverse consequences for the patient, including improper care and even death. Later chapters cover the details of how to perform each step of each procedure you will be required to perform. Your major job duties will include:

- Correctly identifying the patient, and collecting and labeling specimens of blood using appropriate equipment.
- Transporting samples to the laboratory in a timely manner, using appropriate handling procedures.
- Receiving specimens sent to the laboratory by logging into the computer system and/or accession book.
- Processing and directing specimens to the correct testing departments.
- Following the laboratory's procedures for test analysis, reporting, and maintaining records of patient test results.
- Performing moderately complex point-of-care testing.
- Adhering to the laboratory's quality control policies.
- Effectively and professionally interacting with patients and healthcare professionals.
- Performing data entry tasks accurately and efficiently.
- Problem-solving and using telephone or fax for result reporting.
- Maintaining the work area, inventory, and equipment.
- Observing confidentiality through knowledge and practice of requirements in HIPAA and other regulations.
- Adhering to all safety and infection control regulations throughout the process.

In addition, the successful phlebotomist will also likely develop other healthcare skills, such as performing blood pressure determinations and performing or instructing patients in performing collection of nonblood specimens, such as urine.

A trained phlebotomist can also be employed as a medical assistant, a laboratory assistant, or an **accessioner**, after receiving specialized training. A medical assistant works in a clinic or hospital to assist other staff in patient care and facility preparation. A medical assistant requires training in medical billing and coding with a specific certification process. A laboratory assistant assists in performing routine laboratory testing in a clinical laboratory, reference laboratory, physician's office, or blood donor services. An accessioner performs a variety of tasks related to specimen preparation in the clinical or reference laboratory. A phlebotomist may be cross-trained to perform clerical duties, such as patient registration.

Personal Characteristics

As a phlebotomist, you will often be the first medical professional a patient meets. You therefore represent not only yourself or the laboratory but the entire healthcare facility. This public relations aspect of your work is important because it sets the tone for the patient's stay in the healthcare facility and the patient's satisfaction with the service the facility provides. How you present yourself has an effect on everyone with whom you interact. The quality of care you provide has a direct effect on the patient's health and satisfaction, as well as on the healthcare facility's reputation in the healthcare setting. In addition, your interaction with a patient also affects scoring on patient satisfaction surveys. These survey results are monitored by The Joint Commission and influence the quality rating of the health care system.

Fig. 1.2 Phlebotomists spend much of the day interacting with people, and interpersonal skills are a vital part of the job.

The phlebotomist is a member of the healthcare profession and must display professional behavior at all times (Fig. 1.2). Professionalism is both an attitude toward your work and a set of specific characteristics. A professional displays the following characteristics.

Dependability

The phlebotomist plays a crucial role in the healthcare institution and is depended on to perform that role skillfully, efficiently, and without constant supervision. The phlebotomist must report to work on time and avoid all unnecessary absences or tardiness. Failure to do so can affect patient care. A late or absent phlebotomist decreases the overall function of the laboratory and may even prevent a patient from having a sample collected in a timely manner for monitoring of medication, for example.

Honesty and Integrity

Because the phlebotomist often works without supervision, unquestioned integrity is crucial. Everyone makes errors, and you will be no exception. It is vital for the health and safety of your patients that you admit to errors when they are made. Unreported errors can result in patient injury and death.

Positive Attitude

Your attitude affects everyone you interact with, and having a positive attitude toward your job makes others around you more positive as well. This is especially important in your interactions with patients and their families as well as other healthcare professionals.

Empathy and Compassion

The phlebotomist is often called on to interact with patients experiencing health crises or undergoing painful or unpleasant treatments. Patients may be worried about the procedure being performed, the condition for which they are being treated, or the cost of their care. By being sensitive to patients' concerns and taking the time to reassure anxious patients, you can help make their stay less stressful (Fig. 1.3).

Professional Detachment

Conversely, it is important to remain emotionally detached from patients. You will encounter many distressing situations in your career. Becoming emotionally involved on a personal level does not help your patients and can lead to stress and burnout. Your approach to patients in distress must be sympathetic and understanding, but you must retain enough professional distance to allow you to do your job efficiently. Developing this balanced approach is a significant step in your professional growth.

Professional Appearance

Appearance has a significant effect on how the phlebotomist is thought of by patients and treated by coworkers, including superiors. First impressions are often lasting ones. Cleanliness and scrupulous grooming are critical, with conservative clothing, hair, and makeup the general rule. Avoid long, dangling jewelry and earrings, exposed piercings other than in ears, strong perfume, and excessive or gaudy makeup. Employers usually set specific standards with regard to dress code and personal hygiene. In addition, keep your fingernails short, avoid artificial nails, and if you use nail polish, use neutral shades and avoid chips. Long nails and chipped polish breed bacteria and fungi, which may affect patients' health.

Fig. 1.3 Dealing compassionately with patients in stressful situations is part of the phlebotomist's job.

Interpersonal Skills

The phlebotomist must be able to communicate effectively with patients and coworkers. Patients may be fearful, uncooperative, or excessively talkative. In all cases, the phlebotomist must be able to communicate clearly to patients what is to be done and to obtain consent for the procedure. Speaking slowly, clearly, and in a courteous tone will help you gain the patient's trust, which is necessary to perform the procedure effectively. Nonverbal communication is important as well. By making eye contact, smiling, and appearing relaxed, calm, and prepared, you communicate confidence and professionalism to patients. Reading patients' nonverbal communication, or body language, will let you know when you need to take extra steps to put them at ease. For example, anxious patients often fidget, tap their fingers, or bounce their legs. Fearful patients may have their eyes "glazed over," unable to focus. Take the time to reassure anxious patients by listening to their needs. Take the time to answer questions. Patients need empathetic attention—they are people, not just names on requisition forms. Treat all patients as if they are a family member.

You may find some challenges that interfere with effectively communicating with patients. These may include having too little time, because of the need to move on to the next patient, or environmental issues, such as noise or lack of privacy for conversation. Patients may be in pain, or tired, or embarrassed, or anxious. You may inadvertently use medical jargon the patient does not understand. The patient may have values or beliefs that keep them from offering important information, such as the belief that one's ill health should not be discussed with strangers. And the patient may be experiencing "information overload," and not be able to process important new information you are trying to share with them. Keeping these possibilities in mind when you communicate with patients can help make your interactions better.

Telephone Skills

The phlebotomist is often required to answer calls and take messages in the laboratory. The information that comes in over the phone may be critical for patient care or for the operation of the laboratory. It is essential that you display the same high level of professionalism in answering the phone as in dealing directly with patients and coworkers. If you are staffing the desk, do the following:

- Answer the phone promptly.
- Smile when speaking, even though you cannot be seen; it will positively affect your voice tone.
- Identify the department and yourself, and ask how you can help.
- Write everything down, including the name of the person calling, their phone number, and the date and time of the call. Be prepared to take a message by having writing materials at hand.
- Speak slowly and clearly.
- Do not put the caller on hold until you determine it is not an emergency call.
- Make every attempt to help, but give only accurate information. If you do not know the answer to a question, find out and call back, if necessary.

An example of these telephone skills steps is illustrated in Box 1.1.

CLINICAL TIP

Always write down *all* pertinent information when answering the phone.

PROFESSIONAL ORGANIZATIONS AND STANDARDS

The high standards necessary for the proper practice of modern phlebotomy have led to the creation of several organizations that develop standards and monitor training in the field. There are three aspects of this type of professional monitoring: program

BOX 1.1 Answering the Phone

Here is an example of the correct way to answer the phone in the clinical laboratory:

[Phone rings]

Phlebotomist: Good afternoon, this is the clinical laboratory at Mercy Hospital. Sandy speaking. How may I help you?

Caller: This is Dr. Tom Watson from Fairview Clinic. Can you tell me if the results from the fecal test on a patient on Three West are ready yet?

Phlebotomist: I will try to find out. Can you tell me the patient identification number on the test request and the date that the specimen was sent?

Caller: The number is 243576-1. The date for the specimen was 8/12.

Phlebotomist: Thank you. Can you hold while I check?

Caller: Yes.

Phlebotomist: Thank you. Please hold.

[Phlebotomist places call on hold, checks for the results, and returns to the phone.]

Phlebotomist: Dr. Watson? What is your patient's name?

Caller: The patient is Harry Blum.

Phlebotomist: I'm sorry. The results are not back yet–we've had a slight delay here. May I take your number and call you when they are ready? It should be about 2 hours.

Caller: Yes. I'm at 555-5555.

Phlebotomist: [Writes down number.] I will call you as soon as the results are ready.

Caller: Thank you.

Phlebotomist: Thank you. Good-bye.

approval, phlebotomist certification, and continuing medical education. The program in which you are training to become a phlebotomist should be approved for running a training program. The approval can be through a national organization like the National Accrediting Agency for Clinical Laboratory Sciences (NAACLS) (see later) or a state agency. Once you receive your training, you can become certified by taking a certification examination. After you become certified, you may need to participate in continuing medical education to remain certified. Some of the organizations and the services they provide are shown in Table 1.1.

Membership in a professional organization for phlebotomists offers an additional way to follow changes in the field and to learn important new information. Some of the organizations listed in Table 1.1 publish journals with useful articles or sponsor workshops or seminars.

Approval

Programs that train phlebotomists receive **approval** from a professional organization by meeting and documenting established requirements, called ***standards***. An approved education program exposes students to both classroom and clinical experiences and fully prepares them to become professional phlebotomists. As shown in Table 1.1, the organizations that provide approval are the American Society of Phlebotomy Technicians (ASPT), NAACLS, and the National Phlebotomy Association (NPA). The program you are enrolled in may be approved by one or more of these organizations. As discussed later, California approves training programs within that state.

Certification

After completing an approved program, you are eligible to take a certifying examination. **Certification** is evidence that an individual has demonstrated proficiency in a particular area of practice. As shown in Table 1.1, the organizations and companies that offer certification are American Allied Health, the American Certification Agency for Healthcare Professionals (ACA), the AMT, the American Society for Clinical Pathology (ASCP), the ASPT, the National Healthcareer Association (NHA), and the NPA. Once you pass the examination, you may use the title shown in Table 1.1 as part of your professional name.

State Licensure

Several states require that phlebotomists obtain a license directly from the state to perform phlebotomy within the state. These states include California, Louisiana, Nevada, and Washington. The requirements for each state as of late 2018 are discussed below.

California

Phlebotomists in California fall under a set of state regulations governing their education, training, and certification. Those who wish to become phlebotomists must show proof of having met several educational requirements, including the following:

- High school diploma or equivalent
- Forty hours of classroom instruction in phlebotomy (20 hours basic, 20 hours advanced) in a state-accredited program
- Forty hours of practical training in phlebotomy in a state-accredited program, including at least 50 venipunctures and 10 skin punctures
- Certification from a national phlebotomy organization that is approved by the state to administer examinations and issue certification.

Once you have met all these requirements, you are eligible to apply to the state for certification to practice phlebotomy. (A high school diploma or equivalent plus 20 hours of training will allow you to qualify as a limited phlebotomy technician and perform skin punctures only; this does not require certification.) State certification is for 2 years, with renewal based on meeting continuing education requirements.

The initial certification granted is as a certified phlebotomy technician level I (CPT-I), which enables phlebotomists to perform dermal punctures and venipunctures without supervision and arterial punctures with the supervision of a physician, registered nurse, medical laboratory scientist, medical laboratory technician, or certified respiratory therapist. After performing 20 successful supervised arterial punctures, the CPT-I can apply to become a CPT-II, with the ability to perform unsupervised arterial punctures.

Practicing phlebotomists may need to show proof of classroom instruction to obtain state certification, even if they are already certified by a national organization.

Regardless of whether you plan to practice in California, it is wise to get the maximum amount of training before you start your career as a phlebotomist.

Louisiana

The state of Louisiana requires phlebotomists to apply for licensure through the State Board of Medical Examiners after receiving certification from one of the private national organizations. There are multiple exemptions from this requirement, however.

TABLE 1.1 Organizations That Provide Accreditation, Certification, or Continuing Education

Name	Approves Training Programs	Certifies Phlebotomists (Title Awarded)	Offers Continuing Education Units
American Allied Health, Inc. Testing and Certification PO Box 1487 Lowell, AR 72745 (479) 553-7614 www.americanalliedhealth.com	No	Yes	No
American Certification Agency for Healthcare Professionals (ACA) PO Box 58 Osceola, IN 46561 (574) 277-4538 www.acacert.com	No	Yes	Yes
American Medical Technologists (AMT) 10700 W. Higgins Rd., Suite 150 Rosemont, IL 60018 (847) 823-5169 (800) 275-1268 www.americanmedtech.org	No	Yes (registered phlebotomy technician [RPT])	Yes
American Society for Clinical Laboratory Science (ASCLS) 1861 International Drive, Suite 200 McLean, VA 22102 (571) 748-3770 (800) 867-2727 www.ascls.org	No	No	Yes
American Society for Clinical Pathology (ASCP) Board of Certification (BOC) 33 W. Monroe St., Suite 1600 Chicago, IL 60603 (312) 541-4999 www.ascp.org	No	Yes (phlebotomy technician [PBT])	Yes
American Society of Phlebotomy Technicians (ASPT) PO Box 1831 Hickory, NC 28603 (828) 327-3000 www.aspt.org	Yes	Yes (certified phlebotomy technician [CPT])	Yes
National Accrediting Agency for Clinical Laboratory Sciences (NAACLS) 5600 N. River Rd., Suite 720 Rosemont, IL 60018-5119 (773) 714-8880 www.naacls.org	Yes	No	No
National Center for Competency Testing (NCCT) 7007 College Blvd, Suite 385 Overland Park, KS 66211 (800) 875-4404 www.ncctinc.com	No	Yes	No
National Healthcareer Association (NHA) 11161 Overbrook Rd. Leawood, KS 66211 (800) 499-9092 www.nhanow.com	No	Yes (CPT)	Yes
National Phlebotomy Association (NPA) 1901 Brightseat Rd. Landover, MD 20785 (301) 386-4200 www.nationalphlebotomy.org	Yes	Yes	No

If you fall into one of the categories for exemption in the board's rules, you do not need a state license to practice phlebotomy. Those exempted include phlebotomists supervised by a licensed physician, or a licensed clinic, hospital, nursing home, or other licensed healthcare facility authorized by licensure to perform clinical laboratory testing.

Nevada

In Nevada, you must present a high school diploma or equivalency degree. You must also be certified by one of two national certification agencies (either the ASCP or the AMT) or complete at least 6 months of training under the supervision of a state-approved practitioner. For the purposes of the application, phlebotomists are classified as either Office Lab Assistants (if you work in a physician's private practice) or Lab Assistants (if you work in an independent licensed laboratory, a hospital, or other facility serving more than a single physician's patients).

Washington

Phlebotomists in the state of Washington must obtain certification from the state as a "Medical Assistant–Phlebotomist." This is not to be confused with a medical assistant who has completed a training program specific to medical assistants. A Medical Assistant–Phlebotomist is trained specifically in the field of phlebotomy. Requirements for licensure as a Medical Assistant–Phlebotomist include a high school diploma or equivalency degree; the ability to read, write, and converse in English; 7 hours of acquired immunodeficiency syndrome (AIDS) education; and proof of appropriate training in phlebotomy. Acceptable proof includes one of the following: a transcript indicating successful completion of a phlebotomy program through an accredited postsecondary school, a statement from a healthcare practitioner that he or she supervised your training, or a transcript indicating you received phlebotomy education and training in the military.

Continuing Education

Certification programs usually require phlebotomists to participate in continuing education programs and earn a certain number of **continuing education units (CEUs)** to remain certified. These programs provide updates on new information, regulations, and techniques and help phlebotomists refresh skills that are used less frequently. Larger healthcare institutions often sponsor such programs on site. As shown in Table 1.1, the organizations that provide continuing education are the AMT, the American Society for Clinical Laboratory Science (ASCLS), the ASCP, the ASPT, and the NPA.

LEGAL ISSUES IN PHLEBOTOMY

As in every other profession, phlebotomy is bound by laws and regulations governing the workplace, relations with customers (patients), and the privacy of privileged information, such as medical records. Failure to observe these laws and regulations may be cause for dismissal and may lead to a lawsuit against you or your institution. Here, we stress the two most important legal aspects of the phlebotomist's profession: informed consent and confidentiality.

FLASH FORWARD
Legal issues are discussed in more detail in Chapter 19.

Informed Consent

Informed consent means that a patient must be informed of intended treatments and their risks before they are performed. For the phlebotomist, this means that the patient must understand that blood is to be drawn and must consent to that procedure before the phlebotomist may proceed. Whenever there are communication barriers to the informed consent process, extra care must be taken to assure the patient understands and consents to the procedure. Examples of this are minors (children, infants), for whom parents or guardians give consent; patients who do not speak English; and patients who are mentally impaired or unconscious. Follow your facility policy in these cases. The patient has the right to refuse any medical treatment, including phlebotomy procedures requested by the physician. When a patient refuses, follow your institution's policy to ensure that the patient's physician is notified promptly. This usually involves notifying the patient's nurse, who will then notify the physician.

Confidentiality

All information regarding a patient's condition, including the types of tests ordered or the results of those tests, is confidential medical information. For the phlebotomist, this means that information regarding a patient should never be discussed with a coworker who is not involved in that patient's treatment. Discussions should never occur in common rooms or public areas, such as elevators, hallways, waiting rooms, or cafeterias. Furthermore, a phlebotomist should never discuss patients with their own friends and family.

Health Insurance Portability and Accountability Act

The privacy of medical information is covered by the Health Insurance Portability and Accountability Act (HIPAA), a law that went into effect in 1996. Under HIPAA, medical institutions must have procedures in place to actively protect the confidentiality of a patient's **protected health information (PHI)**. PHI includes any information about the patient's name, address, contact information, race, health status, treatment, or payment for health care. It may be in written, oral, or electronic forms. PHI is present on requisitions, labels, and other patient-specific materials.

As a phlebotomist, you will have access to some elements of a patient's PHI, and you are responsible for helping to protect the confidentiality of that information. That means, among other things, you must not discuss PHI with anyone who is not authorized to have access to it. For instance, you must not discuss a patient's health condition or treatment with a coworker who is not part of the patient's treatment team. Similarly, you must not have such discussions with family members or friends outside of work. If you are working at a computer screen displaying PHI, you must take care to prevent members of the public from viewing it. If you are carrying a stack of requisitions during your hospital rounds, as you enter a patient's room, you must ensure that the PHI of another patient is not visible.

REVIEW FOR CERTIFICATION

The modern professional phlebotomist must display technical, organizational, and interpersonal skills. The ability to communicate effectively with patients, the public, and coworkers is critical. Phlebotomy can be a stressful profession, and it is important to remain professionally detached even while showing compassion and care for all patients.

Phlebotomy training occurs at institutions that have received accreditation from one or more national agencies. After completing course work and practical training, the phlebotomist is eligible to take a national examination and receive certification from a national phlebotomy organization. Continuing education is often required to maintain certification. California, Louisiana, Nevada, and Washington have state licensure requirements.

Significant legal issues in phlebotomy include confidentiality and informed consent. The phlebotomist should never disclose information about a patient to third parties who are not involved in the patient's care. Every patient has the right to refuse treatment, including the withdrawal of blood. HIPAA regulates protected health information. The phlebotomist must ensure the confidentiality of PHI under his or her control.

WHAT WOULD YOU DO?

Maintaining a professional appearance is part of what it means to be a professional phlebotomist. Dress codes may vary, but most institutions will not look kindly on any flamboyant aspect of personal appearance, including piercings, tattoos, revealing dress, or unusual hair colors. Artificial nails can interfere with your performance of your job, and broken nails can harbor infection. So if you want this job, you will need to do your best from the first day to meet the expectations of your employer, including for your appearance. You can remove the nails, take the piercings out while you are work, and cover up the tattoos so they are not visible. Do not wait to be told by your new employer—show up on the first day ready to be a part of the medical profession in every respect.

STUDY QUESTIONS

See answers in Appendix F.

1. Define phlebotomy.
2. List the major job duties of the phlebotomist.
3. Besides drawing blood samples, what other skills may a phlebotomist be trained to perform?
4. Define certification.
5. Explain the purpose of CEUs.
6. List three organizations that provide accreditation for phlebotomy programs.
7. List three organizations that provide certification for phlebotomists.

8. Why would a phlebotomist wish to become a member of a professional organization?
9. What is informed consent?
10. Describe two actions that would violate HIPAA's regulation of protected health information.
11. Describe some of the ancient phlebotomy practices and their uses.
12. Describe modern-day phlebotomy practices, their use in modern health care, and their similarities to ancient phlebotomy practices.
13. List and explain at least four responsibilities in the phlebotomist's job-related duties.
14. List at least four of the required personal characteristics of the phlebotomist.
15. Explain which one of the preceding four personal characteristics you feel is the most important to possess.
16. List the two most important legal aspects of the phlebotomist's profession.

CERTIFICATION EXAMINATION PREPARATION

See answers in Appendix F.

1. Phlebotomy skills would not include
   a. organization.
   b. handling patient correspondence.
   c. interpersonal skills.
   d. being able to handle stress.
2. The monitoring system for institutions that train phlebotomists is known as
   a. certification.
   b. accreditation.
   c. licensure.
   d. CEUs.
3. Once certified, what must a phlebotomist earn to ensure continued certification?
   a. CEUs
   b. Licensing points
   c. Accreditation
   d. A degree
4. Informed consent means
   a. patients must ask their physicians if they can have blood drawn.
   b. patients waive their rights.
   c. patients must be informed of intended treatments and their risks before they are performed.
   d. the phlebotomist may draw a patient's blood without the patient's permission.
5. Which characteristic is not a required personal characteristic of a professional phlebotomist?
   a. Dependability
   b. Honesty
   c. Compassion
   d. Sense of humor
6. When a patient in the hospital refuses to have blood drawn, the phlebotomist should
   a. persuade the patient to comply.
   b. perform the phlebotomy.
   c. notify a family member.
   d. notify the patient's nurse to ensure that the physician or other ordering practitioner is notified promptly.

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CHAPTER 2 Healthcare Structure

Phlebotomists may be employed in a variety of healthcare settings, including health maintenance organizations, clinics, urgent care centers, nursing homes, hospital laboratories, reference laboratory draw stations, and physician's office laboratories. Many phlebotomists, however, work in the clinical laboratory of a hospital. The various departments within the clinical laboratory are all involved in the analysis of patient samples, whether blood, urine, or other body fluids or tissues. To be accredited, all clinical laboratories must meet standards set by a variety of national organizations. In this chapter, you will learn about the organizational structures found in hospitals, how the phlebotomist fits into the larger healthcare environment, and how each department in the laboratory works with others to provide the many services offered.

OUTLINE

OBJECTIVES

After completing this chapter, you should be able to:

1. Describe the overall structure of a typical hospital.
2. Explain the roles of each of the following hospital branches, and list the kinds of jobs included:
   a. Fiscal and information services
   b. Support services
   c. Nursing services
   d. Professional services
3. Describe the departments and functions of the professional services branch of the hospital.
4. List the personnel who may work in the laboratory.
5. Describe the functions of the anatomic and surgical pathology laboratory.
6. List the major departments of the clinical laboratory.
7. Describe the kinds of samples typically analyzed and the kinds of tests that may be performed in each of the following clinical laboratory sections:
   a. Hematology
   b. Coagulation and hemostasis
   c. Chemistry
   d. Specimen
   e. Microbiology
   f. Urinalysis and clinical microscopy
   g. Serology or immunology
   h. Blood bank or immunohematology
   i. Molecular diagnostics
   j. Referrals
8. Explain the role of molecular diagnostics and flow cytometry in laboratory testing.
9. Explain how laboratory quality is monitored, and list at least four organizations that are involved in ensuring quality laboratory testing.
10. Describe other healthcare settings where a phlebotomist may work.

KEY TERMS

anatomic and surgical pathology area
autologous donation
blood bank
blood type
centrifuge
chemistry panel
Clinical and Laboratory Standards Institute (CLSI)
Clinical Lab Improvement Act of 1988 (CLIA '88)
clinical laboratory
clinical pathology area
coagulation
College of American Pathologists (CAP)
complete blood count (CBC)
culture and sensitivity (C&S) test
flow cytometry
forensic
health maintenance organization (HMO)
hemolyzed
hemostasis
icteric

immunochemistry
immunohematology
The Joint Commission
lipemic
molecular diagnostics
nursing home
physician's office laboratory (POL)
preferred provider organization (PPO)
professional services
reagent
reference laboratory
serum separator tube
stat
urgent care center

ABBREVIATIONS

2-hr PPBS 2-hour postprandial blood sugar
AIDS acquired immunodeficiency syndrome
ALP alkaline phosphatase
ALT alanine aminotransferase
ANA antinuclear antibodies
aPTT activated partial thromboplastin time
AST aspartate aminotransferase
BMP basic metabolic panel
BUN blood urea nitrogen
C&S culture and sensitivity
CAP College of American Pathologists
CBC complete blood count
CCU cardiac care unit
CK creatine kinase
CK-MB creatine kinase-MB
CLIA '88 Clinical Laboratory Improvement Act of 1988
CLSI Clinical and Laboratory Standards Institute
CMP comprehensive metabolic panel
CNA certified nursing assistant
CT computed tomography
diff differential
DNA deoxyribonucleic acid
EDTA ethylenediaminetetraacetic acid
ER, ED emergency room, emergency department
ESR erythrocyte sedimentation rate
FBS fasting blood sugar
FDP fibrin degradation product
GTT glucose tolerance test
hCG human chorionic gonadotropin
Hct hematocrit
HDL high-density lipoprotein
Hb hemoglobin
Hb Alc glycated hemoglobin/glycosylated hemoglobin
HIV human immunodeficiency virus
HMO health maintenance organization
ICU intensive care unit
INR international normalized ratio
IV intravenous
LDL low-density lipoprotein
LIS laboratory information services
LPN licensed practical nurse
MCH mean corpuscular hemoglobin
MCHC mean corpuscular hemoglobin concentration
MCV mean corpuscular volume
MIS manager of information services
MLS medical laboratory scientist
MLTs medical laboratory technicians
MPV mean platelet volume
MRI magnetic resonance imaging
MTs medical technologists
NICU neonatal intensive care unit
NSY nursery
OR operating room
PCA patient care assistant
PCT patient care technician
PET positron emission tomography
Plt platelets
POLs physician's office laboratories
PPOs preferred provider organizations
PT prothrombin time
RBCs red blood cells
RDW red blood cell distribution width
RN registered nurse
RPR rapid plasma reagin
SST serum separator tube
STAT short turnaround time
TDM therapeutic drug monitoring
WBCs white blood cells

WHAT WOULD YOU DO?

It's your third week on your new job as a phlebotomist at Green Hills Hospital. Your supervisor has been showing you the rounds, observing your technique, and helping you learn the routine, but today you are on your own. Your first three blood draws go just fine, but they took longer than you expected. You are now on your fourth patient, and there is a problem. Your instructions were to draw the sample by 7:30 a.m. but it's now 7:45 a.m. and you are just getting started. If the blood sample isn't drawn, the patient may not be ready for his treatment later that morning. Should you take the sample even though it is after the specified time and just label it 7:30 a.m.?

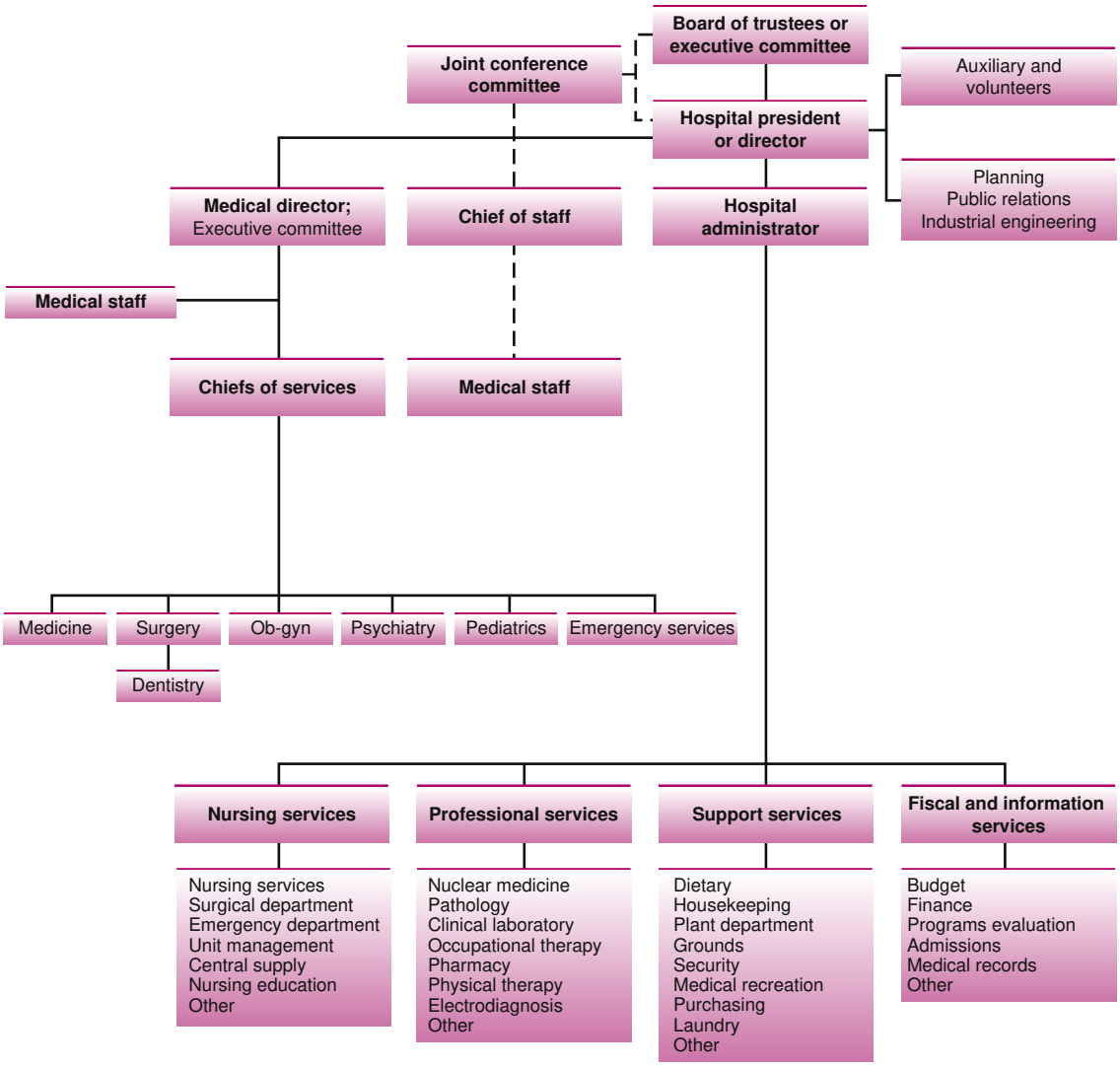

Fig. 2.1 Example of a Hospital Organizational Chart. (Modified from Hupp J, Tucker M, Ellis: *Contemporary oral and maxillofacial surgery,* ed. 6, St. Louis, 2014, Mosby.)

HOSPITAL ORGANIZATION

The hospital laboratory in which a phlebotomist works is one part of a large organization. Organization of the hospital may vary, with larger hospitals having more complex and varied structures than smaller hospitals (Fig. 2.1). The chief of staff oversees the medical staff. The medical staff includes many types of specialists (see Table 2.1). The hospital administrator oversees the central administration of the hospital. The hospital administrator also oversees the various branches of support personnel. These are divided into several branches, typically fiscal and information services, support services, nursing services, and professional services. Professional services include the clinical laboratory in which the phlebotomist works and are discussed in detail later.

Fiscal and Information Services

This branch is responsible for admissions and medical records, as well as for billing, accounting, and other financial aspects of the hospital. Human resources may be a part of this branch as well.

Support Services

This branch includes all aspects of the physical plant of the hospital, such as cleaning, maintenance, and security, as well as food service and purchasing.

Nursing Services

Nursing services personnel provide direct care to patients. Phlebotomists have a great deal of direct contact with nursing personnel. Some nursing services departments have their own phlebotomy team. Nursing services include a range of people with various

TABLE 2.1 Medical Specialties Within a Typical Hospital

Department	Medical Specialist	Practice Area
Anesthesia	Anesthesiologist	Administers medications during surgical procedures to manage pain and consciousness
Cardiology	Cardiologist	Diagnosis and treatment of diseases of heart and circulatory system
Dermatology	Dermatologist	Diagnosis and treatment of skin disorders
Endocrinology	Endocrinologist	Diagnosis and treatment of diseases of hormones disorders
Gastroenterology	Gastroenterologist	Diagnosis and treatment of diseases of intestinal and stomach disorders
Gerontology	Gerontologist	Diagnosis and treatment of diseases that affect older patients
Internal Medicine	Internist	Diagnosis and treatment of diseases that affect one or more organ systems
Nephrology	Nephrologist	Diagnosis and treatment of kidney diseases
Neurology	Neurologist	Diagnosis and treatment of diseases that affect the nervous system
Obstetrics/Gynecology	Obstetrician, Gynecologist	Treatment/management of pregnant women. Diagnosis and treatment of diseases of the female reproductive system
Oncology	Oncologist	Diagnosis and treatment of cancer
Orthopedics	Orthopedist	Diagnosis and treatment of diseases of bone, muscle, and joint redundant
Pediatrics	Pediatrician	Diagnosis and treatment of diseases in children from birth to adolescence
Pharmacy	Pharmacist	Prepares and dispenses medications ordered by medical doctors
Pulmonary Medicine	Pulmonologist	Diagnosis and treatment of lung diseases
Psychiatry	Psychiatrist	Diagnosis and treatment of diseases of the mind
Radiology	Radiologist	Examination and interpretation of medical images for diagnosis of diseases, including x-ray, ultrasound, magnetic resonance imaging, and nuclear medicine studies
Surgery	Surgeon	Performs surgery to treat disease
Urology	Urologist	Diagnosis and treatment of diseases of the urinary tract

levels of education and training, including the registered nurse (RN), licensed practical nurse (LPN), certified nursing assistant (CNA), patient care technician (PCT), or patient care assistant (PCA), and ward clerk or unit secretary. Nursing staff are divided among a number of units within the hospital, depending on the size of the institution. The most common divisions are the emergency room (ER) or emergency department (ED), operating room (OR), intensive care unit (ICU), cardiac care unit (CCU), nursery (NSY), maternity, pediatrics, and labor and delivery, as well as inpatient floors for medical, surgical, and psychiatric patients. Larger hospitals have specialty units, such as neonatal intensive care unit (NICU), neurology, and pulmonology units. Nurses can also hold positions, such as case managers, discharge planners, and other specialized service providers within the hospital.

Professional Services

Professional services personnel provide services at the request of licensed practitioners (including physicians and nurse practitioners) who aid in the diagnosis and treatment of patients. Each department provides specialized services.

Cardiac Catheterization

This department evaluates and treats patients with cardiovascular disease by inserting devices into the bloodstream that are threaded up to the heart.

FLASH FORWARD
You will learn more about these devices in Chapter 12.

Clinical Laboratory

The **clinical laboratory** analyzes samples from patients at the request of physicians or other licensed healthcare personnel. The samples may be blood, urine, or other body fluids, or they may be cells from aspiration procedures or pieces of tissue from biopsies. Results of these tests are used for making a diagnosis, monitoring treatment, or determining a patient's prognosis. A more detailed discussion of the clinical laboratory is presented later in this chapter.

Nuclear Medicine

This department uses radioisotopes to perform tests and treat diseases. Radioisotopes are unstable forms of certain elements that can be detected as they break down. They are often used as tracers; when injected into a patient's bloodstream, they can be tracked to reveal the structure and function of internal organs. In large doses, radioisotopes can be used to destroy cancerous tissue.

Occupational Therapy

Occupational therapists assess patients and design adaptive aids or compensatory strategies to help people with physical or mental impairments

perform tasks of daily living and reach their maximum potential.

Pharmacy

The pharmacy prepares and dispenses drugs that have been prescribed by physicians.

Physical Therapy

Physical therapists assess patients both before and after treatment and devise plans of physical treatment. Physical therapists design exercises, stretching programs, and other physical treatments to aid in a patient's rehabilitation after injury or illness.

Radiation Therapy

The radiation therapy department also treats cancer, using x-rays or other high-energy radiation sources to destroy tumors.

Radiology or Medical Imaging

The radiologist interprets a range of diagnostic and therapeutic procedures using various forms of radiant energy. The radiologic technologist obtains radiographs, computed tomography (CT) scans, magnetic resonance imaging (MRI) scans, positron emission tomography (PET) scans, and fluoroscopy images.

Respiratory Therapy

Respiratory therapists provide treatment for respiratory disorders. They often perform arterial punctures for the determination of arterial blood gas measurements.

INTRODUCTION TO THE CLINICAL LABORATORY

The clinical laboratory (also called a *medical laboratory*) is divided into two main areas: the **anatomic and surgical pathology area**, which analyzes the characteristics of cells and tissues, and the clinical pathology area, which analyzes blood and other body fluids. The phlebotomist works in the clinical pathology area of the clinical laboratory. Box 2.1 lists many of the personnel within a typical clinical laboratory.

Laboratory Personnel

The clinical laboratory is usually under the supervision of a pathologist, who is a physician with special training in laboratory analysis of tissues and fluids or a physician who has a minimum of 2-years experience directing or supervising high complexity testing or a one who holds an earned doctorate in chemical, physical, biological, or clinical laboratory science from an accredited institution. A laboratory manager directs the administrative functions of the laboratory, including hiring personnel. Management staff may include a manager of information services (MIS) and a laboratory information services (LIS) coordinator. Laboratory supervisors, such as department supervisors or shift supervisors, supervise personnel, monitor equipment maintenance, and monitor test results. Medical laboratory scientists (MLSs) or medical laboratory technicians (MLTs) run routine tests, perform equipment maintenance, and collect specimens. MLSs have bachelor of science degrees in clinical laboratory science–medical technology, whereas MLTs have associate's degrees. The American Society for Clinical Pathology now assigns the title Medical Laboratory Scientist (MLS) to both MT and clinical laboratory technician positions. Phlebotomists collect blood specimens for analysis in the laboratory. Phlebotomists obtain certification from a nationally recognized certifying agency.

Anatomic and Surgical Pathology Area

This area is usually divided into three sections, or departments.

Cytogenetics

The cytogenetics department examines chromosomes for evidence of genetic disease, such as Down syndrome.

Cytopathology

The cytology department processes and stains cells that are shed into body fluids or removed from tissue with a needle (aspiration) and examines them for the presence of cancer or other diseases. The cytotechnologist assists in this work. One of the most common tests performed in cytology is the Pap smear.

BOX 2.1 Personnel in a Typical Clinical Laboratory

Pathologist/lab director
Laboratory manager
Laboratory supervisor (e.g., department or shift supervisor)
Lead medical technologist
Staff medical technologist
Medical laboratory scientists/technicians
Laboratory assistant
Phlebotomist

BOX 2.2 Blood Bank Tests

Type and Rh	Determines patient's blood group and Rh type
Antibody screen	Detects the presence of antibodies to antigens in patient's blood
Cell panel	Identifies atypical antibodies present in patient's blood
Fetal screen	Identifies fetal cells in female patient's blood
Cross match/ compatibility test	Pretransfusion testing between donor and recipient blood
Antigen type	Determines antigen identity

Histology

The histology department prepares tissues from autopsy, surgery, or biopsy for microscopic examination by a pathologist. Special stains are used to highlight particular cell morphology. The histotechnologist helps prepare samples for the pathologist to examine.

Clinical Pathology Area

Blood and other body fluids can be analyzed in a number of ways, and the divisions within the clinical pathology area reflect these differences. The number of sections in this area depends on the size of the hospital. In some laboratories, some functions may be combined. The clinical departments in a typical laboratory are as follows:

- Blood banking or immunohematology
- Chemistry
- Specimen processing
- Coagulation and hemostasis
- Hematology
- Flow cytometry
- Microbiology
- Molecular diagnostics
- Serology or immunology
- Urinalysis and clinical microscopy
- Phlebotomy
- Referrals

FUNCTIONS OF THE CLINICAL PATHOLOGY LABORATORY DEPARTMENTS

Blood Bank or Immunohematology

The **blood bank** or **immunohematology** department deals with blood used for transfusions. Blood is tested there to identify the blood type of both patient and donor blood to determine their compatibility (Box 2.2). Compatibility testing is performed to ensure that the patient's immune system does not reject the donor blood.

Specimens for this department are drawn in a plain red-top tube or a special pink-top tube containing a chemical called ethylenediaminetetraacetic acid (EDTA). The strictest attention must be paid to patient identification and sample labeling. A fatal transfusion reaction may occur if either patient identification or labeling are incorrect (Box 2.2).

Blood type is determined by the presence and type of particular antigens on the surface of red blood cells (RBCs). In routine blood typing, two major antigen groups are tested for: the ABO group and the Rh group. In addition, dozens of other antigens can be determined to improve the match and prevent adverse transfusion reactions. This is important for patients receiving multiple transfusions over a lifetime, such as for leukemia or anemia.

In compatibility testing, patient serum is mixed with donor RBCs to look for clumping of cells, caused by a reaction between the patient's antibodies and the antigens on the donor cells. If clumping is seen, the donor blood cannot be used. Patients can also donate their own blood for use later, called ***autologous donation***. This is often done several weeks before a patient is scheduled for surgery.

The blood bank department may also process donated blood to obtain blood components. Blood is donated and handled by the unit, which is equivalent to a pint. With use of a centrifuge, blood can be separated in several ways to obtain the following components:

- Packed cells, consisting of RBCs, white blood cells (WBCs), and platelets, without plasma
- Fresh frozen plasma, collected from a unit of blood and immediately frozen
- Platelets, harvested from several units of blood and combined in a single packet
- Cryoprecipitate, the component of fresh plasma that has clotting factors

Each of these has specific uses. For instance, cryoprecipitate may be used for patients with clotting disorders.

FLASH FORWARD
You will learn about blood bank collections in Chapter 14.

Chemistry

The chemistry department performs a range of tests on the chemical components of blood. Chemistry tests may be performed as either single tests or as groups, called ***chemistry panels***. The most common tests and panels are shown in Table 2.2. The panels

TABLE 2.2 Common Chemistry Tests and Panels

Test or Panel	Purpose
Basic Metabolic Panel (BMP) • Blood urea nitrogen (BUN) • Calcium • Creatinine • Electrolytes • Glucose	Is used as a general metabolic screen
Coronary Risk or Lipid Panel • Cholesterol • High-density lipoprotein (HDL) • Low-density lipoprotein (LDL) • Triglycerides • B-type natriuretic Peptide – BNP	Assesses risk for heart disease
Electrolytes • Bicarbonate • Chloride (Cl^-) • Potassium (K^+) • Sodium (Na^+)	Evaluates levels of ions in the blood
General Health or Comprehensive Metabolic Panel (CMP) • Alkaline phosphatase (ALP) • Aspartate aminotransferase (AST) • Bilirubin • BMP • Total protein or albumin	Assesses the overall health standard of the patient
Glucose • 2-Hour postprandial blood sugar (2-hr PPBS) • Fasting blood sugar (FBS) • Glucose tolerance test (GTT) • Glycosylated hemoglobin (Hb A_{1c})	Assesses risk for diabetes mellitus (elevated levels indicate diabetes mellitus)
Liver Function Panel • Alanine aminotransferase (ALT) • Albumin • Alkaline phosphatase (ALP) • Aspartate aminotransferase (AST) • Bilirubin–conjugated • Bilirubin–total • Globulin • Total protein • GGT- gamma-glutamyl transferase	Assesses liver function
Myocardial Infarction • Creatine kinase (CK) • Creatine kinase-MB (CK-MB) • Troponin I	Determines the occurrence and timing of a myocardial infarction
Renal Disease • Albumin • Creatinine clearance • Phosphorus	Assesses kidney function
Pancreas • Amylase • Lipase	Assessment of pancreatic function
Drug tests • Drugs of abuse • Alcohol	Detection of drugs and their metabolites in urine

are used to screen for a variety of diseases or assess general wellness in patients.

General types of tests performed include toxicology, immunochemistry, and electrophoresis. Toxicology tests analyze plasma for levels of drugs and poisons. These tests are used for therapeutic drug monitoring (TDM), identification of illegal drugs, and detection of lead and other toxic substances. **Immunochemistry** tests use antibodies to detect a range of substances in the blood. Electrophoresis separates chemical components of blood based on differences in electrical charge. Electrophoresis is most often used to analyze hemoglobin, enzymes, and other proteins.

Most tests are automated, and advances in the instruments used to perform these tests allow them to be run using very small samples. In many cases, this means that less blood is needed from the patient, which can decrease patient discomfort significantly. For patients who require frequent blood monitoring, it can also reduce the chance of developing anemia. The clinical pathology laboratory must keep records of the amount of blood drawn from each patient.

CLINICAL TIP

Always determine the specimen volume requirements of tests requested by the physician.

FLASH FORWARD

You will learn how to determine collection volumes for newborns and infants in Chapter 12.

Specimen Processing

Chemistry tests are performed on either serum or plasma. Serum is collected in a tube without anticoagulants (a plain red-top tube) or in a **serum separator tube (SST)**. Plain red-top tubes need 45 to 60 minutes for full clot activation, and an SST needs a minimum of 30 minutes. When results are needed quickly (a **stat**, or short turnaround time requisition), blood can be collected in a tube with clot activators. After clotting, serum is separated out by centrifugation. A **centrifuge** spins the sample at high speeds to separate components based on density (Fig. 2.2). Plasma, which is also used for stat results, is collected with the anticoagulants heparin sodium or sodium fluoride in the tube. These anticoagulants prevent blood from clotting, allowing for immediate centrifugation, which shortens the TAT (turnaround time) for reporting the test results.

Fig. 2.2 A Centrifuge Spins Samples at High Speeds.

FLASH FORWARD

You will learn more about serum and plasma in Chapter 7.

Serum is normally a clear, pale yellow fluid. The color and appearance of the serum sample can be altered by both the patient's condition and the collection technique. Liver disease can increase the amount of bilirubin in the serum, making it appear a darker yellow (called ***icteric*** *serum*). Recent ingestion of fats or other lipids can make the sample cloudy (**lipemic** serum). Hemolysis, or breakage of RBCs, can give the serum a pink tinge (**hemolyzed** serum). Hemolysis may occur as a result of a poorly performed draw. Many laboratory tests measure the substance of interest by photometry, in which the substance is reacted with other chemicals to form a colored solution whose intensity is detected by passing light through the sample. If the original sample is degraded by hemolysis or other contamination, however, the results of photometry tests can be erroneous.

Serum quality can also be affected by postcollection handling procedures. Some samples must be chilled during transport, whereas others must be protected from light. Some tests must be performed within 1 hour of collection.

FLASH FORWARD

You will learn more about special specimen handling procedures in Chapters 14 and 16.

Chemistry tests are also performed on other body fluids, such as urine, cerebrospinal fluid, and synovial fluid (from joints).

Coagulation and Hemostasis

This department is usually part of the hematology department, but it may be separate in larger hospitals.

BOX 2.3 Coagulation Tests

- *Activated partial thromboplastin time (aPTT):* monitor heparin therapy, coagulation factor deficiency
- *D-Dimer:* disseminated intravascular coagulation
- *Factor activity assays:* coagulation factor deficiency
- *Fibrin degradation product (FDP):* disseminated intravascular coagulation
- *Fibrinogen:* risk of cardiovascular disease
- *International normalized ratio (INR):* monitor Coumadin therapy
- *Prothrombin time/protime (PT):* coagulation factor deficiency
- *Thrombin time:* heparin-like anticoagulants, antibody inhibitors of thrombin

Fig. 2.3 Automated Coagulation Instrument.

Hemostasis refers to the process by which the body stops blood from leaking out of a wound. Hemostasis involves coagulation and other processes. **Coagulation** depends on the presence of clotting factors and platelets.

Coagulation tests are performed on plasma (Box 2.3). Coagulation studies (samples) are collected in a tube containing the anticoagulant citrate, which preserves the coagulation factors better than other anticoagulants do. Coagulation tests are most often performed to monitor anticoagulant therapy, for instance, in a patient who has had a thrombotic stroke, heart attack, or thrombophlebitis. Drugs to prevent the formation of clots help avoid the recurrence of stroke, but the dosage must be adjusted to allow a minimal level of clotting and uncontrolled bleeding. The activated partial thromboplastin time (aPTT) is used to monitor intravenous (IV) heparin therapy, and the prothrombin time/protime (PT) and international normalized ratio (INR) are used to monitor oral warfarin (Coumadin) therapy. These tests aid in the diagnosis of a variety of clotting disorders, including hemophilia (Fig. 2.3). The assays for specific clotting factors determine deficiencies and abnormalities.

Fig. 2.4 In the hematology laboratory, blood is analyzed by a computer-controlled instrument.

FLASH FORWARD

You will learn about hemostasis in Chapter 7.

Hematology

The hematology department analyzes blood for evidence of diseases affecting the blood-forming tissues and the cells produced by those tissues—namely, RBCs, WBCs, and thrombocytes/platelets (Plt). This department also analyzes the clotting ability of the blood.

FLASH FORWARD

You will learn about the composition and function of blood in Chapter 7.

Hematology tests are most often performed on whole blood, which is blood that has not coagulated (clotted). To prevent the blood from clotting after it is collected from the patient, the blood is drawn into a tube containing an anticoagulant (usually EDTA). Thus the blood cells remain freely suspended in the liquid component of the blood, just as they are inside the body.

FLASH FORWARD

You will learn about anticoagulants and other tube additives in Chapter 8.

In the hematology laboratory, blood is analyzed in a computer-controlled instrument that counts and identifies the various types of cells (Fig. 2.4). The most common hematology test is the **complete blood count (CBC)**. This automated test includes a hemoglobin (Hb) determination, hematocrit (Hct), WBC count, RBC count, and platelet count. It may also include a WBC differential (diff), which determines the kinds of WBCs present. Among other applications, the CBC is used to diagnose and

TABLE 2.3 Complete Blood Count

Test	Purpose
White blood cell (WBC) count	Counts the number of WBCs in a sample of known volume
Red blood cell (RBC) count	Counts the number of RBCs in a sample of known volume
Hemoglobin (Hb)	Measures the level of Hb in the blood as a whole; this determines the oxygen-carrying capacity
Hematocrit (Hct)	Measures the percentage of blood volume attributable to RBCs
Mean platelet volume (MPV)	Assesses platelet volume and size
Mean corpuscular volume (MCV)	Determines the size of the average RBC
Mean corpuscular hemoglobin (MCH)	Measures the average amount of Hb in an RBC
Mean corpuscular hemoglobin concentration (MCHC)	Assesses the ratio of Hb to the size of the RBC
Red cell distribution width (RDW)	Determines the range of sizes of RBCs
Platelet count (Plt)	Counts the number of platelets in a sample of known volume
Differential (diff)	Classifies and counts the types of WBCs; morphologic (shape) abnormalities of RBCs or platelets detected by the analyzer can be checked by manual examination of a blood smear under a microscope

TABLE 2.4 Other Hematology Tests

Test	Purpose
Body fluid analysis	Determines the number and types of cells in body fluids
Bone marrow	Determines the number and types of cells in bone marrow
Erythrocyte sedimentation rate (ESR)	Determines sedimentation rate of red blood cells (RBCs) as a test for inflammation
Reticulocyte count	Evaluates bone marrow delivery of RBCs into the peripheral circulation
Sickle cell (solubility test)	Determines whether RBCs containing hemoglobin S are present; used to diagnose sickle cell anemia

BOX 2.4 Flow Cytometry Tests

CD4/CD8	T- cell marker used to monitor patients with human immunodeficiency virus
CD34, CD33, CD41, CD19, CD2	Used to diagnosis various blood disorders
Bone marrow cell markers	Used to monitor and diagnose blood disorders

classify types of anemia, leukemia, infectious diseases, and other conditions that affect the number and types of blood cells. The complete list of tests included in the CBC is given in Table 2.3. Other common hematology tests are listed in Table 2.4.

FLASH FORWARD

You will learn about the types of blood cells in Chapter 7.

Flow cytometry is a special analytic technique that is used in hematology, immunology, and anatomic pathology. Flow cytometry identifies cellular markers on the surface of WBCs (see Box 2.4). This is done to determine lymphocyte subclasses in patients with acquired immunodeficiency syndrome (AIDS), as a measure of the disease process, and to determine CD4/CD8 ratios of helper to suppressor cells, as a means of tracking the health of patients infected with human immunodeficiency virus (HIV). It is also used to diagnose and classify malignancies, aiding in the development of treatment plans. Either whole blood or bone marrow specimens are used to perform this testing.

FLASH FORWARD

You will learn about special patient populations, including patients with HIV, in Chapter 12.

Microbiology

The microbiology department isolates and identifies pathogenic microorganisms in patient samples and is responsible for infection control in the healthcare institution. The department also determines a pathogenic organism's susceptibility to specific antibiotic treatments. Microbiology comprises bacteriology (the study of bacteria), mycology (the study of fungi), parasitology (the study of parasites), and virology (the study of viruses). Specimens to be tested include blood, urine, throat swabs, sputum, feces, pus, and other body fluids (Box 2.5).

FLASH FORWARD

Collection of blood cultures is discussed in Chapter 14, and nonblood samples are covered in Chapter 15.

The most common microbiology tests are **culture and sensitivity (C&S) tests**, which detect and identify microorganisms and determine the most effective antibiotic therapy. Bacteria are identified

BOX 2.5 Microbiology Tests

Gram Stain	Stain that screens microorganisms for gram positive/gram negative
C&S	Culture and sensitivity
Acid Fast Bacillus–AFB Stain	Stain used to identify microorganism that causes tuberculosis
O & P	Identification in fecal sample of parasitic organisms
Cultures for various pathogens	Differential media used to grow and isolate microorganisms
KOH	Verifies the presence of fungal elements
Wet Prep	Verifies the presence of fungal elements
GC Stain	Stain that verifies the presence of the microorganism that causes gonorrhea

by their nutritional requirements and by the staining characteristics (shape and color) detected with Gram stain. Results are usually available in 24 to 48 hours. Identification of fungi usually takes much longer, because they take longer to grow in culture.

Molecular Diagnostics

Molecular diagnostics testing is used to diagnose genetic disorders, analyze forensic evidence, track disease, and identify microbiologic pathogens (see Box 2.6). At the heart of these techniques is the analysis of the deoxyribonucleic acid (DNA) in the sample. In the clinical laboratory, molecular diagnostic techniques are used most commonly to identify infectious agents, such as HIV, and genetic diseases, such as cystic fibrosis; to test for parentage; and to perform **forensic** studies on criminal evidence. Specimens analyzed include blood, body fluids, skin cells, hair, and other body tissues that contain DNA. Special tubes and handling procedures are required for these specimens. The most important aspect of this type of test is to keep the sample free from contamination with DNA from other sources. Keeping the laboratory clean is important, and usually only authorized personnel are allowed entrance.

FLASH FORWARD
You will learn about specimen handling and processing in Chapter 16.

Serology or Immunology

The serology or immunology department evaluates the patient's immune response through the detection of antibodies. Antibodies are proteins that help fight infection by binding to surface molecules of the infective agent, called *antigens* (Table 2.5).

TABLE 2.5 A Sample of Common Immunology Tests

Test	Purpose
Anti-*Haemophilus influenzae* B antibody	Detects exposure to *Haemophilus influenzae* B
Antinuclear antibodies (ANA)	Detects autoimmune disease
C-reactive protein	Detects inflammatory disease
Hepatitis B surface antigen	Detects hepatitis B infection
Human chorionic gonadotropin (hCG)	Detects pregnancy
Rapid plasma reagin (RPR)	Detects syphilis infection
Rheumatoid factor	Detects rheumatoid arthritis

BOX 2.6 Molecular Diagnostic Tests

Chlamydia by polymerase chain reaction (PCR)	Identification of *Chlamydia trachomatis*
Cryptococcus by PCR	Identification of *Cryptococcus neoformans*
HIV	Identification of human immunodeficiency virus
MRSA	Identification of Methicillin-resistant *Staphylococcus aureus*
H *Pylori*	Identification of *Helicobacter pylori*

Antibodies are found in the serum; thus samples for serology testing are serum samples, collected in either a plain red-top tube or an SST. Antibodies may be formed in response to infection by microorganisms, such as bacteria, fungi, parasites, or viruses. For example, the presence of antibodies against HIV is a sign of exposure to that virus. Similarly, antibodies are used to diagnose syphilis, hepatitis, infectious mononucleosis, and other communicable diseases. Antibodies may also form against antigens in the body's own tissues in a process called *autoimmunity*. Detection of such autoantibodies is part of the diagnostic process for systemic lupus erythematosus, for instance.

FLASH FORWARD
The immune system is discussed in Chapter 7.

Urinalysis and Clinical Microscopy

Urine is examined to assess kidney disease and metabolic disorders that alter the levels of substances in the urine. Diabetes, for instance, causes elevated glucose, and damage to the kidneys themselves may lead

TABLE 2.6 Complete Urinalysis

Test	Purpose
Clarity	Detects crystalline and cellular elements
Color	Detects blood, bilirubin, and other pigments
Specific gravity	Measures urine concentration
Chemical Examination	
Bilirubin	Indicates liver disease when level is elevated
Blood	Detects red blood cells (RBCs) or hemoglobin
Glucose	Indicates diabetes mellitus when level is elevated
Ketones	Indicates diabetes mellitus or starvation when level is elevated
Leukocyte esterase	Detects white blood cells (WBCs)
Nitrite	Detects bacterial infection
pH	Determines the acidity of the urine
Protein	Indicates kidney disease when level is elevated
Urobilinogen	Indicates liver disease or hemolytic disorder when level is elevated
Microscopic Examination	
Cells and other structures	Detects WBCs, RBCs, epithelial cells, bacteria, yeast, and parasites; also detects crystals and casts (structures sloughed off renal tubules)

to protein in the urine. Many urinalysis tests are performed with plastic dipsticks with pads embedded with reagents that are dipped into the sample. The **reagents** (test chemicals) embedded in the pads change color, indicating the results of the test. The tests commonly performed on urine are shown in Table 2.6.

Feces may be examined for blood—called *occult blood*—as a screen for colorectal cancer. They are also examined for parasites and their ova (eggs). Other body fluids (e.g., spinal fluid and joint fluid) may also be analyzed in this section.

Phlebotomy

The phlebotomy department is responsible for collection of blood samples from inpatients and outpatients. The phlebotomist is also responsible for proper handling and timely delivery of samples to the laboratory for analysis. You will learn much more about all of these responsibilities in the coming chapters.

Referrals

The referrals department handles and ships specimens for any tests not done by the laboratory. These are usually newer tests that may require special equipment or training not available in the laboratory. Some of these tests are approved diagnostic tests, whereas others are used for research only. Physicians often call the referral department requesting information about a new and uncommon test. Referral personnel will do research to find a laboratory that performs the test so that the specimen can be sent to that laboratory. Frequently, a hospital laboratory will contract with a single, large, national, commercial laboratory to handle all of the tests not done in-house.

STANDARDS AND ACCREDITATION FOR THE CLINICAL LABORATORY

The clinical laboratory must meet rigorous performance standards to ensure the quality of its procedures and results. The **Clinical Laboratory Improvement Act of 1988 (CLIA '88**, or *CLIA*) mandates the regulation of all facilities that perform patient testing. The goal of CLIA is to ensure the accuracy and quality of laboratory testing. Clinical laboratories in the US are regulated by the federal government's Centers for Medicare and Medicaid Services (CMS). Standards and guidelines are set by the **Clinical and Laboratory Standards Institute (CLSI)**, a nonprofit organization formerly known as the *National Committee for Clinical Laboratory Standards* (*NCCLS*).

Through adherence to CLSI standards, the clinical laboratory performs tests that deliver results that are as accurate as possible, enhancing patient care and improving public health. The standards are continually assessed and updated by the consensus of its members. The updated changes are guided by new technology, emerging disease, and research results.

Laboratories that meet these standards are eligible to receive accreditation from one or more agencies. Accreditation is required for the healthcare facility to receive Medicare or Medicaid reimbursement. The following agencies are involved in the accreditation of clinical laboratories:

- ***The Joint Commission (TJC)***. This organization was previously known as the *Joint Commission on Accreditation of Healthcare Organizations*, and you may still hear it referred to by its acronym *JCAHO* (pronounced "Jayco"). Joint Commission employees inspect facilities seeking accreditation. TJC inspects and accredits both laboratories and hospitals. Laboratories must be inspected and accredited every 2 years.
- ***College of American Pathologists (CAP)***. Unlike TJC, CAP accredits only laboratories. Inspection

and accreditation occur every 2 years. Unannounced inspections occur within 6 months of the accreditation renewal date. CAP inspection is conducted by volunteer professionals from other laboratories.

- *State agencies.* In states with their own licensure requirements, laboratories must be licensed or registered in accordance with state law.

OTHER HEALTHCARE SETTINGS

In addition to working in hospitals, phlebotomists may be employed in other healthcare settings, including the following:

- ***Health maintenance organizations (HMOs).*** HMOs have become major providers of healthcare in the past 2 decades. HMOs typically function as full-service outpatient clinics, providing most medical specialties under one roof (Table 2.1).
- ***Preferred provider organizations (PPOs).*** A PPO is a group of doctors and hospitals that offer their services to large employers to provide healthcare to employees.
- ***Urgent care center.*** An urgent care center is an outpatient clinic that provides walk-in services to patients who cannot wait for scheduled appointments with their primary healthcare providers or who do not have a primary healthcare provider.
- ***Physician's office laboratories (POLs).*** Physicians in a group practice may employ a phlebotomist to collect patient samples, which are then usually analyzed by a separate reference laboratory or, if the facility is large enough, in an on-site laboratory.
- *Reference laboratories and private testing laboratories.* These are independent laboratories that analyze samples from other healthcare facilities or from outpatients sent to the laboratory by their healthcare providers. The phlebotomist may travel to other facilities to obtain samples (mobile phlebotomy) or may collect samples on site.
- ***Nursing homes.*** Phlebotomists may be employed by a nursing home to obtain samples from clients for analysis by a reference laboratory.
- *Blood donor services or health fairs.* Phlebotomists may be hired to draw blood donations, either in a stationary setting, such as a clinic, or a mobile setting, such as a Bloodmobile. Health fairs are mobile health services that move within a community to reach those who may not otherwise have access to them.

In any of these settings, you may be required to perform clerical tasks, such as patient registration or telephone follow-up. As always, you will be most successful in your career if you bring a high level of professionalism to your work, whatever the task you are performing. Exhibiting skill and care in performing these tasks shows you are able to handle multiple kinds of responsibilities, an ability that is highly valued by most employers.

REVIEW FOR CERTIFICATION

Most phlebotomists work in hospitals, in the clinical laboratory. The clinical laboratory is divided into two major sections: the anatomic and surgical pathology area and the clinical pathology area. Clinical pathology is further divided into a number of departments, each responsible for the analysis of one or more types of samples. Blood bank or immunohematology focuses on compatibility testing and blood storage. Chemistry measures the chemical composition of the fluid portion, coagulation and hemostasis is concerned with the coagulation process, and hematology analyzes the cells of the blood. Microbiology tests for bacterial and other infections. Molecular diagnostics analyzes DNA in a variety of tissues. Serology or immunology is concerned with elements of the immune response. Urinalysis and clinical microscopy is responsible for performing urine and feces analysis. Phlebotomy is responsible for collection and delivery of blood samples. Finally, the referrals department handles and ships specimens for any tests not done by the laboratory.

All clinical laboratories are monitored and accredited by one or more national organizations. Other healthcare settings in which the phlebotomist may work include HMOs, reference laboratories, urgent care centers, and nursing homes.

WHAT WOULD YOU DO?

You should not take the sample. Instead, immediately inform the patient's nurse and your supervisor to determine what to do. It is possible that the physician ordering the sample will not want the sample if it is not drawn by the time specified, and taking an unnecessary sample increases the patient's discomfort and puts him at unnecessary risk. Most important, you should never alter the information on a sample to match what it "should" be—that puts the patient at even greater risk, because medical decisions may be made based on incorrect information. Honesty and integrity are vital to the practice of phlebotomy. You may be admonished for not taking the sample on time, but you will have done the right thing—making sure the patient has received the best possible care.

STUDY QUESTIONS

See answers in Appendix F.

1. Name the branches of support personnel in the hospital organizational system.
2. Name the two main areas of the laboratory, and identify which area the phlebotomist works in.
3. Name the specialty of the physician who oversees the laboratory.
4. Name two common laboratory tests performed in the coagulation department, and explain which therapy each test monitors.
5. Describe the tests the immunology department performs.
6. Define molecular diagnostics.
7. Name five liver function tests.
8. C&S testing is performed in which department?
9. Describe the significance of CLIA '88.
10. Name two organizations that accredit clinical laboratories.
11. What organization sets laboratory standards and guidelines?
12. Name four healthcare settings, besides the hospital, in which a phlebotomist may be employed.
13. Name the laboratory department that has a special specimen or patient identification system. What might be the outcome of mislabeling or mishandling specimens within this laboratory?
14. Describe the details the blood bank technologist looks for in compatibility testing to determine test results.
15. Define professional services, and give at least two examples of them.

CERTIFICATION EXAMINATION PREPARATION

See answers in Appendix F.

1. Fiscal services is responsible for
   a. cleaning and maintenance.
   b. performing tests.
   c. diagnosis and treatment of the patient.
   d. admitting, medical records, and billing.
2. In addition to the laboratory, the following department may draw arterial blood gases:
   a. physical therapy
   b. occupational therapy
   c. respiratory therapy
   d. radiology
3. The following department uses radioisotopes to perform tests:
   a. respiratory therapy
   b. cytogenetics
   c. nuclear medicine
   d. hematology
4. The clinical laboratory is typically under the direction of a
   a. pathologist.
   b. phlebotomist.
   c. pharmacist.
   d. medical assistant.

5. The analytic tool used to identify cell markers in HIV patients is
   a. a syringe.
   b. a flow cytometer.
   c. an electrolyte.
   d. a C&S test.
6. A CBC is performed in the _____ department.
   a. chemistry
   b. urinalysis
   c. serology
   d. hematology
7. aPTT testing monitors
   a. chemotherapy.
   b. physical therapy.
   c. heparin therapy.
   d. warfarin/coumadin therapy.
8. The type of chemistry test associated with drug analysis is known as
   a. immunology.
   b. cardiology.
   c. toxicology.
   d. electrophoresis.
9. The _____ department identifies pathogenic microorganisms in patient samples.
   a. virology
   b. microbiology
   c. mycology
   d. parasitology
10. A C&S test is analyzed in the _____ department.
    a. microbiology
    b. chemistry
    c. hematology
    d. urinalysis
11. Occult blood testing is performed on
    a. plasma.
    b. feces.
    c. serum.
    d. cerebrospinal fluid.
12. When patients donate their blood for use during their own surgery, this is known as
    a. autologous donation.
    b. platelet donation.
    c. cryoprecipitate donation.
    d. fresh frozen plasma donation.
13. Independent laboratories that analyze samples from other healthcare facilities are known as
    a. physician office laboratories.
    b. urgent care centers.
    c. reference laboratories.
    d. waived laboratories.

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CHAPTER 3 Safety

Like any workplace, a hospital or other healthcare facility contains certain hazards that must be treated with caution and respect to prevent injury. These hazards include biological, physical, chemical, radioactive, electrical, and fire factors, as well as the most significant hazard involved in phlebotomy—sharps in the form of needles, lancets, and glass. **Latex sensitivity** is also a growing concern in the workplace. Here, we discuss the variety of potential hazards you may encounter and outline the proper precautions to take to prevent accidents or injuries. The **Occupational Safety and Health Administration (OSHA)** is the governmental agency responsible for workplace safety.

OUTLINE

OBJECTIVES

1. Explain the role of the Occupational Safety and Health Administration (OSHA) in workplace safety.
2. List eight types of safety hazards.
3. Describe six precautions that can reduce the risk of injury.
4. Explain steps to be taken to lessen the risk of physical or sharps hazards.
5. List the items that must be included on a chemical label according to the Globally Harmonized System.
6. List two other kinds of labels used to identify hazardous materials.
7. Explain the purpose of the safety data sheet (SDS).
8. Describe the components of a chemical hygiene plan.
9. Discuss safety precautions to be used when handling hazardous chemicals.
10. Identify the radioactive hazard symbol.
11. Describe precautions to be taken to reduce the risk of electrical hazards.
12. Describe the four classes of fire, and identify the type or types of fire extinguisher used to combat each.
13. Explain what to do in case of the following:
    a. bleeding wound
    b. no sign of breathing
    c. shock
    d. latex sensitivity

KEY TERMS

allergic contact dermatitis
anaphylaxis
cardiopulmonary resuscitation (CPR)
chemical hygiene plan
Department of Transportation (DOT) label
Globally Harmonized System (GHS) of Classification and Labeling of Chemicals
irritant contact dermatitis
latex sensitivity
National Fire Protection Association (NFPA) label
Occupational Safety and Health Administration (OSHA)
radioactive hazard symbol
safety data sheet (SDS)
sharps

ABBREVIATIONS

AED Automated external defibrillator
CHP chemical hygiene plan
CPR cardiopulmonary resuscitation
DOT Department of Transportation
FDA Food and Drug Administration
GHS Globally Harmonized System
HBV hepatitis B virus
HCl hydrochloric acid
HCV hepatitis C virus
HIV human immunodeficiency virus
MRI magnetic resonance imaging
NFPA National Fire Protection Association
OSHA Occupational Safety and Health Administration
PPE personal protective equipment
SDS safety data sheet

WHAT WOULD YOU DO?

It's 9 a.m., and you are heading to your first draw on the chronic care wing of Mercy Hospital. As you pass the nurse's station, a nurse offers you one of the doughnuts from the box on the desk. You have a tight schedule and cannot stop to eat one now, so the nurse suggests you take it along with you. "It should fit right there in your tray next to your tubes. I'll wrap it up good and tight for you," she offers. Is it appropriate to take the snack for later?

FLASH FORWARD
You will learn about infection control and the special precautions needed to collect and handle biological specimens in Chapter 4.

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION

Workplace safety is regulated by OSHA. The regulations are designed both to inform workers about hazards in the workplace (e.g., by requiring that workers know the health effects of the chemicals they use) and to protect workers from harm (e.g., by requiring an emergency shower nearby in case of chemical spills). Your employer is required by OSHA to maintain a safe workplace, provide a comprehensive safety training program, and report accidents that occur on the job. OSHA regulations are revised as needed to increase workplace safety in light of new information or new hazards. Therefore you should keep up to date on all relevant information as it changes throughout your career.

TYPES OF SAFETY HAZARDS

Despite their goal of promoting health, healthcare facilities can be dangerous places for people who are not aware of the potential risks. Types of hazards include the following:

- *Biological:* infectious agents, including airborne or bloodborne organisms, such as bacteria and viruses
- *Physical:* wet floors, heavy lifting (e.g., boxes and patient transfers)
- *Sharps:* needles, lancets, and broken glass
- *Chemical:* preservatives and reagents (laboratory-grade chemicals)
- *Radioactive reagents*
- *X-ray equipment*
- *Electrical:* dangerous high-voltage equipment
- *Fire or explosive:* open flames, oxygen, and chemicals (e.g., nitrous oxide)
- *Gases under pressure*
- *Latex sensitivity:* allergic reaction to latex in gloves or other equipment

In addition to specific safety precautions for phlebotomy procedures, a number of general precautions can reduce your risk of injury:

- Practice hand hygiene, as discussed in Chapter 4.
- Always wear the appropriate personal protective equipment (PPE) when handling specimens.
- Avoid touching your face, nose, or mouth in the work area. Do not rub your eyes, handle contact lenses, or apply cosmetics, especially when wearing gloves.
- Never store food or beverages in the laboratory refrigerator with reagents or specimens.
- Do not let anything hang loose that might get contaminated or caught in equipment. Tie back shoulder-length hair, and never wear long chains, large or dangling earrings, or loose bracelets.
- Protect your feet from spills, slips, and falling objects. Never wear open-toe or open-back shoes. Shoes should be sturdy, made of nonabsorbent material, and have nonskid soles.

Fig. 3.1 Safety cones; note English and Spanish warnings.

- Avoid putting anything in your mouth in the work area. This means no eating, drinking, smoking, or chewing gum, while in the laboratory area. Never put pens or pencils in your mouth.

Physical Hazards

Avoiding physical hazards in the workplace is mostly a matter of common sense, plus learning some important habits:

- Avoid running. This is not only a safety rule but also a consideration for patients, who may become concerned or agitated.
- Watch for wet floors. Your facility should use cones or other types of signs to warn when a floor is wet and should have cleanup equipment for spills (Fig. 3.1).
- Bend your knees when lifting heavy objects or transferring a patient (Fig. 3.2).
- Maintain a clean, organized work area.

Sharps Hazards

Sharps, especially needles and lancets, are the most common hazards you will encounter as a phlebotomist. Sharps are dangerous both because of the physical injury they may cause and because they may carry bloodborne pathogens, such as human immunodeficiency virus (HIV), hepatitis B virus (HBV), or hepatitis C virus (HCV). The risk of contracting a bloodborne pathogen from a needlestick depends on several factors, including the pathogen involved, the amount of blood you are exposed to, and the level of virus in the patient's blood.

To prevent contact, always use the safety engineering features as specified for the device you are using. Safety engineering features for sharps include shielded or self-blunting needles for both vacuum tube systems and butterflies, as well cylindrical sheaths for syringe needles, used when transferring blood into vacuum tubes.

FLASH FORWARD

Bloodborne pathogens are discussed in Chapter 4.

The safety feature must be activated as soon as the needle is removed from the vein, unless it is an in-vein safety activation device. Never detach the needle from the plastic tube holder, because this will expose the rubber-covered needle that punctures the tube. The needle-vacutainer unit is disposed of in its entirety in a sharps container. A used needle should never be removed from a syringe by hand, and you should never bend or break a needle. Dispose of

Fig. 3.2 (A) Improper lifting technique. (B) Proper lifting technique. The knees should be bent while lifting; this allows the legs to bear the weight, instead of the back.

Fig. 3.3 Sharps containers.

sharps in a puncture-resistant container immediately after activating the safety feature (Fig. 3.3). It is best to keep the needle disposal device within arm's reach during the procedure.

The Needle Stick Safety and Prevention Act of 2001 required all employers to switch to safety needle devices to minimize the risk of accidental sticks and solicited employee input in choosing safer devices. Failure to comply with the 2001 regulation can result in high fines for the institution and the individual who violates the act.

If you are stuck by a used needle or other sharp object that has been in contact with blood, or if you get blood in your eyes, nose, mouth, or broken skin, you should perform the following steps:

1. *Immediately* flood the exposed area with water for 10 to 15 minutes and clean any wound with soap and water or a skin disinfectant.
2. Report this immediately to your employer. Your employer is required to keep a log of such incidents. Follow your facility's exposure control plan for reporting and medical treatment for an accidental needle exposure.
3. Seek immediate medical attention, including counseling for exposure to HIV, HBV, and HCV.

FLASH FORWARD

You will learn more about exposure control plans in Chapter 4.

Some phlebotomists may be tempted to cut some safety corners, especially as they gain more confidence in their handling of needles and other sharps. However, there is never a good enough reason to take such risks. The risk of infection is always present, and there can be months of psychologic trauma while waiting to learn the results of serologic testing after an accidental needle stick. In many institutions, not following safety procedures is grounds for dismissal.

Chemical Hazards

You will encounter many different chemicals in your work as a phlebotomist, including several that can be quite harmful if handled improperly. For example, hydrochloric acid (HCl), which burns mucosal tissue and skin, is used as a preservative for urine. Bleach, which causes irritation of mucosal tissue and skin, is used as a disinfectant in the laboratory.

Identification of Chemicals and Your Right to Know

The safe handling of chemicals begins with proper labeling. All chemicals should have labels that identify the chemical by name, and you should read the label carefully before using any chemical. Do not use a chemical that is not labeled.

OSHA mandates using the **Globally Harmonized System (GHS) of Classification and Labeling of Chemicals**. The GHS label contains information on the identity of the chemical, the chemical manufacturer or other responsible party, appropriate hazard warnings communicated through the visual symbols called *pictograms*, explanations of the hazards involved in exposure to the chemical, and first-aid measures to take in the event of exposure (Fig. 3.4).

OSHA also requires that each chemical come with a **safety data sheet (SDS**; also called a *materials safety data sheet*), which provides information about the chemical, its hazards, and the procedures for cleanup and first aid. The SDS has 16 sections, with each section providing specific information on

TABLE 3.1 Safety Data Sheet (SDS) Sections

1	Identification
2	Hazard identification
3	Composition/information on ingredients
4	First-aid measures
5	Fire-fighting measures
6	Accidental release measures
7	Handling and storage
8	Exposure controls/personal protection
9	Physical and chemical properties
10	Stability and reactivity
11	Toxicologic information
12	Ecologic information
13	Disposal considerations
14	Transport information
15	Regulatory information
16	Other information

A

OSHA® QUICK CARD™

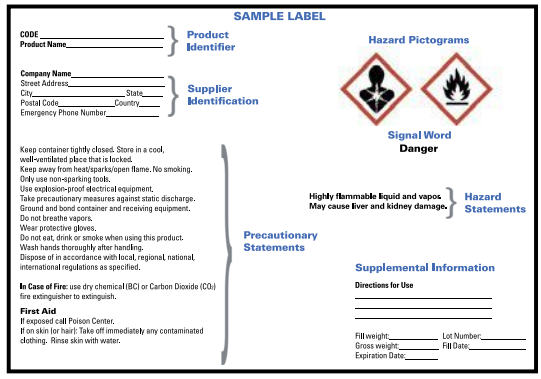
Hazard Communication Standard Labels

OSHA has updated the requirements for labeling of hazardous chemicals under its Hazard Communication Standard (HCS). As of June 1, 2015, all labels will be required to have pictograms, a signal word, hazard and precautionary statements, the product identifier, and supplier identification. A sample revised HCS label, identifying the required label elements, is shown on the right. Supplemental information can also be provided on the label as needed.

For more information:

OSHA® Occupational Safety and Health Administration
www.osha.gov

(800) 321-OSHA (6742)
www.osha.gov



B

Fig. 3.4 Examples of OSHA-mandated labeling. A. Pictograms and Hazards. B. Globally Harmonized System Label. (From OSHA: *Hazard Communication*, 2013. Retrieved from www.osha.gov/dsg/hazcom/index.html.)

that chemical (Table 3.1). These data sheets must be kept on file in the workplace, and you have a right to review them. It may also be possible to access these sheets through your facility's intranet.

CLINICAL TIP

The Chemical Hazardous Communication Standard (Haz Com Standard) or "Right-to-know" law allows an employee to review all information on chemical hazards in the workplace.

Two other types of secondary labels are still in use to identify hazardous materials. The **Department of Transportation (DOT) label** (Fig. 3.5) displays the type of hazard, the United Nations hazard class number, and an identifying number. The **National Fire Protection Association (NFPA) label** (Fig. 3.6) is a design recognized by firefighters that warns of the location of hazardous materials in the event of a fire. It uses a diamond-shaped symbol whose four quadrants contain numbers indicating the relative danger level in four areas: health, fire, chemical stability, and specific hazard types. Higher numbers indicate higher risk. Primarily designed for fixed installations, this symbol has been widely used to indicate hazards at the entrances to laboratory facilities within buildings. How the DOT and NFPA labels will be used in conjunction with the GHS will be determined as time goes on.

Fig. 3.5 Department of Transportation label displaying the type of hazard, the United Nations hazard class number, and an identifying number.

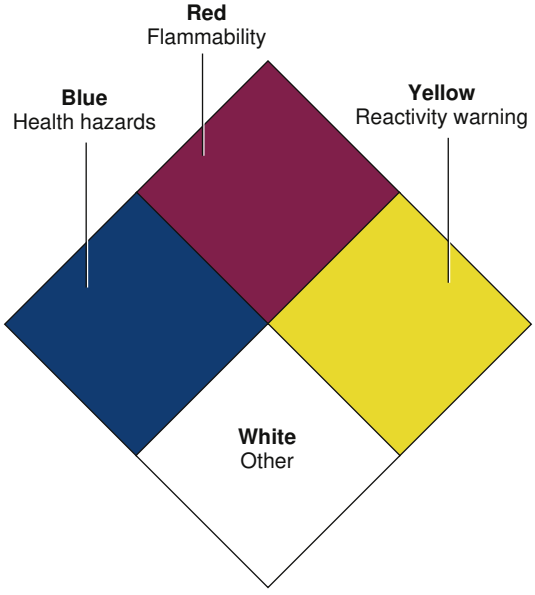


Fig. 3.6 National Fire Protection Association (NFPA) label.

Reducing Risk

OSHA has issued the Chemical Hazardous Communication Standard ("Haz Com Standard") to control the risk of exposure to dangerous chemicals in the workplace. This regulation is also called the *Right-to-Know Law*. It is your responsibility to read the SDS before handling any chemical. OSHA further requires that every workplace develop and train its employees in a **chemical hygiene plan (CHP)**. The plan describes all safety procedures, special precautions, and emergency procedures used when working with chemicals. Each employee must receive training in the details of the plan.

Although some chemicals are more dangerous than others, you should treat every chemical as if it were hazardous. This means that you should always use PPE when working with chemicals, including eye protection, a laboratory coat, and gloves.

Follow protocols and instructions carefully. For instance, if a protocol says to add an acid to water, do not add the water to the acid instead. Combining acid and water releases heat. By adding acid to water, you allow the large amount of water to heat up slowly. By adding water to concentrated acid, the small amount of water may boil on contact (Fig. 3.7). This can cause the acid to splash out of the container onto the skin or mucous membranes, causing burns.

CLINICAL TIP

- Never add water to acid. Always add acid to water.
- Follow the written chemical hygiene plan of your facility.
- Always review the SDS before handling any chemical.
- Never mix chemicals together unless you are following an approved protocol.
- Never store chemicals above eye level.
- Always store a chemical in its original container.
- Always use the appropriate PPE and engineering controls before handling any chemical.

Know the Location of Safety Showers and Eyewash Stations in the Laboratory When Accidents Happen

Despite precautions, chemical accidents occasionally occur. In such cases, you must be prepared to act quickly to prevent or minimize a serious injury.

If a chemical spills on you, proceed immediately to the safety shower or eyewash station. Flush the affected area with water for a minimum of

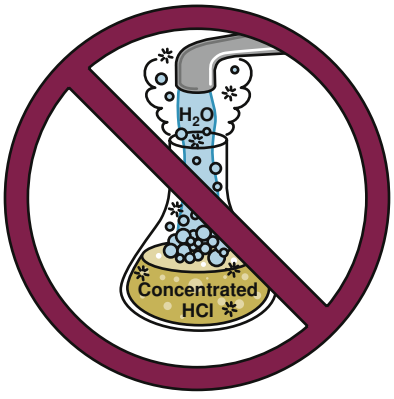


Fig. 3.7 Adding water to concentrated acid is very dangerous.

15 minutes. Report your accident to the appropriate supervisor in your department, and then proceed to the emergency room to be evaluated for further treatment.

If a chemical spills on the floor or a work surface, alert nearby personnel of the danger, and then follow laboratory protocol for cleanup. Cleanup kits should be available, with different types of equipment and neutralizing chemicals used for different types of spills. You must take the time to learn how to use the cleanup kit in your facility.

Radioactive Hazards

Radioactive materials are used in healthcare facilities to perform diagnostic tests and deliver treatment. In areas in which radioactivity is used, the **radioactive hazard symbol** is displayed (Fig. 3.8). Although the duties of a phlebotomist do not involve direct handling of radioactive materials, you may be exposed to small amounts of such materials when drawing blood from a patient in the radiology department, for instance, or when drawing blood from a patient receiving radioactive treatments or undergoing imagery with a radioactive substance. X-rays are used for diagnosis. Precautions taken by the staff of the radiology department should prevent you from ever being exposed to x-rays. You should not be drawing blood while a patient is receiving an x-ray.

The effects of radiation exposure increase with the length of exposure, the distance to the radiation source, the dose of radiation, and the shielding in place. Appropriate shielding devices are required to protect employees from unnecessary exposure to radiation. Pregnant women need to be especially careful to minimize their exposure because of the risk to the fetus. There are several important guidelines to follow to minimize your risk:

- Recognize the radioactive hazard symbol.
- Exercise extra caution in areas where radioactive materials are in use.
- Learn your institution's procedures for minimizing exposure and responding to accidents.

Pregnant women in the first trimester should not enter a patient's room or a laboratory facility if there is a radiation alert posted at the door; this precaution can prevent a possible adverse effect on the fetus.

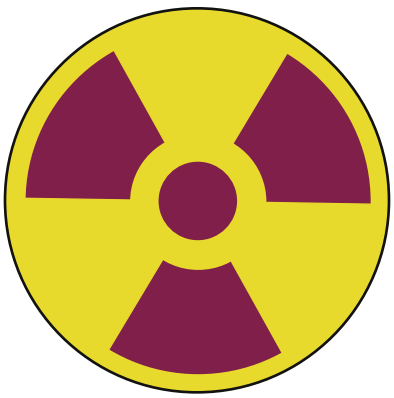


Fig. 3.8 Radioactive hazard symbol.

Electrical Hazards

Electrical hazards in the laboratory may result in shock or fire. General rules of electrical safety apply in healthcare institutions as well, including the following:

- Know the location of the circuit breaker box for the equipment you are using.
- Avoid using extension cords, since long-term use of extension cords violates OSHA regulations.
- Avoid buildup of static/sparks by standing on antistatic mats when operating electrical equipment.
- Report and avoid using loose electrical switches or outlets, frayed cords, overloaded circuits, and ungrounded equipment.
- Unplug a piece of equipment before servicing it.
- If a piece of equipment is marked as defective with an electrical caution warning, do not attempt to use it or open it, even for inspection. It may contain batteries or electrical capacitors that store electricity even when unplugged.
- Avoid contact with any electrical equipment while drawing blood. Electricity may pass through you and the needle and shock the patient.

Emergency Response to Electric Shock

When someone receives an electric shock in the workplace, turn off the equipment, either by unplugging it or by switching off the circuit breaker. In the event you cannot turn off the electricity, break the electrical contact between the source and the victim using a nonconductive material, such as a wooden broom handle. Do not touch the victim directly until the risk of further shock is removed.

Call for medical assistance (call 911 or your facility's emergency service), then check the victim's respiration and circulation by taking their pulse and counting breaths per minute. Start **cardiopulmonary resuscitation (CPR)** if indicated (CPR is discussed later in this chapter). Electrical shock can cause physiologic shock resulting in insufficient blood supply to the heart and organs. Keep the victim warm with a blanket or coat, and

elevate the victim's legs so the torso is higher than the head.

Someone who receives an electrical shock, even one that doesn't cause an immediate problem, is at higher risk for heart irregularities for several hours afterward. A victim of an electrical shock should therefore monitor their own condition, preferably under medical supervision, until the danger is over.

Emergency Response to Electric Burns

Electrical shock can also cause tissue burns. Tissue burns caused by electricity can be extensive, with extremities being the most vulnerable. Victims should receive immediate care even when no visible damage is apparent.

Fire and Explosive Hazards

Fires or explosions in the laboratory may occur as a result of chemical or electrical accidents or carelessness with flames or other fire sources. In addition to preventive measures, the most important steps to take to minimize the risk of injury are summarized in the acronym *RACE* (Box 3.1):

*R*escue. Remove any patients from the immediate area where fire risk is present (Fig. 3.9).

*A*larm. Call 911 or the appropriate number for fire emergency in your facility.

*C*onfine. Close all windows and doors.

*E*xtinguish. If the fire is small and contained, use a fire extinguisher (Fig. 3.10) or fire blanket to put it out.

Know how to use a fire extinguisher. The proper technique is summarized in the acronym *PASS* (Box 3.2):

*P*ull the pin.
*A*im at the base of fire.
*S*queeze the handle.
*S*weep.

Also know the location of all fire extinguishers and emergency exits in your facility. Exit signs should be plainly marked with written escape routes posted around the office or facility.

BOX-3.1 RACE Procedure

In the event of fire, RACE:
*R*escue patients
*A*larm: call 911
*C*onfine: close doors and windows
*E*xtinguish the fire

BOX-3.2 Use of a Fire Extinguisher

To use a fire extinguisher:
*P*ull the pin.
*A*im at the base of fire.
*S*queeze the handle.
*S*weep.

Fig. 3.9 Fire pull and RACE card.

Fig. 3.10 Fire extinguisher with evacuation plan and fire alarm.

TABLE 3.2 Classes of Fire

Class	Fuel	Extinguisher
A	Wood, paper, and cloth	A, ABC
B	Grease, oil, and flammable liquids	ABC, BC, and halogenated agents
C	Energized electrical equipment	C
D	Flammable metals	D, special equipment
K	Cooking oils and grease	K, special equipment

Classes of Fire

There are five classes of fire, as identified by the NFPA, based on the fire's fuel source (see Fig. 3.8). These dictate the type of extinguisher that should be used to combat the fire, as shown in Table 3.2. Every extinguisher will include the class or classes of fire it is designed to fight. Some extinguishers are only rated for one type, whereas others, such as an ABC extinguisher, can be used on multiple types. Type A fires can be extinguished with water, carbon dioxide, dry chemical, or a chlorofluorcarbon. Any extinguisher marked with an A (e.g., A, ABC) can be used. Class B fires can be extinguished with carbon dioxide, dry chemical, or a chlorofluorocarbon. Any extinguisher marked with a B can be used. Class C fires can be extinguished with carbon dioxide or dry chemical. Any extinguisher marked with a C can be used. Class D and type K fires contain specialized chemicals and require extinguishers specifically marked with the appropriate letter for each.

Magnetic Resonance Imaging Hazards

A magnetic resonance imaging (MRI) machine uses an extremely powerful magnet to create images of the body. The strength of the magnet poses significant safety risks when proper precautions are not taken. The magnet is strong enough to pull metal objects toward it from across the room at great speed. Warning signs are posted outside the MRI examination room. Anyone entering the MRI examination room must remove all metallic objects, including jewelry, belt buckles, and even zippers. People with implanted metallic devices may be barred from entering. The instructions of the MRI staff must be followed to prevent serious injury or death.

EMERGENCY FIRST-AID PROCEDURES

A full review of first-aid techniques is beyond the scope of this chapter. Here we review the most common types of emergencies and the major steps that should be taken to deal with them. Healthcare workers should be trained in the techniques of CPR and should refresh their skills biannually.

Cardiopulmonary Resuscitation

A victim of cardiac arrest will be unresponsive and will not be breathing normally. Quick intervention may save the person's life. Chest compressions restore circulation, and are the most important intervention. Guidelines issued by the American Heart Association (AHA) emphasize that continual chest compressions should be the initial CPR action for all victims, regardless of their age, and that breathing aid is less important than continual compression, especially in adults. If you are not trained in rescue breathing or cannot provide rescue breathing, you should perform compression only ("hands-only CPR") after determining the victim is not responsive and not breathing normally. For a trained professional, it is appropriate to deliver rescue breathing with compressions. The AHA uses the mnemonic CAB to help remember CPR steps. C is for compression, A is for airway, and B is for breathing.

1. Determine whether the victim is conscious by asking loudly, "Are you okay?" If there is no response, alert emergency medical personnel (either within the hospital or by calling 911).
2. Determine whether the victim is breathing normally. If the victim is unresponsive and is not breathing or is only gasping, begin chest compressions immediately. (If there is an automated external defibrillator [AED] device nearby, use that instead.)
3. To perform chest compressions, place the victim flat on their back and kneel next to the victim's neck and shoulder. Place your hands, one on top of the other in the middle of the victim's chest. Push down on the chest, right between the nipples, compressing the chest between 1½ and 2 inches. Use your body weight to help you compress the chest to the appropriate depth. Compressions should be at the rate of 100 per minute, so each compression should take less than 1 second. Continue compressions until professional help arrives.
4. If you are trained in CPR, clear the victim's airway. Begin by tilting the head back, by placing your palm on victim's forehead and lifting the chin. Clear the airway as you have been instructed in your CPR training.
5. Perform rescue breathing to restore oxygen to the circulation. Once the head is tilted back and the airway is clear, pinch the nostrils and cover the victim's mouth with yours to form a seal. Give two rescue breaths. Each breath lasts one second. The victim's chest should rise. If it does not, retilt the head and repeat the rescue breath. Each cycle of CPR is two breaths followed by 30 compressions.

6. When an AED is available, use it according to the directions on the machine. Administer one shock, then resume CPR cycles, starting with compressions for two minutes.
7. Continue until emergency medical personnel arrives.

CPR for Children and Infants

Cardiac arrest in children and infants is usually caused by respiratory failure. Since oxygen is quickly depleted, administering rescue breathing is essential.

Bleeding Aid

Severe bleeding is a life-threatening medical emergency. Don't remove large or deeply embedded objects. Remove any clothing or debris on the wound. Don't probe the wound or attempt to clean it. Wear disposable protective gloves if available. Follow OSHA standard precautions. The ABCs of treating a bleed are:

A—Alert—call 911.

B—Bleeding—find the source of the bleed.

C—Compression—apply direct pressure to the wound. Cover the wound with a clean cloth and apply pressure by pushing directly on it with both hands. A tourniquet applied proximal (closer to the body's center) to the wound can reduce bleeding as well.

Elevate the limb unless you suspect a fracture. This will lessen the blood flow to the area of the wound, and therefore limit the amount of blood loss. Maintain compression on the wound until medical assistance is available.

First Aid for Physiologic Shock

Shock is a life-threatening medical condition of low blood flow to the tissues, resulting in cellular injury and inadequate tissue function. It is important to recognize the early signs of shock: pale, cold, or clammy skin; rapid pulse; dizziness or fainting; shallow breathing; weakness; and possible nausea or vomiting. Anything that affects the flow of blood through the body can cause shock. Some common causes of shock are:

1. significant blood loss
2. dehydration
3. allergic reaction
4. reduced blood pressure
5. heart failure
6. nerve damage
7. blood infections

In the event of possible shock, perform the following actions:

- Call for professional assistance.
- Keep the victim lying down.
- Elevate the victim's legs, unless you suspect a fracture.
- In case of vomiting, keep the victim's airway open by turning the victim's head to the side and sweeping out his or her mouth with your finger.
- Keep the victim warm.

DISASTER EMERGENCY PLAN

Most institutions have disaster emergency plans that describe procedures in the event of a large-scale disaster, such as a flood, hurricane, fire, or earthquake. Learn your institution's procedures so that you are prepared to respond in an emergency. Pay special attention to your responsibilities. These may range from reporting to a specific place or person outside your facility in case of a fire in your building to helping remove patients from danger. If you are assigned to multiple institutions, be sure to check procedures and your responsibilities at each one.

You may also have responsibilities as a responder in the event of a health-related emergency, for instance, when a surge of injured patients arrives at your hospital, as they might in the event of a multicar accident or building collapse. In such an event, you may be called on to take on responsibilities outside of your normal duties, whether in processing patients as they arrive, taking samples in the emergency room, or working longer shifts. Again, know your institution's plan and your responsibilities, and be prepared to respond quickly.

SENSITIVITY TO LATEX AND OTHER MATERIALS

Latex sensitivity is a serious issue in the healthcare field. Today, many healthcare facilities have stopped using latex gloves, replacing them with stretch nitrile or vinyl. However, there are sources of latex present in healthcare facilities, including disposable gloves, dental dams, airway and intravenous tubing, syringes, stethoscopes, catheters, dressings and bandages. The reaction to latex products can take a variety of forms.

Irritant contact dermatitis occurs as a result of direct skin contact with materials left on the latex surface during manufacturing, such as processing chemicals. Redness, swelling, and itching

may occur within minutes to hours of exposure. Removing the glove and washing the exposed area are enough to reduce the reaction within several hours. The skin may become highly sensitized with repeat exposure.

Allergic contact dermatitis is a true allergic response in which the body's immune system reacts to the proteins or other components of the latex that are absorbed through the skin. Perspiration increases absorption. Absorption may also occur through inhalation of glove powder. Symptoms may not be localized to the exposed area.

Anaphylaxis is a rapid, severe immune reaction that can be life threatening if not treated. During anaphylaxis, the airway may swell shut, the heart rate may increase, and the blood pressure drops. Epinephrine injection and emergency room management are needed for anaphylaxis.

Those at highest risk for developing a latex allergy include people who are often exposed to natural rubber latex, including rubber industry workers and those who frequently wear latex gloves (such as healthcare workers), and people who have had multiple surgeries.

Regulations by the Food and Drug Administration (FDA) require the labeling of medical gloves that contain natural rubber latex or powder. Glove boxes are required to bear caution statements whose wording depends on the actual content of the gloves.

Nitrile and vinyl are much less allergenic but may nonetheless cause a reaction in some individuals. In addition, they may react with chemicals in some hand lotions, causing irritant or allergic dermatitis. Only approved lotions or hand creams should be used to prevent these reactions.

FLASH FORWARD
You will learn about latex tourniquets in Chapter 8.

Preventing Latex Reactions

Individuals with known sensitivity to latex should wear a medical alert bracelet and carry an epinephrine auto injector (commonly called an *epipen*). They should avoid areas where powdered latex gloves or aerosols containing latex products are used. Patients should be asked about allergies or other reactions to previous latex exposure. The substances causing latex allergy are similar to ones found in chestnuts and some tropical fruits, such as kiwi, avocado, and banana. Patients should be asked about allergies or reactions to any of these fruits.

REVIEW FOR CERTIFICATION

Safety is a paramount concern in the healthcare workplace. OSHA is responsible for workplace safety and has created rules and regulations to improve safety. These regulations govern the handling of sharps, chemicals, and other occupational hazards. The phlebotomist must pay close attention to workplace safety and learn the most effective ways to avoid hazards such as biologic, physical, sharps, chemical, radioactive, electrical, and fire dangers. Most important of all is the danger of accidental contamination with blood or other body fluids.

WHAT WOULD YOU DO?

Unfortunately, you must pass on the snack. Food and beverages should never be stored or transported along with specimens because of the risk that one or the other will become contaminated. It is also a violation of OSHA regulations, and your employer could be fined. If you eat contaminated food, you could become ill or even die. If the sample becomes contaminated, the patient may suffer from incorrect results or may need another sample drawn.

STUDY QUESTIONS

See answers in Appendix F.

1. Name six types of safety hazards in the workplace and give an example of each.
2. List five safety precautions that can reduce the risk of injury in the workplace.
3. Because needle sticks are a major concern, what should you never do after performing a venipuncture?
4. List the five identifying features that all hazardous material labels must display.
5. Describe the purpose of an SDS.
6. Explain the purpose of a chemical hygiene plan.
7. In the event a chemical spills on your arm, what steps should be taken?
8. Describe the steps in the emergency response to electric shock.

9. List the five classes of fire and at least one fuel responsible for each class.
10. Describe the protocol for hands-only CPR.
11. Describe three types of reaction associated with latex usage.
12. Name the organization that regulates workplace safety, and define its purpose.
13. Explain the process that should be followed in controlling a bleeding emergency.
14. List the signs of shock and the steps to take to prevent further complications.
15. What is the best way for a phlebotomist to prepare for a disaster that occurs in the community?
16. Choose a local healthcare institution. Research its disaster emergency plan, and find out what responsibilities phlebotomists have in the plan.

CERTIFICATION EXAMINATION PREPARATION

See answers in Appendix F.

1. OSHA stands for
   a. Occupational Standards in Health Associations.
   b. Outline of Safety Hazards and Accidents.
   c. Occupational Safety and Health Administration.
   d. Occupational Standards and Health Administration.
2. When mixing acids and water, you should
   a. add acid to water.
   b. add water to acid.
   c. never mix acids and water together.
   d. add equal amounts in an empty container.
3. Chemicals should be
   a. stored above eye level.
   b. labeled properly.
   c. cleaned up using soap and water.
   d. disposed of in the sink.
4. The first action to take in the event of fire is to
   a. call the fire department.
   b. close the windows and doors.
   c. remove patients from danger.
   d. pull the fire alarm.
5. In the event of electric shock, the first thing you should do is
   a. call 911.
   b. attempt to turn off the electrical equipment.
   c. break contact between the source and the victim.
   d. start CPR.
6. Class C fires involve
   a. wood.
   b. grease or oil.
   c. flammable materials.
   d. electrical equipment.
7. Which of the following does the NFPA symbol not warn about?
   a. Protective equipment
   b. Fire
   c. Chemical stability
   d. Health
8. The first thing to do when giving CPR to a victim is
   a. clear the airway.
   b. place the victim on a firm, flat surface.
   c. begin mouth-to-mouth ventilation.
   d. determine whether the victim is conscious.
9. Safety equipment in the laboratory may include
   a. personal protective equipment.
   b. an emergency shower.
   c. an eyewash station.
   d. all of these.
10. An SDS provides information on
    a. sharps.
    b. patients.
    c. chemicals.
    d. office procedures.
11. Reaction to latex products may include
    a. irritant contact dermatitis.
    b. allergic contact dermatitis.
    c. anaphylaxis.
    d. all of these.
12. The yellow diamond in the NFPA label indicates
    a. health hazards.
    b. flammability.
    c. reactivity warning.
    d. other.

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CHAPTER 4 Infection Control

The goal of infection control is to develop and maintain an environment that minimizes the risk of acquiring or transmitting infectious agents to hospital personnel, patients, and visitors. It is not always possible for you to know if a patient is infectious or is incubating an infection. Therefore it is important that you understand how infections occur and follow infection control practices and policies to protect yourself and your patients from infectious agents. Infection control requires recognizing potential sources of transmission and breaking the chain of infection. Techniques for preventing transmission include hand hygiene, use of personal protective equipment (PPE), and use of both Standard and Transmission-based Precautions. In Chapter 3, you learned how to recognize and prevent physical safety hazards on the job. In this chapter, we examine in detail the biologic hazards with which you may come in contact. By taking appropriate precautions against potentially infectious organisms, you can make the workplace safe for you, your patients, and your coworkers.

OUTLINE

OBJECTIVES

1. Define infection, and differentiate between community-acquired and healthcare-associated infections.
2. Explain how organisms found in a hospital differ from those found in the community.
3. Describe four ways that infectious agents may be transmitted, and give examples of each.
4. Discuss the importance of proper hand hygiene in breaking the chain of infection.
5. Describe the proper handwashing technique, including the sequence of steps.
6. Define personal protective equipment (PPE) and describe at least four types.
7. Describe the order and procedure for putting on and removing PPE.
8. Define Occupational Safety and Health Administration (OSHA) and explain its role in infection control.
9. Define bloodborne pathogen and give examples.
10. Explain how bloodborne pathogens may be transmitted.
11. Explain the components of Standard Precautions.
12. Define Transmission-based Precautions and describe the types.
13. Explain general procedures for cleaning up a blood spill.

KEY TERMS

Airborne Infection Isolation Precautions
airborne transmission
bloodborne pathogens (BBPs)
chain of infection
common vehicle transmission
Contact Precautions
contact transmission
droplet nuclei
Droplet Precautions
droplet transmission
exposure control plan
fomite
healthcare-associated infection
hepatitis B virus (HBV)
high-efficiency particulate air (HEPA)
human immunodeficiency virus (HIV)
infection
isolation
micrometer
nosocomial infection
opportunistic microorganism
pathogen
personal protective equipment (PPE)
protective environment (PE)
reservoir
resident flora
sepsis
Standard Precautions
Transmission-based Precautions
vectors