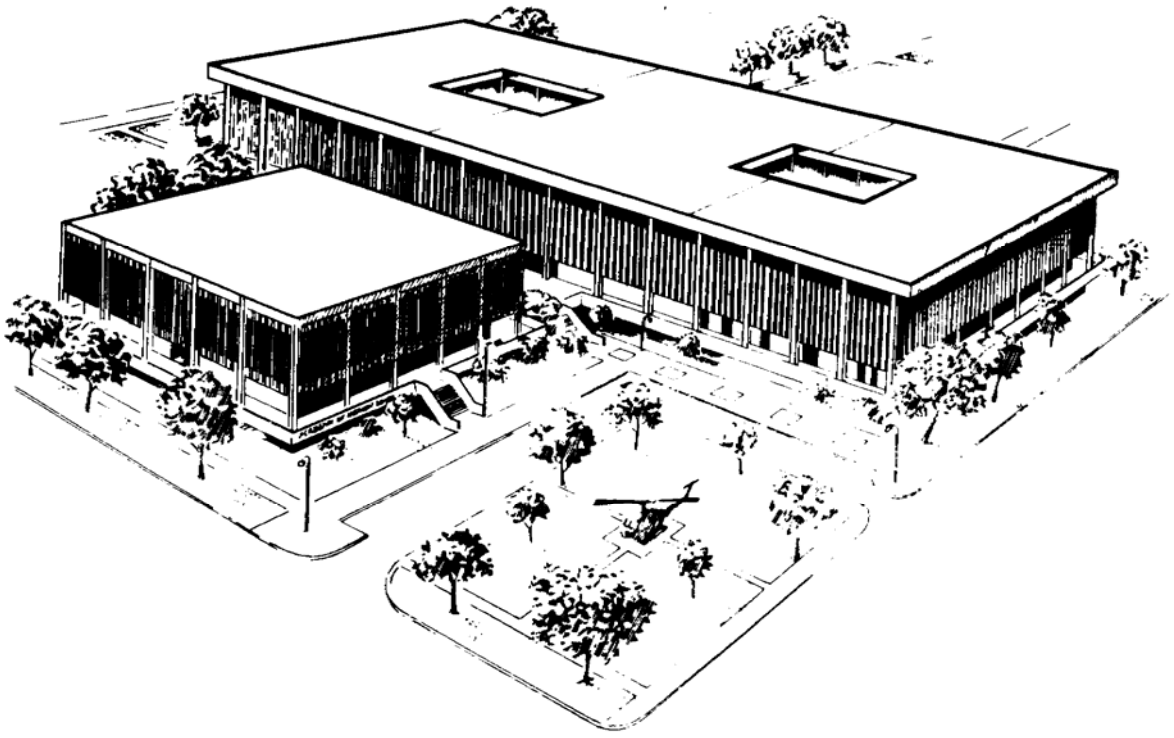
U.S. ARMY MEDICAL DEPARTMENT CENTER AND SCHOOL
FORT SAM HOUSTON, TEXAS 78234-6100



# INTRODUCTION TO RADIOGRAPHY

## SUBCOURSE MD0064 EDITION 200

## DEVELOPMENT

This subcourse is approved for resident and correspondence course instruction. It reflects the current thought of the Academy of Health Sciences and conforms to printed Department of the Army doctrine as closely as currently possible. Development and progress render such doctrine continuously subject to change.

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## CLARIFICATION OF TRAINING LITERATURE TERMINOLOGY

When used in this publication, words such as "he," "him," "his," and "men" are intended to include both the masculine and feminine genders, unless specifically stated otherwise or when obvious in context.
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**CORRESPONDENCE COURSE OF**
**THE ACADEMY OF HEALTH SCIENCES, UNITED STATES ARMY**

**SUBCOURSE MD0064**

# INTRODUCTION TO RADIOGRAPHY

## INTRODUCTION

Although the discovery of x-radiation dates back only to 1895, its history involves many people, many discoveries, and significant advances in technology. Interestingly, the US Army is directly responsible for the development of the profession of the radiologic technologist (or its Army equivalent, the X-ray Specialist). To understand our present, we will briefly explore our past, to include some of the notable individuals responsible for the developments that led to the discovery of x-rays.

An awareness of the many modalities of radiology and the interrelationship between radiology and other hospital departments will enhance your effectiveness in contributing to the proper diagnosis and treatment of patients in the health care environment. This subcourse will identify and briefly describe those modalities and the various members of the health care team.

With the complexity and expense of modern x-ray machines, and the potential risk to patients of incorrectly performed procedures, technologists must have a working knowledge of fundamental principles of anatomy, physiology, and radiation protection. In addition, technologists must understand certain aspects of math, physics, biology, computers, photographic processing, ethics and law, and much more. As a consequence of the broad-ranging knowledge required of technologists, the curriculum of schools of radiologic technology is very structured. This subcourse examines not only some of the reasons for this complexity and structure, but some of the important organizations involved in the continuing education of students and credentialing of technologists and training programs.

**Subcourse Components:**

This subcourse consists of 6 lessons and an appendix. The lessons are:

- Lesson 1, The History of X-rays.
- Lesson 2, An Introduction to the Health Care Delivery System.
- Lesson 3, Hospital Organization.
- Lesson 4, Radiology Department Organization
- Lesson 5, Accreditation and Credentialing
- Lesson 6, Professional Development.
- Appendix, Glossary of Terms

Here are some suggestions that may be helpful to you in completing this subcourse:

--Read and study each lesson carefully.
--Complete the subcourse lesson by lesson. After completing each lesson, work the exercises at the end of the lesson, marking your answers in this booklet.

--After completing each set of lesson exercises, compare your answers with those on the solution sheet that follows the exercises. If you have answered an exercise incorrectly, check the reference cited after the answer on the solution sheet to determine why your response was not the correct one.

**Credit Awarded**:

To receive credit hours, you must be officially enrolled and complete an examination furnished by the Nonresident Instruction Branch at Fort Sam Houston, Texas. Upon successful completion of the examination for this subcourse, you will be awarded 12 credit hours.

You can enroll by going to the web site http://atrrs.army.mil and enrolling under "Self Development" (School Code 555).

A listing of correspondence courses and subcourses available through the Nonresident Instruction Section is found in Chapter 4 of DA Pamphlet 350-59, Army Correspondence Course Program Catalog. The DA PAM is available at the following website: http://www.usapa.army.mil/pdffiles/p350-59.pdf.

## LESSON ASSIGNMENT

**LESSON 1** Introduction to Radiology.

**LESSON ASSIGNMENT** Paragraphs 1-1 through 1-14.

**LESSON OBJECTIVES** After completing this lesson, you should be able to:

1-1. Identify Pre-x-ray discoveries, significant persons, and dates.

1-2. Identify misconceptions caused by the "New Photography."

1-3. Identify the earliest practical applications of x-rays.

**SUGGESTION** After completing the assignment, complete the exercises of this lesson. These exercises will help you to achieve the lesson objectives.

# LESSON 1

## Section I. PRE X-RAY DISCOVERIES

### 1-1. INTRODUCTION

In order to have a sense of perspective about where the field of radiography is going today, it is helpful to examine how far it has come along since the early days of its inception. To that end, this lesson provides a brief history of radiography. Covered in this lesson are significant pre-xray discoveries, pioneering individuals and the dates of milestone discoveries or inventions. Also discussed are popular misconceptions about the New Photography, and the earliest practical applications of x-rays.

### 1-2. WILLIAM GILBERT (1600's)

a. **First Developments of the 1600s**. Logically speaking, the history of x-rays begins with some of the events and theoretical discoveries that prepared the way for the development of the more complex x-ray machines. The history of radiography begins in the early 1600's, with the work of an English physician who was a member of the court of Queen Elizabeth I. Fascinated by the similarities and differences between magnetism and electricity, William Gilbert conducted some experiments to compare the two phenomena. At the outset, he had no real idea as to how the two phenomena might be related.

b. **Electricity, the Attraction Between Rubbed Objects**. It was Gilbert who coined the term electricity, an anglicized version of the Greek word for amber (elektron). Gilbert used the term electricity to describe the attraction between rubbed amber and almost any lighter object.

### 1-3. OTTO VAN GUERICKE (1646)

In 1646, Otto Van Guericke invented an air pump that was capable of removing air from a vessel or tube. He also made a crude electrical machine, known as a sulphur ball that could be whirled on bearings and rubbed with the hands to produce static electricity.

### 1-4. CHARLES DU FAY (1733)

In 1733, the French Scientist, Charles Francois Du Fay, showed that there seemed to be two distinct kinds of electricity, which he named vitreous and resinous, and that objects deemed to fall into one or the other category. Du Fay discovered that objects charged with the so-called vitreous electricity repelled other objects with the same charged, but attracted those with the so-called resinous charge.

## 1-5. BENJAMIN FRANKLIN (1750)

In 1750, Benjamin Franklin conducted tests on atmospheric electricity and friction and concluded that the two phenomena were identical. As a result, he renamed Du Fay's vitreous charge, a positive charge and resinous charge, a negative charge. (Ben Franklin mistakenly concluded that positive charges move through a wire towards the negative.)

## 1-6. ALESSANDRO VOLTA (1775)

In 1775, Alessandro Volta invented an electrophorus electrostatic device, a machine that produced light with static electricity. In 1800, he invented the Voltaic Pile, the first device to produce continuous electric current, and the forerunner to the modern wet-cell battery.

## 1-7. MICHAEL FARADAY (1831-1833)

Between 1831 and 1833, Michael Faraday developed the Field Concept to explain electromagnetic induction. He also formulated two basic laws of electrolysis. In 1838, Faraday studied the passage of electricity through gases. In the apparatus that he used, he called one component the anode and the other the cathode.

## 1-8. SIR WILLIAM CROOKES (1877)

a. **Cathode Produces Fluorescence.** In 1877, Sir William Crookes developed the Crookes' partial vacuum tube. In 1879, he used the term cathode ray to describe electrons emitted from the cathode in an evacuated tube. He characterized these rays as negatively charged particles. (It should be noted that cathode rays are not x-rays.) Crookes demonstrated that cathode rays produced fluorescence in various salts and could be deflected (bent) by a magnet. Crookes also showed that a magnet could deflect the narrow beam visualized by the bombardment of florescent screens.

b. **Electrons Accelerated From Cathode.** In the Crookes' tube, (figure 1-1), cathode rays (electrons) were accelerated from the cathode to the anode by high voltage. Many electrons traveled directly to the opposite end of the tube and there, x-rays and fluorescent light were produced.

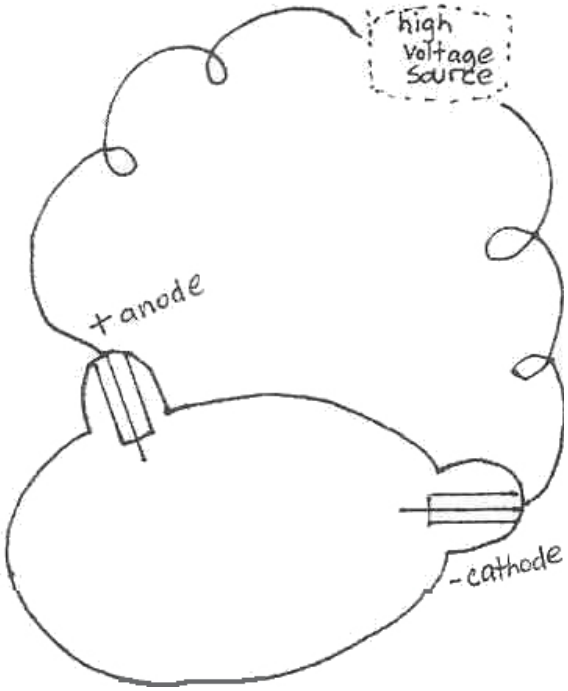


Figure 1-1 Sketch of the Crookes' partial vacuum tube.

## 1-9. WILLIAM HITTORF (1880)

In 1880, William Hittorf found that a solid body placed between the cathode and the area in which phosphorescence appeared, seemed to cast a shadow on the walls of the tube. He, thus, concluded that cathode rays appeared to travel in straight lines and could be easily stopped.

## 1-10. PHILLIPPE LENARD (1893)

a. In 1893, the French physicist, Phillippe Lenard investigated the penetrating power of cathode rays. His observations led him to the conclusion that the rays could be made to pass through very thin metal sheets. He discovered that cathode rays left an impression on a photographic plate, much like a beam of light.

b. Lenard was the first to correctly describe the photoelectric effect of ultraviolet light on metal. Additionally, he was the first scientist to measure the ionization potential of the cathode rays.

## Section II. THE DISCOVERY OF X-RAYS

### 1-11. WILHELM ROENTGEN (1895)

a. **Reproducing Lenard's Experiments**. Between the years 1894 and 1895, Wilhelm Conrad Roentgen attempted to reproduce his predecessor, Philippe Lenard's, experiments. Concerned that outside light could have possibly affected Lenard's data in some fashion, Roentgen waited until nightfall, even enclosing his Crookes Partial Vacuum Tube in cardboard to keep its light from affecting his findings.

b. **The Cardboard Screen with Barium Platinocyanide**. Now, it so happened that on a distant table, Roentgen had a small cardboard screen coated with barium platinocyanide crystals. This screen had nothing whatsoever to do with the experiment, as Roentgen had originally conceived it. But, it was an unforeseen and chance reaction of the barium platinocyanide to Roentgen's experiment that was to take on enormous importance for the discovery of x-rays.

c. **Crookes Tube Turned On, Barium Platinocyanide Screen Phosphorescent**. With his laboratory in darkness, Roentgen turned on the apparatus. From his peripheral (side vision), he noticed a change in the screen covered with barium platinocyanide, the one that was located on a distant table. The screen had begun to fluoresce (exhibit phosphorescence). He noted, too, that when his apparatus was turned off, there was no effect. With the apparatus on, the screen glowed. Moving the screen closer caused the fluorescence to intensify or brighten. Realizing that this invisible source had already penetrated the wrapping of his tube, he experimented with other materials and discovered that books with many pages had little effect. Very dense objects almost totally blocked the invisible beam. In the course of trying many different objects, he noticed that that the image of his hand, as projected onto the screen made the flesh virtually invisible, while the bones were very apparent. It was immediately obvious to Roentgen that this could be a useful tool for medical observation. Thus, it was on November 8, 1895, when Roentgen noticed a faint luminescence from the cardboard screen coated with barium platinocyanide crystals that x-rays were discovered. Roentgen felt sure that others must have already observed what he had just seen. So, he spent many hours reviewing publications of the day to learn more about what he had just witnessed. By daybreak it became clear to him that he seemed to have been the first to observe this phenomenon.

d. **Substituting Photographic Film for the Screen**. In his next round of experiments, Roentgen substituted photographic film for the screen. To prove to his contemporaries the value of his discovery, Roentgen persuaded his wife, Berta, to place her hand atop the fluorescing screen on which he had placed a piece of the light-sensitive photographic film. With the Crookes Tube above her hand, he again turned on the apparatus. Historians estimate that with the limited power of his equipment, this first radiograph may have required as long as fifteen minutes of exposure.

e. **"On a New Kind of Ray."** After processing, Roentgen had proof of his discovery. He named the invisible rays X-rays, for the mathematical unknown in algebraic equations. During the following month, he studied many more of the properties of X-radiation and by Dec. 1895, he had published his paper, "On a New Kind of Ray," informing the world of this new diagnostic tool. Roentgen received the first Nobel Prize in Physics in 1901 for his work. After his discovery was made public, A.W. Goodspeed of the University of Pennsylvania displayed an x-ray photograph that had been accidentally made in February 22, 1890. The Goodspeed display shows that Roentgen was not the first to produce x-rays. But, he was the first to recognize x-rays for what they were and could do.

## 1-12. A NEW PHOTOGRAPHY

a. The announcement of Roentgen's discovery to the rest of the world was greeted with widespread enthusiasm. At the same time, however, there were widespread misconceptions as to the precise nature of these rays. Initially, radiography was considered merely some kind of specialized branch of photography. Photographers and physicians made most radiographs simply as a hobby.

b. "**Enterprising photographers established Roentgen Studios."** An 1886 price list of Eastman Dry Plate and Film Company listed such popular sizes as: 14x17, 11x14, 10x12, and 8x10. It is interesting to note that many photographs of the day were taken on 14x17, 10x12, and 8x10 films, which are still the conventional sizes of radiographic images used today. Many early radiographs were made on glass photographic plates and some of these early radiographs have survived to this day. In December 1896, Eastman Kodak Company introduced the first paper designed specifically for X-ray purposes.

## 1-13. PUBLIC OPINION AND REACTIONS

a. **Concerns About Impropriety**. There is always fear about the implications of a new scientific breakthrough, for example, genetic engineering in our day. Similarly, in 1901, this new breakthrough was greeted with eager anticipation and misgivings about the potential adverse consequences of the "New Photography." In retrospect, it is interesting and somewhat amusing to consider the misconceptions of the day regarding the new x-rays. The misconceptions about the "New Photography" are reflected in a poem printed in 1896 in an issue of "Photography Magazine" in which reference is made to the "New Photography's" ability to "...gaze thro cloak and gown--and even stays..."There was concern about potentially licentious uses for x-rays. (See poem, other column.) These concerns reached such heights that Minister Reed of New Jersey went so far as to promulgate a law on February 10, 1896, expressly forbidding the use of x-rays in opera glasses! In a similar vein, a famous lingerie firm in London actually marketed a line of x-ray-proof pants and brassieres!

b. **Misunderstanding About Its Scientific Uses**. A New York newspaper of the late 1890's printed the following misinformation attributing outlandish powers to the new x-rays: "At the college for physicians and surgeons, the Roentgen rays were used to reflect anatomic diagrams directly into the brains of the students, making a much more enduring impression than the ordinary methods of learning anatomical details."

## 1-14. EARLY APPLICATIONS

a. **Foreign Body Localization and Identification of Fractures**. Despite popular misconceptions, the scientific community recognized the potential value of x-rays in the treatment and assessment of disease, scientific research, and industry.

b. **Immediate Use As a Surgical Aid Within the Military Medical Community**. The military medical community almost immediately recognized the value of x-rays as an aid to surgical procedures.. There is evidence that by 1896, military physicians in both Italy and England were using x-rays to localize bullets and diagnose fractures. In 1896, for example, LTC Giuseppe Alvaro of Italy used x-rays to localize bullets in the forearms of two separate patients during the "Ethiopian Campaign." In the same year, MAJ W.C. Beevor of Britain used x-rays on the battlefield during the "Tirah Campaign" in India. There is also evidence of the use of x-rays in the "River War" of 1896 - 1898 in India and Pakistan. The first recorded use of x-rays by the US Army was in 1898 during the "Spanish-American War." The Dutch in the “Boer War of 1899” also used x-rays.

c. **Military Surgeons, the First Roentgenologists**. The first roentgenologists, or radiologists, were military surgeons using x-rays to localize bullets, identify fractures, etc. During "World War I," the heavy workload of surgeons led to the use of enlisted soldiers to serve as manipulators, individuals trained to assist surgeons in taking radiographs. These manipulators were the equivalent of today's radiological technologists or, for the Army, X-ray Specialists.

**Continue with Exercises**

**EXERCISES, LESSON 1**

**INSTRUCTIONS**. The following exercises are to be answered by marking the lettered response that best answers the question or best completes the incomplete statement.

After you have completed all the exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers.

1. The pre-x-ray studies made in the 1600's by the English physician William Gilbert involved an investigation of:

   a. The distinct types of electricity, which he termed, vitreous and resinous.

   b. The similarities and differences between magnetism and electricity.

   c. The sulphur ball.

   d. Atmospheric electricity and friction.

2. Otto Van Guericke's contribution to pre-x-ray discoveries was:

   a. The discovery of electrons.

   b. The coining of the term electricity, an anglicized version of the Greek word for amber (elektron).

   c. The discovery that so-called vitreous electricity repelled objects with the same charge, while attracting those with the so-called resinous charge.

   d. The invention of the first electrical machine, an air pump that could remove air from a vessel or tube.

3. In 1733, the French scientist, Charles Francois Du Fay discovered that:

   a. Barium platinocyanide crystals would phosphoresce when struck by energy.

   b. Ionizing radiation could be generated through friction.

   c. Electrically charged vitreous particles were attracted to resinous particles.

   d. Positive charges move through a wire toward the negative charge.

4. In 1775, the Italian scientist, Alessandro Volta:

   a. Invented the precursor to the wet-cell battery, a device that produced light with static electricity.

   b. Coined the terms vitreous and resinous to describe charged particles.

   c. Used the term cathode ray to describe electrons emitted from the cathode of an evacuated tube.

   d. Used the terms positive and negative, rather than resinous and vitreous to describe electrically charged particles.

5. In 1750, Benjamin Franklin conducted tests on:

   a. Salts that could be deflected by a magnet, thereby, producing phosphorescence.

   b. Electromagnetic induction, studying the passage of electricity through gases.

   c. The production of fluorescent light.

   d. Atmospheric electricity and friction, concluding that they were identical.

6. Michael Faraday's contribution to pre-x-ray discoveries between 1831 and 1833 was that he:

   a. Used the term cathode ray to describe electrons emitted from the cathode of an evacuated tube.

   b. Renamed the so-called vitreous and resinous charges.

   c. Developed 2 basic laws of electrolysis and studied the passage of electricity through gases.

   d. Recognized the medical applications of x-radiation.

7. How did Sir William Crookes' work move science forward toward the discovery of x-rays?

   a. He coined the term cathode ray to describe electrons emitted from an evacuated tube that could produce fluorescence.

   b. He found that cathode rays appear to travel in a straight line.

   c. He investigated the penetrating power of cathode rays through metal sheets.

   d. He was the first to measure the ionization potential of cathode rays.

8. What did William Hittorf discover in his experiments with the Crookes' tube in 1880?

   a. Cathode rays would leave an impression on a photographic plate.

   b. A solid body placed between the cathode ray and the area of phosphorescence
   cast a shadow on the walls of the Crookes vacuum tube.

   c. Cathode rays were not x-rays.

   d. The Voltaic Pile could produce a continuous electric charge.

9. In 1893, Philippe Lenard gained notoriety for being the first scientist to demonstrate that:

   a. Cathode rays appeared to travel in a straight line and could be easily stopped.

   b. The electrons emitted from an evacuated tube produced florescence and could be deflected by a magnet.

   c. Electrons leaving the cathode ray are attracted to the anode by the high voltage.

   d. There was a photoelectric effect of ultraviolet light on metal.

10. Wilhelm Conrad Roentgen was the first scientist to:

    a. Produce x-rays.

    b. Recognize what x-rays were and what they could do.

    c. Use x-rays in foreign body localization.

    d. Use manipulators to assist in the positioning of the patient.

11. William Conrad Roentgen noticed that barium platinocyanide crystals would _____ when struck by the energy from the Crookes' partial vacuum tube apparatus.

    a. Coalesce.

    b. Fluoresce.

    c. Ignite.

    d. Become invisible.

12. Roentgen had his wife place her hand on top of a fluorescing screen on which he had placed a piece of light-sensitive film:

    a. As a publicity stunt.

    b. In order to identify a suspected fracture.

    c. So that the world would recognize the potential value of his discovery.

    d. To gain funding for further experiments.

13. Roentgen published his findings on the properties of x-radiation by December of 1895 in a treatise entitled _____, and was awarded the first Nobel Prize in Physics in 1901 for his discovery.

    a. "On a New Kind of Photography."

    b. "In Search of the Phantom Rays."

    c. " The Quest for x-Radiation."

    d. "On a New Kind of Ray."

14. Which of the following is NOT applicable to the public reaction to Roentgen's discovery?

a. Some thought this was a new and more advanced kind of photography.

b. Some worried that the new photography was not entirely proper as it could penetrate clothing, possibly revealing private parts without the subject realizing it.

c. Some worried about possible health risks resulting from exposure to the mysterious rays.

d. Some scientists had the vision to appreciate the potential benefits of this new discovery.

e. Some believed the use of x-rays permitted a more direct means of memorizing information.

15. In the early days, x-ray sittings were conducted by photographers and by _____ as a hobby.

a. X-ray technologists.

b. Manipulators.

c. Members of the press.

d. Physicians.

16. In 1896, _____were using x-rays in order to localize bullets and diagnose fractures.

a. Scientists conducting controlled experiments in Italy and England.

b. Physicians in private practice in the United States.

c. Military physicians stationed in Italy and England.

d. Health care providers working in Eastern Europe, Asia, and Hawaii.

17. In 1898, the _____used x-rays during the Spanish-American War.

a. United States Army.

b. The French Foreign Legion.

c. The Mexican Conquistadors.

d. Native Americans.

18. The first radiologists, known as _____, were military surgeons using x-rays to localize bullets, identify suspected fractures, and so forth.

a. Manipulators.

b. Roentgen photographers.

c. X-ray specialists.

d. Roentgenologists.

19. During World War II, surgeons trained enlisted men to assist in taking X-rays to alleviate the enormous workload. These assistants were commonly referred to as:

a. Manipulators.

b. Radiographers.

c. Roentgenology apprentices.

d. Technicians.

**Check Your Answers on Next Page**

**SOLUTION TO EXERCISES, LESSON 1**

1. b (para 1-2)
2. d (para 1-3)
3. c (para 1-4)
4. a (para 1-6)
5. d (para 1-5)
6. c (para 1-7)
7. a (para 1-8)
8. b (para 1-9)
9. d (para 1-10)
10. b (para 1-11.c & e)
11. b (para 1-11.c)
12. c (para 1-11.d)
13. d (para 1-11.e)
14. c (para 1-13)
15. d (para 1-12)
16. c (para 1-14.b)
17. a (para 1-14.b)
18. d (para 1-14.c)
19. a (para 1-14.c)

**End of Lesson 1**

## LESSON ASSIGNMENT

| | |
|---|---|
| **LESSON 2** | An Introduction to the Health Care Delivery System. |
| **LESSON ASSIGNMENT** | Paragraphs 2-1 through 2-20. |
| **LESSON OBJECTIVES** | After completing this lesson, you should be able to: |

2-1. Identify modalities and functions of radiographic imaging technology.

2-2. Identify other components of the health care delivery system and their respective functions.

**SUGGESTION** After completing the assignment, complete the exercises of this lesson. These exercises will help you to achieve the lesson objectives.

# LESSON 2

## Section I. RADIOLOGICAL IMAGING

### 2-1. INTRODUCTION

This lesson provides an overview of the health care delivery system. Specifically, it covers radiologic technology modalities and functions and health care system components and functions. As such, it provides insight into the techniques available to those working in the fields of radiology and radiography. In addition, it offers a sense of where and how the field of radiography fits into the larger picture of health care, as a whole. More people in America are engaged in health care than any other occupational field. It is essential to have an appreciation for the contributions made by others on the health care team, in order to have a deeper awareness of yourself as a member of the health care *team*.

### 2-2. RADIOLOGIC IMAGING

The term *radiologic imaging* conjures up images of a static film being taken of a person who is lying on a table with an x-ray tube overhead, and a film underneath (radiography). In fact, radiologic imaging encompasses much more than just radiography. It includes a number of *modalities* or methodologies. (The term *modality is* derived from the Latin *modalis*, meaning *manner or way of doing things;* thus, the modern-day meaning, *methodology*.) These radiographic modalities include: radiation therapy, nuclear medicine, diagnostic medical sonography (ultrasound), and computerized tomography, as well as radiography

### 2-3. RADIOGRAPHY

People tend to think of radiography when they speak of radiologic imaging, perhaps, because radiography is one of the primary methods of diagnosing disease or abnormality. Radiographic examinations can be performed on almost every body part, to include the skull, the thoracic cavity, the spine, the extremities, etc. using an X-ray tube and image receptor.

### 2-4. RADIATION THERAPY

Another modality used in the radiology department is radiation therapy. Radiation therapy is not used to diagnose disease, but, rather, to treat a patient whose condition has already been established, for example, for cancer patients, and those with certain skin diseases. In radiation therapy, diseased areas are exposed to various types of radiation.

## 2-5. NUCLEAR MEDICINE

a. Nuclear medicine, yet another modality, involves using radioactive materials, such as technetium for diagnostic and therapeutic purposes. Liver scans, bone scans, and brain scans are just a few of the procedures involving the use of nuclear medicine. Low-level radiopharmaceuticals (radioactive isotopes) are introduced into the patient's body by intravenous, intramuscular, subcutaneous, or oral methods.

b. Depending upon the pharmaceutical selected, the purpose of this procedure is to examine the manner in which the drug is absorbed by a specific organ. Sometimes, the purpose of the procedure is to identify the structure and function of the organ. Scanning instruments that function as the sensor or receptor of the radiation, are placed next to or over the patient. The scanning instruments detect the radiation produced by the radioactive isotopes concentrated in the organ. An image is then stored in computer memory, which can be recorded on radiographic film.

## 2-6. DIAGNOSTIC MEDICAL SONOGRAPHY (ULTRASOUND)

Diagnostic medical sonography, yet another modality in the battery of techniques available to the radiology department, is better known as ultrasound. This modality is a useful means of diagnosing tumors and malfunctions of organs, as well as other disease processes, such as cirrhosis of the liver and arteriosclerosis. Diagnostic medical sonography involves the use of high frequency sound waves. An image is formed of the anatomical structure of clinical interest. Another popular use of ultrasound is in obstetrics, in determining the size and position of the unborn fetus.

## 2-7. COMPUTERIZED TOMOGRAPHY

Computerized tomography involves diagnosing disease processes through the use of a narrow moving beam. The beam of x-radiation scans a thin cross-section of the body. An infinite number of body planes can be reconstructed using the receptors and the computer storage and processing feature using this technique. See figure 2-1.

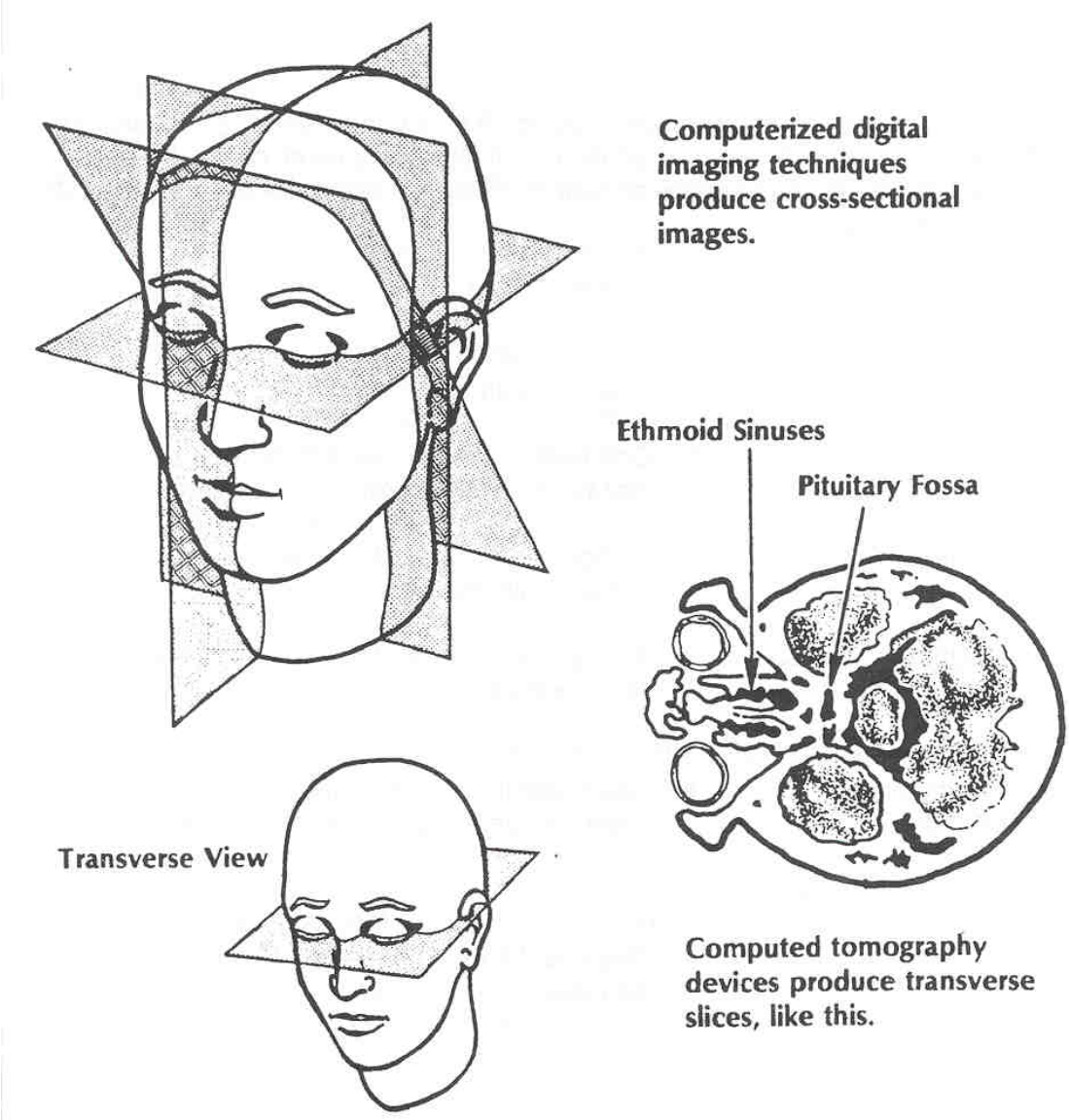


Figure 2-1. Computerized imaging produces visual slices of the body in any direction. At the turn of a knob, tissues can be emphasized, permitting more accurate pinpointing of the condition.

## Section II. COMPONENTS OF THE HEALTH CARE DELIVERY SYSTEM

### 2-8. INTRODUCTION

a. The radiology department with its radiologists and technologists do not exist in a vacuum. Nor is it, by any means, the sole department or the sole specialty within the hospital. It may, admittedly, seem to you, at times, that the demands and the concerns of the radiology department, are the only ones that matter in your day-to-day activities on the job. But, you must see yourself as only *one* component of the health care delivery system.

b. You cannot see yourself and your colleagues in other departments as special-interest groups competing for the limited resources of the hospital. There are many other departments and specialties whose interests and concerns are often inextricably linked to those of the radiology department. You are a member of a health care *team* composed of health care providers from many *different* departments and specialties.

## 2-9. THE AUDIOLOGY DEPARTMENT

Audiology is the study of the hearing impaired. The audiology department deals specifically with those patients whose condition cannot be improved by medication or surgery. Demonstration of the internal auditory canals by radiographers is frequently requested.

## 2-10. THE MEDICAL RECORDS DEPARTMENT

The medical records department is responsible for preparing, maintaining, and analyzing the patient's records and reports from admission to discharge. When you make an entry on the patient's medical record or verify the accuracy of an x-ray request slip, you are contributing to the overall efficiency of the hospital's medical records operation. You are also providing an important communications link with other providers on the health care team, and furnishing medical and legal documentation of the actions taken on behalf of the patient.

## 2-11. MEDICAL LABORATORY DEPARTMENT

The medical laboratory department is responsible for analyzing blood and other body fluids by means of a variety of tests. Physicians rely on the reports provided by medical technologists (or laboratory technicians) as a basis for making a diagnosis of the patient's condition and for making treatment recommendations. Frequently, medical diagnosis of a patient's condition requires test results from both the radiology and the medical laboratory departments.

## 2-12. PHYSICIANS AND THEIR AREAS OF SPECIALIZATION

Physicians practice the art and science of medicine with the aim of diagnosing, treating, and preventing disease, injury, and other abnormalities of the body and mind. Figure 2-2 lists some of the areas in which a physician may choose to specialize. Figure 2-3 lists some of the areas in which a surgeon may choose to specialize. You need to be, at least, familiar with the names of the disciplines that these areas of specialization represent.

| | |
|---|---|
| **DERMATOLOGY** | The skin and its diseases. |
| **GASTROENTEROLOGY** | Disorders of the digestive system. |
| **GERIATRICS** | Diseases and hygiene of old age. |
| **GYNECOLOGY** | The special functions and diseases of women. |
| **INTERNAL MEDICINE** | The diagnosis and non-surgical treatment of disease. |
| **NEONATOLOGY** | The care and treatment of infants. |
| **NEUROLOGY** | The nervous system, its structure, and its diseases. |
| **ONCOLOGY** | The treatment of tumors. |
| **OPHTHALMOLOGY** | The diagnosis and treatment of diseases of the eye. |
| **ORTHOPEDICS** | The surgical treatment of deformities of the bones, joints, muscles, etc. |
| **OTORHINOLARYNGOLOGY** | Disorders of the ear, nose, and throat. |
| **PATHOLOGY** | The structural and functional causes of disease. |
| **PEDIATRICS** | The care, development, and treatment of children. |
| **PODIATRY** | The care and treatment of the feet, especially the treatment and prevention of foot disorders. |
| **PSYCHIATRY** | The study and treatment of disorders of the mind, including psychoses, neuroses, emotional maladjustments, and so forth. |
| **RADIOLOGY** | The diagnosis and treatment of disease through the use of X-rays of the bones and organs. |
| **SURGERY** | The treatment of disease, injury, or deformity by manual or instrumental operations, as in the removal of diseased parts or tissue by cutting. |
| **UROLOGY** | Diseases of the urogenital or urinary system. |
| **CARDIAC SURGERY** | Heart surgery. |
| **NEUROLOGIC SURGERY** | Surgery of the nervous system. |
| **PLASTIC SURGERY** | The surgical repair or restoration of body parts that are injured, deformed, or destroyed. |
| **PULMONARY SURGERY** | Surgery of the lungs and related organs. |
| **THORACIC SURGERY** | Surgery of the chest cavity. |

Figure 2-3. Some of the areas in which a surgeon may specialize.

## 2-13. PHYSICIAN ASSISTANTS

a. **Role.** One of the newest allied health professions is that of the physician assistant. The physician assistant performs a large number of tasks, formerly done by physicians, such as screening large numbers of patients on routine sick call.

b. **Limitations.** This frees the physician's time somewhat so that he or she can oversee the care of a greater number of patients. Physician assistants provide an invaluable service to the military and are legally recognized by most states. Physician assistants are not full-fledged physicians, but are qualified, in most instances, to perform battlefield surgery.

## 2-14. NURSES

Nurses maintain round-the-clock contact with patients, providing physical and emotional support for the patient's needs during the patient's illness or disability.

## 2-15. OCCUPATIONAL THERAPISTS

Occupational or physical therapists work with patients to help them regain daily living skills through the use of artificial limbs and special equipment. Physical therapists perform therapeutic procedures including exercise to increase the patient's strength, endurance, coordination, and range of motion.

## 2-16. PHARMACISTS

Pharmacists have an in-depth knowledge of the composition, proper usage, and indications and contraindications of medications. Pharmacists serve as consultants to physicians, providing up-to-date information on medications, including side-effects or contraindications (adverse interactions) of specific drugs.

## 2-17. RESPIRATORY THERAPISTS

a. **Intermittent Positive Pressure Breathing.** Respiratory therapists perform a variety of therapeutic procedures to help the patient breathe as normally as possible. When the diaphragm is paralyzed, the patient has to learn an alternate system of breathing, such as intermittent positive pressure breathing (IPPB).

b. **Aerosol Therapy.** Aerosol therapy involves the use of aerosol inhalants, as in the case of patients suffering from asthma.

c. **Postural Drainage.** Many diseases adversely affect breathing and require changes of body position to clear the lungs of mucous and phlegm. Respiratory therapists teach patients and their families how to use postural drainage.

d. **Airway Management.** Sometimes, the respiratory therapist must provide instruction to the patient on how to care for devices that artificially facilitate breathing. For example, if a patient has a track tube, the respiratory therapist will train the patient in proper airway management.

e. **Pulmonary Function Testing.** If there is a lung disorder, the respiratory therapist will determine what percentage of the right or left lung is affected and/or how well the breathing apparatus is functioning.

f. **Respiratory Emergencies.** In an emergency, the respiratory therapist will assist the patient to reestablish normal or near-normal breathing.

## 2-18. SOCIAL SERVICES

Social services representatives help families and patients cope with long or short-term illness, injury, or rehabilitation. They help people bring about positive change in their lives, with regard to their physical, mental, or social condition. For example, a burn unit patient and his or her family might require professional assistance to cope with the trauma of disfigurement.

## 2-19. SPEECH PATHOLOGISTS

Speech pathologists evaluate and treat speech or language disorders.

## 2-20. BIOMEDICAL EQUIPMENT TECHNICIANS

Biomedical equipment technicians do not have any contact with the patient. But, they perform an essential service that is crucial to the health care team that wishes to provide quality patient care. Biomedical equipment technicians keep all the equipment in top working order by testing, calibrating, maintaining, and repairing hospital equipment. They also instruct hospital staff in the proper and safe use of the equipment that is used in a hospital environment.

**Continue with Exercises**

**EXERCISES, LESSON 2**

**INSTRUCTIONS.** The following exercises are to be answered by marking the lettered response that best answers the question or best complets the incomplete statement.

After you have completed all the exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers.

**SPECIAL INSTRUCTIONS FOR EXERCISES 1 THROUGH 5**. Match the radiologic imaging modality in the left-hand column, with the appropriate description in the right-hand column by writing the letter in the space provided. (There is one description that will NOT be selected.)

| | |
|---|---|
| 1. _____Radiography. | a. Used for pain control. |
| 2. _____ Radiation therapy. | b. One of the primary methods of diagnosing disease or abnormality. |
| 3. _____ Nuclear medicine. | c. Method of treating patients with cancer and certain skin diseases. |
| 4. _____ Diagnostic medical sonography | d. A diagnosis modality that uses high frequency sound waves. |
| 5. _____ Computerized tomography | e. Radiologic imaging modality by which radioactive materials are used for therapy and diagnosis. |
| | f. Thin cross-sections of the body are scanned Image is then reconstructed for use in the diagnosis of the disease. |

6. Which of the following statements accurately describes radiological imaging?

    a. It solely involves the taking of static film images of a person lying on an X-ray able with X-ray tube overhead.

    b. It consists of one modality.

    c. It encompasses a number of modalities, such as radiation therapy, nuclear medicine, diagnostic medical sonography, radiography, and computerized tomography, to name a few.

    d. The modalities involved vary according to the area in which one is practicing.

7. One of the primary methods of diagnosing disease or abnormality is by means of:

    a. Radiography.

    b. Radiation therapy.

    c. Nuclear medicine.

    d. Computerized tomography.

8. Liver scans, bone scans, and brain scans are just a few of the procedures involved in:

    a. Ultrasound.

    b. Nuclear medicine.

    c. Computerized tomography.

    d. Radiation therapy.

9. A popular use of _____ in obstetrics is in determining the size and position of the unborn fetus.

    a. Nuclear medicine.

    b. Computerized tomography.

    c. Radiological imaging.

    d. Ultrasound.

10. Diseased areas are exposed to various types of radiation in:

    a. Radiological imaging.

    b. Radiation therapy.

    c. Nuclear medicine.

    d. Diagnostic medical sonography.

11. A narrow moving beam of x-radiation is used to scan a thin cross-section of the body in:

    a. Radiological imaging.

    b. Ultrasound.

    c. Computerized tomography.

    d. Nuclear medicine.

12. Patients whose hearing impairment cannot be improved by medication or surgery are referred to the _____ department.

    a. Audiology.

    b. Medical records.

    c. Medical laboratory.

    d. Neurology.

13. Patient records and reports are prepared, maintained, and analyzed by the:

    a. Orthopedics department.

    b. Pathology department.

    c. Social services department.

    d. Medical records department.

14. Blood and blood fluids are analyzed in the _____ department.

    a. Medical laboratory.

    b. Pharmacy.

    c. Occupational therapy.

    d. Radiology.

15. Physicians who specialize in the treatment of tumors are known as:

    a. Radiologists.

    b. Oncologists.

    c. Neurologists.

    d. Otorhinolaryngologists.

16. Surgeons who specialize in the repair or restoration of injured, deformed, or destroyed parts of the body are known as:

    a. Cardiac surgeons.

    b. Thoracic surgeons.

    c. Plastic surgeons.

    d. Neurological surgeons.

17. This relatively new health care professional is, in most instances, qualified to perform battlefield surgery.

    a. Radiological technologists.

    b. Physician assistants.

    c. Occupational therapists.

    d. Respiratory specialists.

18. Round-the-clock contact with the patient, emotional as well as physical support is provided by:

    a. Nurses.

    b. Physicians.

    c. Pharmacists.

    d. Physician Assistants.

19. The health care providers who work with patients to help them regain daily living skills using special equipment and artificial limbs are known as:

    a. Neurologists.

    b. Orthopedists.

    c. Pathologists.

    d. Occupational therapists.

20. These individuals serve as consultants to the physician, providing up-to-date information on medications, including side effects or contraindications.

    a. Nurses.

    b. Physician Assistants.

    c. Pharmacists.

    d. Medical Records Specialists.

21. Intermittent positive pressure breathing involves:

    a. Teaching a patient an alternate system of breathing.

    b. Determining the percentage of lung disorder.

    c. Assisting the patient to re-establish normal or near normal breathing in an emergency.

    d. Facilitating clearage of mucus or other buildup in the lungs.

22. Therapeutic procedures to help the patient breathe as normally as possible are performed by:

    a. Occupational therapists.

    b. Pharmacists.

    c. Respiratory specialists.

    d. Pulmonary surgeons.

23. Hospital personnel who train the staff in the proper use of equipment and maintain the equipment by testing, calibrating, and repairing it are known as:

    a. Biomedical equipment technicians.

    b. Speech pathologists.

    c. Pathologists.

    d. Social services specialists.

24. These individuals help families and patients cope with long or short-term illness, injury, or rehabilitation, and the physical, mental, or social stresses of daily life.

    a. Respiratory therapists.

    b. Social services specialists.

    c. Urologists.

    d. Forensic specialists.

**Check Your Answers on Next Page**

**SOLUTION TO EXERCISES, LESSON 2**

1. b (para 2-3)
2. c (para 2-4)
3. e (para 2-5a)
4. d (para 2-6)
5. f (para 2-7)
6. c (para 2-2)
7. a (para 2-3)
8. b (para 2-5a)
9. d (para 2-6)
10. b (para 2-4)
11. c (para 2-7)
12. a (para 2-9)
13. d (para 2-10)
14. a (para 2-11)
15. b (para 2-12)
16. c (fig 2-3)
17. b (para 2-13a)
18. a (para 2-14)
19. d (para 2-15)
20. c (para 2-16)

21. a (para 2-17a)

22. c (para 2-17a)

23. a (para 2-20)

24. b (para 2-18)

**End of Lesson 2**

## LESSON ASSIGNMENT

| | |
|---|---|
| **LESSON 3** | Hospital Organization. |
| **LESSON ASSIGNMENT** | Paragraphs 3-1 through 3-11 |
| **LESSON OBJECTIVES** | After completing this lesson, you should be able to: |

3-1. Identify the level of care provided at different military health care facilities.

3-2. Identify examples of intradepartmental dependencies within the hospital.

3-3. Identify the definition and purpose of the hospital chain of command.

**SUGGESTION** After completing the assignment, complete the exercises of this lesson. These exercises will help you to achieve the lesson objectives.

# LESSON 3

## Section I. MILITARY HEALTH CARE SYSTEMS

### 3-1. INTRODUCTION

A hospital is a complex world unto itself, equipped with everything from a supply system, kitchen, clerks, housekeepers, communications systems, transportation systems, sleeping facilities, and monitoring services, to its own personnel scheduling and supervision system. It is a 24-hour-a-day environment that never stops to sleep. There are always patients with a never-ending array of physical and emotional needs. The department of radiology is just one part of the hospital system. And, you, as a radiologic technologist, need to know where you fit into the scheme of things within the hospital.

### 3-2. THE TROOP MEDICAL CLINIC

The military health care system is comprised of many levels. Routine sick call for active duty military personnel begins at the troop medical clinic (TMC) where records for active duty personnel are maintained. When a soldier is issued a sick slip from his or her unit, he or she reports to the TMC for initial care. Active duty personnel cannot *simply* walk into a hospital for treatment. Care begins at the TMC level. If the medical problem cannot be adequately diagnosed or treated at this level, the patient is then sent for further diagnostic testing and/or treatment at a hospital.

### 3-3. THE EMERGENCY ROOM

The emergency room of a military hospital, that is, an army community hospital or medical department activity (MEDDAC), treats both active duty and civilian emergencies. No medical records are maintained in the emergency room, but all necessary diagnostic facilities are immediately available here. Specialty and support facilities are also available. (Family members make appointments through the TMC appointment system for routine care.)

### 3-4. THE ARMY COMMUNITY HOSPITAL

The Army community hospital provides both inpatient and outpatient care. Diagnostic, treatment, and support departments are provided at this level of care. Radiology is one example of a diagnostic service. The patient is always *referred* to the radiology department. No patient can simply *walk in* and request x-rays. Specialty clinics such as orthopedic, surgical, and obstetrical departments are also provided at this level of care.

## 3-5. THE MEDICAL DEPARTMENT ACTIVITY

A medical department activity (MEDDAC) provides centralized, specialized treatment facilities, inpatient and outpatient care and treatment services, diagnostic, consultation service, and medical laboratory support, if required. The MEDDAC provides these services for a given health service region.

## 3-6. THE MEDICAL CENTER

Medical centers (MEDCEN) are the largest type of treatment facility in the military health care system. Medical centers support a large geographical area with all of the services available to military medicine. See below for a list of MEDCENs.

*The Seven MEDCENs*

*Brooke Army Medical Center (BAMC), Fort Sam Houston, TX.*

*Dwight David Eisenhower Army Medical Center, Augusta, GA.*

*Womack Army Medical Center, Fort Bragg, NC.*

*Madigan Army Medical Center, Tacoma, WA.*

*Tripler Army Medical Center, AMC, HI.*

*Walter Reed Army Medical Center, Washington, DC.*

*William Beaumont Army Medical Center, El Paso, TX.*

Figure 3-1. Medical centers.

# Section II. ORGANIZATION AND RESPONSIBILITY WITHIN THE HEALTH CARE FACILITY

## 3-7. THE HOSPITAL EXISTS FOR THE PATIENT

The patient should be the central focus within any medical treatment facility. Without patients, medical facilities would not exist. The medical treatment machine is a mammoth bureaucracy. Therefore, it is easy to fall into the erroneous thinking that the machine exists for its own sake. and the patient is only one small cog in the bureaucratic wheel. The fact is the health care infrastructure does not exist *for its own sake,* but *in order to* promote the physical and emotional well-being of the patient.

## 3-8. THE HOSPITAL STAFF

a. **The Medical Staff.** The medical staff of a hospital consists of the physicians, interns, residents, and physician assistants.

b. **The Executive Board (Civilian) vs. the Executive Staff (Military).** The term *executive board* pertains to civilian hospitals. The executive board is a body that establishes policies, sets goals, makes financial plans, and hires the hospital director or administrator. In the military, the executive *staff* would constitute the military counterpart to a civilian hospital's executive board.

c. **The Role of the Executive Board (Civilian).** Not all physicians in a civilian hospital are practicing members of the hospital. Thus, one of the responsibilities of the executive board of a civilian hospital is to extend rights and privileges to nonmember physicians to practice in the hospital. This ensures that there will be enough specialists to support the hospital in its mission. Another important responsibility is to organize the staff to cooperate in making the rules that govern their respective activities. The rules may relate to standards of care, medical records, restrictions on patients and/or staff, and so forth. Whatever the rules pertain to, they must promote a smooth interrelationship among the various departments of the hospital.

## 3-9. HOSPITAL DEPARTMENTS

a. **Credentials of the Department Head and Other Personnel.** Generally, each department within a treatment facility will have a supervisor whose education and expertise relate directly to their particular area of responsibility. For example, the pharmacy department will usually have a registered pharmacist as its department head, the radiology department will have a board certified radiologist, and so forth. The personnel in each department are specifically trained for work within that department. Thus radiological technologists (X-ray specialists) are trained in radiological imaging, pharmacy specialists are trained in an area of pharmacy, and so forth.

b. **Direct Patient Care.** Some departments, such as the nursing department meet patient needs directly.

c. **Diagnostic Services.** Other departments, such as the medical laboratory and radiology departments, provide diagnostic services.

d. **Therapeutic Services.** Still others, such as the physical therapy, occupational therapy, and radiation therapy departments, provide therapeutic services. (Thus, the radiology department provides both diagnostic and therapeutic services for patients.)

e. **Administrative and Support Services.** All departments need administrative and/or support services, such as medical records, the comptroller, supply, housekeeping, laundry, medical library, personnel, and so forth.

## 3-10. INEXTRICABLE INTER-RELATIONSHIPS ACROSS DEPARTMENTS

a. **No Department is an Island.** It goes without saying that *no* department is totally self-sufficient. Specialty clinics depend upon diagnostic departments to aid in treatment. Thus, for example, an orthopedic surgeon cannot properly set a bone without the x-ray films to demonstrate the type and placement of the fracture.

b. **Dependence on Administrative and Support Functions.** All departments depend on administrative and support elements that provide supplies, medical records, housekeeping services, and so forth.

c. **Intra-Departmental Cooperation Essential.** Few patients are likely to require the services of *all* departments during a given hospital stay. But, the well-being of *most* patients does require the cooperative efforts of many departments.

## 3-11. THE CHAIN OF COMMAND

a. **Lines of Authority and Responsibility.** The chain of command is the organizational structure (in this case, that of a hospital). That structure determines the lines of authority and responsibility, as well as the appropriate channels of *vertical* communication.

b. **Complaints.** The channels for handling complaints and problems are prescribed by the chain of command. If you have a complaint about a troublesome patient, the proper avenue of redress is through the *next* person above you in the chain of command, namely, the chief technologist, or Non-Commissioned Officer in Charge (NCOIC). The NCOIC will take up your complaint with the radiologist, who will, in turn discuss the problem with the attending physician responsible for the treatment of the patient in question.

c. **Policies, Directives, and Method of Communication.** Besides handling complaints and problems, the chain of command is designed to issue and enforce policies and directives. It also provides an *organized* method of communication among the various departments and services.

d. **Organizational Chart.** The organizational chart shown (figure 3-2) indicates lines of authority and responsibility for a *typical* radiology department. (Department organization may, of course, vary somewhat from one locale to another.) If, for example, a patient had a complaint about a technologist, it would, hopefully, be directed *through* the NCOIC and resolved at the lowest level possible, as opposed to being channeled directly to the Hospital Commander. To take another example, a student coordinator (see figure 3-2) would address any complaint that he or she might have through the next person in the chain; in this case, the assistant NCOIC, and so forth.

# RADIOLOGY DEPARTMENT

## Chain of Command

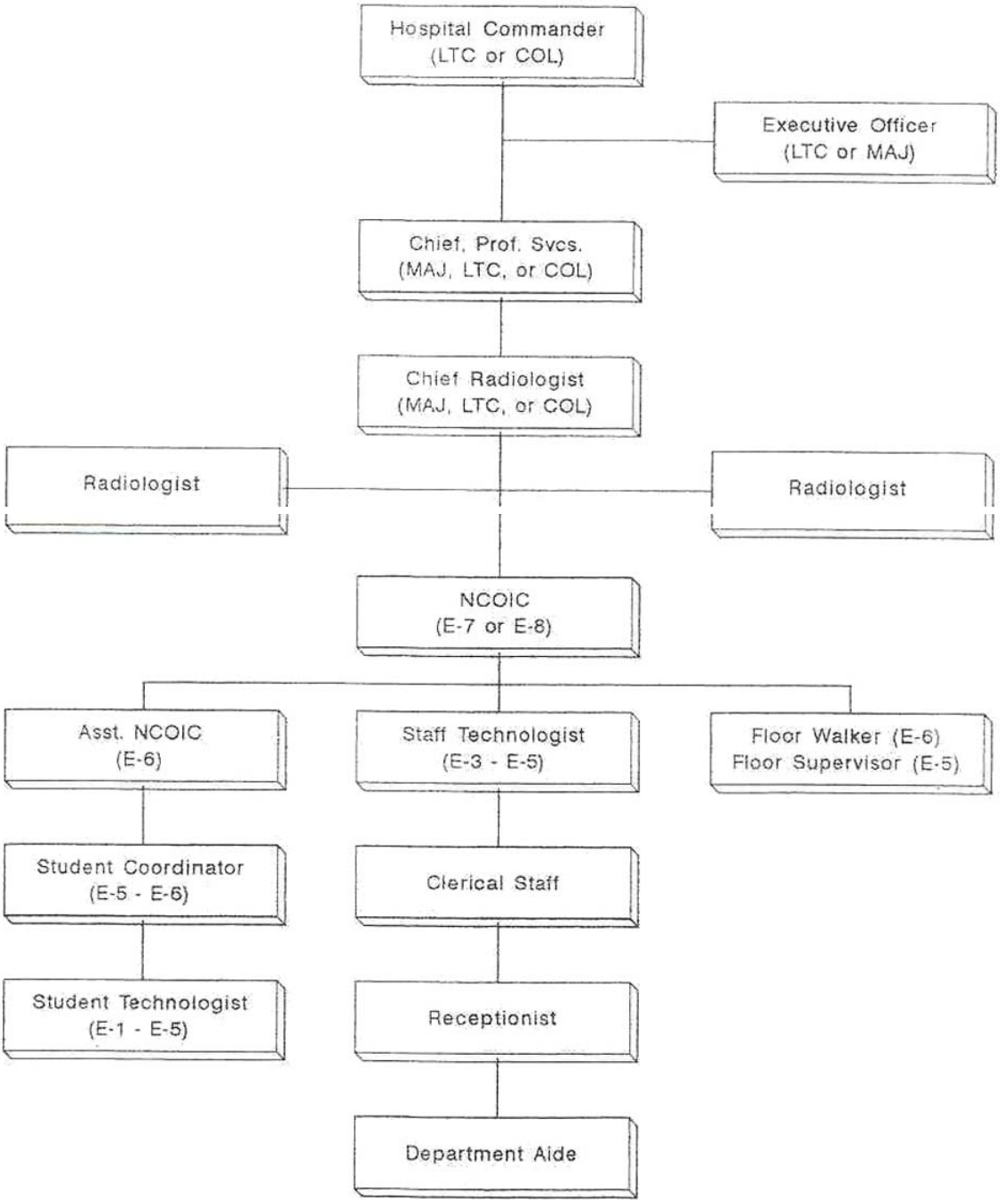


Figure 3-2. Organizational chart showing lines of authority and responsibility.

**Continue with Exercises**

## EXERCISES, LESSON 3

**INSTRUCTIONS.** The following exercises are to be answered by marking the lettered response that best answers the question or best completes the incomplete statement.

After you have completed all the exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers.

1. Normally, military personnel begin routine sick call at the:

   a. Troop medical clinic (TMC).

   b. Emergency room.

   c. Army community hospital.

   d. MEDDAC or MEDCEN.

2. Normally, family members receive routine care through the:

   a. Troop medical clinic.

   b. Emergency room.

   c. Central appointment system.

3. A sick slip must be obtained from the unit before going to the:

   a. Troop Medical Clinic.

   b. Emergency room.

   c. Army community hospital.

   d. MEDDAC or MEDCEN.

4. *No* medical records are maintained at the:

    a. Troop Medical Clinic.

    b. Emergency room.

    c. Army community hospital.

    d. MEDDAC or MEDCEN.

5. Inpatient, outpatient, diagnostic, treatment, support services, and specialty clinics are provided at the:

    a. Troop medical clinic.

    b. Emergency room.

    c. Army community hospital, MEDDAC, and MEDCEN.

    d. All of the above.

6. At which level of care would a radiology department be found?

    a. Troop Medical Clinic.

    b. Emergency room.

    c. Army community hospital, MEDDAC, or MEDCEN.

    d. All of the above.

7. The largest type of military treatment activity is the:

    a. MEDCEN.

    b. Emergency room.

    c. Army community hospital.

    d. MEDDAC.

8. The executive board of a hospital consists of:

    a. Interns and residents.

    b. Health care providers involved in direct patient care.

    c. Physician assistants.

    d. Those who set policy, make financial plans, and hire the hospital director.

9. The head of the radiology department will usually be someone with:

    a. Administrative skill and training in any one of a number of medical specialties.

    b. Board certification in radiology.

    c. Education and expertise in hospital administration.

    d. A specialty in health care ethics and the law.

10. Which department provides both diagnostic and therapeutic services?

    a. Nursing.

    b. Medical records.

    c. Occupational therapy.

    d. Radiology.

11. All departments need the services of the _____ elements of the hospital.

    a. Radiologic.

    b. Administrative and support.

    c. Therapeutic.

    d. Direct patient care.

12. Specialty clinics, such as the orthopedic department, rely on the services of departments to aid in treatment.

    a. Therapeutic.

    b. Direct patient care.

    c. Diagnostic.

    d. Administrative and Support.

13. If a staff radiologic technologist has a complaint, he or she should follow the chain of command by taking up the complaint with the:

    a. Hospital commander.

    b. Chief of professional services.

    c. Chief radiologist.

    d. Non-Commissioned Officer in Charge (NCOIC).

14. Lines of authority and responsibility, and the proper channels for communication within an organization are prescribed by the:

    a. Chain of Command.

    b. Order of procedure.

    c. Rules and regulations.

    d. The American Society for Radiologic Technologist's code of ethics.

15. The well being of most patients will generally require the cooperative efforts of many _____ within the hospital:

    a. Departments.

    b. Orderlies.

    c. Bureaucrats.

    d. Records.

**Check Your Answers on Next Page**

**SOLUTION TO EXERCISES, LESSON 3**

1. a. (para 3-2)
2. c (para 3-3)
3. a (para 3-2)
4. b (para 3-3)
5. c (para 3-4, 3-5, 3-6)
6. c (para 3-4 and 3-6)
7. a (para 3-6)
8. d (para 3-6)
9. b (para 3-9a)
10. d (paras 3-9c & d)
11. b (para 3-9e)
12 c (para 3-10a)
13. d (para 3-11b)
14. a (para 3-10c)
15. a (para 3-10c)

**End of Lesson 3**

## LESSON ASSIGNMENT

| | |
|---|---|
| **LESSON 4** | Radiology Department Organization. |
| **LESSON ASSIGNMENT** | Paragraphs 4-1 through 4-4 |
| **LESSON OBJECTIVES** | After completing this lesson, you should be able to: |

4-1. Identify the functions of the chief radiologist and the Non-Commissioned Officer in Charge (NCOIC).

4-2. Identify the organizational structure of a radiology department.

4-3. Identify the sections within a standard operating procedure (SOP).

| | |
|---|---|
| **SUGGESTION** | After completing the assignment, complete the exercises of this lesson. These exercises will help you to achieve the lesson objectives. |

## LESSON 4

## RADIOLOGY DEPARTMENT ORGANIZATION

### 4-1. INTRODUCTION

The organization of the radiology department is determined by the roles and functions of the hospital and the community it serves. While there is no typical or average radiology department, there *are* certain characteristics common to *most* departments. The organization of a radiology department affects the disposition and management of personnel and physical resources. Management aims to arrange employees into *working* groups according to their *functions.* The administration directs the efforts and skills of employees toward reaching departmental objectives in a cohesive and efficient manner.

### 4-2. THE RESPONSIBILITIES OF THE CHIEF RADIOLOGIST AND NON-COMMISSIONED OFFICER IN CHARGE

Within the radiology department, many responsibilities will be overseen by the chief radiologist and the NCOIC. To begin with, they must establish effective working relationships with the medical staff, administration, and other departments and services. Jointly, they develop and approve all policies and procedures for the department. They verify qualifications and capabilities of all radiology staff technical personnel. They develop comprehensive safety rules in cooperation with the Hospital Safety Committee and a comprehensive in-service training program for the whole of the radiology department. They review and evaluate the quality of services. They also determine equipment needs, equipment modification, and usage.

### 4-3. THE ORGANIZATIONAL CHART

Every well-managed department will have an organizational chart, which establishes clear lines of authority, responsibility, and accountability. Having a clear sense of organizational components together with the accepted lines of communication on paper will help to ensure proper control of operations and define record-keeping responsibilities. (See previous lesson, figure 3-2.)

### 4-4. THE STANDARD OPERATING PROCEDURE

a. **The Need for a Standard Operating Procedure.** To ensure effectiveness, *every* aspect of departmental operation must have a standard operating procedure (SOP), a set of instructions, which covers operational features and provides standardized procedures. Each SOP is generally designed to meet joint accreditation standards and hospital policies. Standard operating procedures are an effective way to make available to all personnel the policies of the organization and pertinent general information relating to specific assignments. Standard operating procedures generally take the form of manuals.

b. **Standard Operating Procedures in Manual Format.** Standard operating procedures will normally take the form of manuals covering various aspects of procedure. The manuals spell out who does what and how frequently. Manuals usually include samples of authorization forms for radiographic procedures. Thus, a properly filled out copy of an X-ray request form will be included in the forms manual, and views performed per routine and fluoroscopic procedures will be covered in a manual. Patient preparation instructions will be outlined, in writing, in one of the manuals. A film sign-out policy will be defined. Mass casualty procedures will be specified. Departmental safety procedures will be covered in another manual. Radiologic compliance evaluations will be addressed in still another manual, which specifies: frequency of inspections, calibration, and testing of X-ray equipment. Personnel radiation monitoring is another important area of concern, which will also be identified in the SOP. Patient safety and handling procedures; departmental radiation control procedures; sanitation and infection control, quality assurance, in-service education, alert rosters, and various miscellaneous items are also covered in the SOP.

c. **Non-Commissioned Officer's Responsibility.** It is the NCOIC who is responsible for developing the SOPs for the department. Having a good SOP with clearly defined procedures that are updated in a timely fashion is important. A good SOP can help foster the spirit of teamwork and dedication to excellence that will make a patient's visits to the radiology department pleasant and the employees' service to the department as meaningful and satisfying as possible.

**Continue with Exercises**

## EXERCISES, LESSON 4

**INSTRUCTIONS.** The following exercises are to be answered by marking the lettered response that best answers the question or best completes the incomplete statement.

After you have completed all the exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers.

1. The _____ of a radiology department affects the disposition and management of personnel and physical resources.

   a. Location.

   b. Reputation.

   c. Organization.

   d. Accreditation.

2. Which of the following is *NOT* a responsibility of the chief radiologist and the non-commissioned officer in charge (NCOIC)?

   a. Transporting patients and taking X-rays.

   b. Establishing effective working relationships.

   c. Developing and approving policies and procedures.

   d. Developing safety rules and providing in-service training to personnel assigned to the department.

3. Which of the following is *NOT* a responsibility of the chief radiologist or of the NCOIC?

   a. Reviewing and evaluating the quality of radiologic services.

   b. Determining equipment needs and usage.

   c. Determining equipment modification requirements.

   d. Supervising the day-to-day activities on the floor.

4. The lines of authority, responsibility, and accountability are outlined in:

   a. The technique charts.

   b. The statement of patient rights.

   c. The organizational chart.

   d. The code of ethics.

5. Responsibility for control of operations and record-keeping requirements are reflected in the:

   a. Organizational chart.

   b. The training manuals.

   c. The administrative records.

   d. The safety procedures.

6. Standard operating procedures provide standardized instructions designed to meet hospital policies and:

   a. The personal preferences of management.

   b. Joint accreditation standards.

   c. Licensure requirements.

   d. The requirements of the American Medical Association (AMA).

7. If there were a need for a new SOP, it would be the responsibility of the _____to develop it.

   a. Chief radiologist.

   b. Department aide.

   c. Staff technologist.

   d. Non-commissioned officer in charge (NCOIC).

**Check Your Answers on Next Page**

**SOLUTION TO EXERCISES, LESSON 4**

1. c (para 4-1)

2. a (paras 4-1, 4-2)

3. d (paras 4-1,4-2)

4. c (para 4-3)

5. a (para 4-3)

6. b (para 4-4a)

7. d (para 4-4c)

**End of Lesson 4**

## LESSON ASSIGNMENT

| | |
|---|---|
| **LESSON 5** | Accreditation and Credentialing. |
| **LESSON ASSIGNMENT** | Paragraphs 5-1 through 5-12 |
| **LESSON OBJECTIVES** | After completing this lesson, you should be able to: |

5-1. Identify definitions of the terms: *certification*, *accreditation*, and *licensure*.

5-2. Identify organizations and agencies involved with accreditation of radiography training programs.

5-3. Identify functions of the organizations involved with accreditation.

5-4. Identify requirements of the *Consumer-Patient Health and Radiation Safety Act of 1981.*

5-5. Identify the four categories of accreditation used by the Committee on Allied Health Education (CAHEA) to designate the accreditation status of a radiography program.

**SUGGESTION** After completing the assignment, complete the exercises of this lesson. These exercises will help you to achieve the lesson objectives.

## LESSON 5

## ACCREDITATION AND CREDENTIALING

### 5-1. INTRODUCTION

Within the field of radiography, there is confusion as to the meaning of certain key terms, central to the profession. This confusion centers, most especially, around the terms: *certification, accreditation,* and *licensure.* The differences among these concepts are discussed below.

### 5-2. THE CERTIFICATION PROCESS

a. **Authoritative Endorsement.** The term *certification* pertains to the process of obtaining authoritative endorsement (approval or confirmation) as to the qualifications of an individual to perform competently in a specific occupation or profession. Certification is conferred by an *independent* agency or organization.

b. **Becoming Registered.** Within the field of radiological technology, the certification process is also often referred to as *becoming registered*. Generally, one cannot be certified without having successfully completed an accredited program with good grades and a passing score on the examinations.

### 5-3. THE ACCREDITATION PROCESS

Whereas the certification process looks at the individual, the accreditation process looks at the institution of learning. The *accreditation* process, therefore, establishes the merits of the entire educational program offered by an institution of learning. Accreditation involves the public or *official* endorsement of an educational institution or, more specifically, a *course* offered at an institution. An accredited course or institution is one that has been evaluated by an *outside* agency and has been found to conform to prescribed standards. Generally, an individual cannot become registered or certified without having gone through an accredited program.

### 5-4. LICENSURE

a. Attesting to Individual's Qualifications. Like certification, licensure relates back to the *individual*. Under the licensure process, specific individuals are issued permits attesting to their qualifications to practice. Licensure is conferred by a *governmental* agency, such as the State Department of Health or the Medical Board.

b. **Both Licensure and Certification Required in More and More States.** Progressively more and more states have required technologists to be *licensed* as well as *registered (certified)*. Some states, however, have a system of reciprocity, whereby a registered (certified) radiological technologist in good standing, does *not* have to take another examination. He or she simply pays an application fee to obtain licensure in that state.

## 5-5. THE COMMITTEE ON ALLIED HEALTH EDUCATION AND ACCREDITATION OF THE AMERICAN MEDICAL ASSOCIATION

a. **Overall Function.** There are several organizations and agencies that play a number of important roles for radiographers. First, in order of importance is the Committee on Allied Health Education and Accreditation (CAHEA) of the American Medical Association (AMA) is responsible to the United States (US) Office of Education. The CAHEA accredits allied health (health care-related) educational programs.* Since CAHEA cannot possibly have the requisite expertise to evaluate *every* type of X-ray program available, it relies on the recommendations of the Joint Review Committee on Education in Radiological Technology (JRCERT). The CAHEA's role, essentially, is to review JRCERT recommendations to determine the accreditation status of the programs it oversees.

b. **Provisional Accreditation.** There are *four* categories of accreditation. The first, provisional status is conferred upon *new programs* just after application. This status indicates probable *future* program compliance when fully operational.

c. **Nonaccredited Status.** This indicates that the program suffers from *major deficiencies* and a probable inability to rectify these shortcomings or come into compliance.

c. **Probationary Status.** Probationary status is granted to a *previously accredited* program that becomes deficient in some area. The program is given up to two years to rectify the deficiency, with the understanding that it will be reevaluated within 18 months' time.

e. **Full Accreditation.** A program that is either *in compliance or* has only a *minor infraction* is granted fully accredited status. Minor infractions have to be rectified within a year's time. And, the program must undergo full reevaluation within 5 years.

## 5-6. THE JOINT REVIEW COMMITTEE ON EDUCATION IN RADIOLOGICAL TECHNOLOGY

The JRCERT, provides consultation and guidance to programs on matters of compliance with minimum standards of essentials. The JRCERT receives applications for development of programs by sponsoring educational institutions. It coordinates site visits and makes recommendations on accreditation status to CAHEA.

## 5-7. THE AMERICAN SOCIETY OF RADIOLOGICAL TECHNOLOGISTS

a. **History.** The American Society of Radiological Technologists (ASRT) was founded in 1920 by a group of technologists who saw a need to meet in a formalized way to share their knowledge. The express purpose of the ASRT is to advance the science of radiological technology, establish and maintain high standards of education and training, and elevate the quality of patient care.

b. **Functions.** The ASRT formulates essentials and guidelines for accredited educational programs. It does so for various modalities within the field of radiological technology: radiography, radiation therapy, nuclear medicine, and diagnostic sonography. The ASRT also develops curriculum guides for various programs, to include: radiological technology, radiation therapy, and vascular imaging technology. It also promotes the welfare and socioeconomic status of radiological technologists and publishes a professional journal entitled: "Radiology Technology," six times a year. Additionally, the ASRT appoints three members to the JRCERT board.

## 5-8. The American College of Radiology

The American College of Radiology (ACR) is a professional membership organization that represents the interests of physician specialists, such as radiologists in the various disciplines of radiology. Its functions include: providing educational programs for its members and participating in educational activities for radiological technologists.

## 5-9. THE AMERICAN REGISTRY OF RADIOLOGY TECHNOLOGISTS

The American Registry of Radiology Technologists (ARRT) was founded in 1920. This organization developed, initially, out of a movement toward certifying X-ray equipment operators. Its purpose has changed to encourage study by radiological technologists and to elevate the standards of the profession. The American Registry of Radiology Technologists promotes these goals by administering a comprehensive written exam to graduates of educational programs in the various disciplines of radiography, radiation therapy, and nuclear medicine in order to certify successful candidates in these areas.

## 5-10. THE AMERICAN REGISTRY OF CLINICAL RADIOGRAPHY TECHNOLOGISTS

Founded in 1955 by a small group of working technologists, the organization's policies are dete held by working radiological technologists. The ARCRT promotes high standards of training, public health and safety, and continuing education. It conducts educational seminars and recommends methods of continued competency to membership. Its primary function is to provide initial certification by evaluating, examining, and certifying the competency of the technologist applying for registration.

## 5-11. STATE CREDENTIALING

a. **State Credentialing.** State credentialing (licensing) reflects laws that may require technologists to be licensed by the state. In 2003, about 38 States licensed radiologic technologists and technicians. Voluntary registration is offered by the American Registry of Radiologic Technologists. To be eligible for registration,

technologists generally must have graduated from an accredited program and pass an examination. Many employers prefer to hire registered radiographers. To be recertified, radiographers must complete 24 hours of continuing education every other year. Other states have legislative proposals for similar legislation pending. The law may require evidence of ARRT certification or a state-licensing exam. In some states, *limited* or *restricted licenses* may be granted, allowing the licensee to radiograph only *certain* body parts, that is the chest, extremities, or skull.

b. **Additional Testing Not Always Required.** If you are registered, the requirement for additional testing may be waived (depending on the state). No military requirements for licensure or certification currently exist. But, some states require licensure of *all* of its technologists. Licensure is necessary for work in the private sector in those states with licensure laws.

## 5-12. The Consumer-Patient Radiation Health and Safety Act of 1981

The Consumer-Patient Radiation Health and Safety Act of 1981 established that radiographer programs should be accredited. It concludes that trainees of accredited institutions are competently trained and pose no risk to the public, if properly credentialed. It urges voluntary compliance by states in a process monitored by the Secretary of Health and Human Services. It requires compliance by all federal agencies. Hospitals, therefore, seek accreditation under the Joint Commission on Accreditation for Health Care Organizations and technologists are trained in accredited programs.

**Continue with Exercises**

**EXERCISES, LESSON 5**

**INSTRUCTIONS.** The following exercises are to be answered by marking the lettered response that best answers the question or best completes the incomplete statement.

After you have completed all the exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers.

**SPECIAL INSTRUCTIONS FOR EXERCISES 1 THROUGH 6.** Mat*ch the agency in the left-hand column with its function in the right-hand column. Enter the appropriate letter in the space provided.*

| | |
|---|---|
| 1. CAHEA _____ | a. Provides consultation and guidance to programs regarding compliance with minimum standards and essentials. |
| 2. JRCERT _____ | b. Responsible to the United States Office of Education for accrediting allied health education programs. |
| 3. ASRT _____ | c. Professional membership organization; provides educational programs. |
| 4. ACR _____ | d. Formulates guidelines for educational programs; promotes welfare and socioeconomic status of RTs; publishes "Radiology Technology" magazine. |
| 5. ARRT _____ | e. Led by working radiological technologists primarily to provide initial certification, by evaluating the radiological technologist who is applying for registry. |
| 6. ARCRT _____ | f. Administers a comprehensive written exam to graduates; encourages study and the elevation of the standards of the profession. |

7. The term *certification* pertains to the process of:

   a. Obtaining authoritative endorsement as to the qualifications of an individual to perform competently in a specific occupation.

   b. Establishing the merits of a program offered by an educational institution.

   c. The issuing of a permit by a governmental agency attesting to the individual's competence to practice in a particular career field.

   d. Submitting ongoing self-evaluations regarding the adequacy of a program of education.

8. The process by which an outside agency confirms that an institution or program conforms to certain pre-established standards and criteria is referred to as the _____ process.

   a. Certification.

   b. Licensure.

   c. Accreditation.

   d. Probation

9. The issuing of a permit attesting to an individual's competence to practice in a particular field or profession is known as:

   a. Certification.

   b. Licensure.

   c. Accreditation.

   d. Examination.

10. _____ is done by a governmental agency, such as the State Department of Health or the Medical Board.

    a. Certification.

    b. Accreditation.

    c. Licensure.

    d. Referral.

11. The Committee on Allied Health Education and Accreditation of the American Medical Association on the recommendations of the _____ in determining the accreditation status of an educational program, because it lacks the in-house expertise to evaluate *all* educational programs.

    a. American Society of Radiological Technologists (ASRT).

    b. American Registry of Radiology Technologists.

    c. State credentialing agencies.

    d. Joint Review Committee on Education in Radiological Technology (JRCERT).

12. Under, _____previously accredited educational programs that have become deficient are granted up to 2 years to rectify the deficiency and are reevaluated within 18 month's time.

    a. Full accreditation.

    b. Probationary accreditation.

    c. Non-accredited status.

    d. Provisional accreditation.

13. New programs are granted _____ just after they have made application for accreditation.

    a. Provisional accreditation.

    b. Non-accredited status.

    c. Probationary status.

    d. Full accreditation.

14. If an educational program granted full accreditation, has _____ year(s) with in which it must correct minor infractions, if any exist.

    a. Five.

    b. Three.

    c. Two.

    d. One.

15. The legislative mandate to ensure a certain level of competency among radiological technologists resulted in:

    a. The Consumer-Patient Radiation Health and Safety Act of 1981.

    b. State licensing.

    c. Accreditation.

    d. Educational programs.

16. The Consumer Patient Radiation Health and Safety Act of 1981 established:

    a. State licensure.

    b. Federal standards for accreditation and credentialing.

    c. Local educational programs.

    d. Local professional organizations.

**Check Your Answers on Next Page**

**SOLUTION TO EXERCISES, LESSON 5**

1. b (para 5-5,a)
2. a (para 5-6)
3. d (para 5-7,b)
4. c (para 5-8)
5. f (para 5-9)
6. e (para 5-10)
7. a (para 5-2,a)
8. c (para 5-3)
9. b (para 5-4)
10. c (para 5-4)
11. d (para 5-6)
12. b (para 5-5,d)
13. a (para 5-5,b)
14. d (para 5-5,e)
15. b (para 5-11)
16. b (para 5-3)

**End of Lesson 5**

## LESSON ASSIGNMENT

| | |
|---|---|
| **LESSON 6** | Professional Development. |
| **LESSON ASSIGNMENT** | Paragraphs 6-1 through 6-9 |
| **LESSON OBJECTIVES** | After completing this lesson, you should be able to: |

6-1. Identify long and short-term civilian training in the field of radiographic imaging.

6-2. Identify the career progression ladder in a military environment.

6-3. Identify functions of the organizations involved with accreditation.

6-4. Identify the function of various professional organizations, such as:

The American Society of adiological Technologists.

The American Registry of Radiological Technologists.

The American College of Radiology.

**SUGGESTION** After completing the assignment, complete the exercises of this lesson. These exercises will help you to achieve the lesson objectives.

# LESSON 6

## Section I. PROFESSIONAL DEVELOPMENT IN MILITARY AND CIVILIAN ENVIRONMENTS

### 6-1. INTRODUCTION

**a. Continued Training Crucial.** The field of radiological technology is an ever-changing and expanding one. As a radiological technologist, you cannot afford to stand still while the profession moves forward. It is, essentially, your responsibility to pursue the necessary course of education to keep abreast of developments in your field. A real professional that is serious about moving up the career ladder will continually investigate opportunities for career mobility, both in terms of assignments and educational opportunities**.**

b. **Early Career Planning.** If you are seriously interested in getting ahead in your career, you must examine your priorities, assess your individual capabilities and interests, and check out all opportunities. This is not something that you can do later on in your career. You must have a long-term plan *from the beginning*, so that you will get where you want to go career-wise, rather than be the pawn of chance and circumstance. In this lesson, long-term and short-term training programs available to you, both in the civilian and military sectors are explored.

### 6-2. SHORT-TERM CIVILIAN TRAINING ENTRY LEVEL AND BEYOND

a. **Entry Level Training.** The majority of entry-level civilian radiologicl technology training programs are approximately two years in length. At the conclusion of this entry-level training, a candidate is awarded an Associate of Arts degree and makes application to one of the certifying agencies to become a registered technologist.

b. **Specialization.** It might take an additional two years of formal education to specialize in certain modalities, with course work required in one of the following areas: computer tomography, nuclear medicine, special procedures, ultrasonography, or radiation therapy.

### 6-3. LONG-TERM TRAINING (CIVILIAN ENVIRONMENT)

a. **Two-and-a-Half to Eight Years.** Long-term training can range from two and-a-half to eight or more years of formal training. The candidate enrolled in a 4-year program will be working toward a Bachelor of Sciences (BS) in management, administration, education, or computer science. Other training will follow as described below.

b. **Health Care Administration.** Those interested in the administrative aspects of radiology, that is, management, would pursue a BS in Health Care Administration. A candidate for this degree would take many hours of theory in purchasing, personnel management, budget preparation, regulatory specifications, decision making and planning, financial accounting, legal aspects of health care, and data processing.

c. **Education.** A candidate for a degree in education would need to have not only the necessary credentials in radiologic technology, but also many hours in education and learning theory. This degree would be appropriate to someone desiring to become a radiographer-educator.

d. **Computer Science.** A candidate for a degree in Health Care Administration, with an emphasis in computer science would take courses on the use of computers in the manipulation of electronic images. (Such manipulation is needed in the more sophisticated modalities.)

## 6-4. CAREER PROGRESSION IN A MILITARY ENVIRONMENT

a. **Basic Training.** In the military skill progression, a soldier enters the Army and proceeds, with all soldiers, through basic training.

b. **Advanced Individual Training**.**91P course (46 weeks).** From basic training, all soldiers proceed to their respective advanced individual training (AIT). This is the 91P course, which currently consists of 24 weeks of Phase I training at Fort Sam Houston, followed by 22 weeks of Phase II training at a medical center or an army community hospital.

c. **Permanent Change of Station to a Unit.** Following AIT is the permanent change of station (PCS) to a permanent duty station.

(1) Primary Leadership Development Course and correspondence courses. You must take primary leadership development course (PLDC) in the next couple of years after your first PCS. At the same time, you should take the initiative to enroll in the Army Correspondence Course Program to reinforce skills learned in AIT and learn new skills.

(2) National registry and correspondence courses. Hopefully, you will take the initiative to apply for the national certification exam. If you pass the exam, you will earn national registry. By taking PLDC, a variety of correspondence courses relevant to your career field, and applying for registry, you will have a good chance of being promoted.

(3) Civilian education. If you hope to be selected for a first reenlistment, you need to make yourself as competitive as possible. In addition to obtaining all of the extra training mentioned above, you should consider taking some college courses in radiological technology, health care administration, computers, or education. Having some civilian education will increase the likelihood of being selected for a second tour of duty.

d. **First Reenlistment.** If you are selected for a first reenlistment, you will need to continue pursuing training opportunities to refine your skills as an X-ray specialist and an NCO.

(1) Basic Non-Commisioned Officer Course. After selection to Staff Sergeant, you will be sent to the Basic NCO Course (BNCOC). The BNCOC consists of NCO leadership training designed to prepare you for administrative and leadership roles. It includes a week of radiological technology subjects designed to prepare you for the unique challenges of administrative and leadership roles in the radiology department.

(2) More civilian education. Depending on where you are assigned, you will want to take advantage of opportunities to take courses at night or on weekends at the local college or university. Since radiology is a constantly changing field, you can never consider your education complete.

(3) Radiology management course. The chief radiologist is the one who recommends X-ray Specialists to attend the Radiology Management Course, which is offered at the Academy of Health Sciences, Fort Sam Houston. It is a week and three days long course with a capacity is 32 students. The course addresses current management and clinical educational issues for the 91P career field.

e. **Promotion to E-6.** If you have done all you can to hone your skills, as described above, there is a good chance that you will be promoted to the rank of E-6.

(1) Associate of Arts degree. Having completed AIT and all the other training described above, you will have attained a level of training equivalent to the Associate of Arts (AA) degree offered at community colleges after two years of college work.

(2) Other military-oriented courses. You should try to take courses that develop other military skills, such as the airborne course. Successful completion will earn you a badge attesting to the fact that you have successfully jumped out of an airplane. Another important step for this point in your military career is to challenge yourself even more by volunteering for the expert field medical badge test, a 4-day testing cycle that measures your level of achievement in emergency medical care and various soldiering skills. Successful completion of other military courses and tests, such as these, are looked upon very favorably by promotion boards, thus, enhancing your chances for promotion.

f. **Subsequent Reenlistments.** During subsequent reenlistments, you must complete the Advanced NCO course (ANCOC). With successful completion of ANCOC and good on the job performance, you should be able to advance to the rank of Sergeant First Class and Master Sergeant.

## Section II. PROFESSIONAL ORGANIZATIONS

### 6-5. PROFESSIONALS WORKING AND GROWING TOGETHER

a. **Staying Abreast, A Tenet of the Code of Ethics.** In the area of professional growth, radiographers working and learning together can accomplish a great deal more than they can individually. To this end, many professional organizations have evolved. It is not only in your interests to become aware of the activities of the various professional organization, it is, in fact, your *obligation*. One of the tenets of the *Code of Ethics for Radiologic Technologists* is the mandate to stay abreast of a rapidly changing field. One way to do this is to get involved in a professional organization.

b. **The Organizations that Represent You.** You must become familiar with the organizations that represent *you* and contribute to the advancement of *your* profession. By getting involved in the activities of your professional organizations and reading their journals, you will become aware of the issues of the day, of changes in the field, and of new requirements. While this section does not provide an *all-inclusive* overview of the professional organizations that exist, it will put you in the right direction. Remember, that it is, ultimately, *your* responsibility to get involved with your professional organizations.

### 6-6. THE AMERICAN SOCIETY OF RADIOLOGIC TECHNOLOGISTS

a. **History.** Founded in 1920, out of a commonly-held feeling among technologists of the day that they needed to meet and share their knowledge, the ranks of the American Society Of Radiologic Technologists (ASRT) have grown enormously.

b. **Purpose.** The purpose of the ASRT is to advance the science of radiological technology, to maintain high standards of education and training, and to elevate the quality of patient care.

c.. **Functions.**

(1) Essentials and guidelines for accreditation. The ASRT formulates essentials and guidelines of accredited educational programs for various modalities within the field of radiological technology: radiography, radiation therapy, nuclear medicine, and diagnostic sonography.

(2) Curriculum guides. The ASRT also develops curriculum guides for such fields as radiologic technology, radiation therapy, and vascular imaging technology.

(3) Professional advancement. The ASRT promotes the welfare and socio-economic status of radiological technologists. It promotes the elevation of radiologic technology to the status of a bona-fide health care profession on a par with any related field, such as nursing.

(4) Publications. The ASRT publishes a technical scientific journal, entitled "Radiology Technology," which six copies are delivered per year.

## 6-7. THE AMERICAN REGISTRY OF RADIOLOGICAL TECHNOLOGISTS

a. **History.** The American Registry of Radiological Technologists (ARRT) was born out of the joint efforts of two other professional organizations, the Radiological Society of North America and the American Roentgen Society. In 1920 these organizations developed a plan to certify x-ray equipment operators. And, in 1923, the American Registry of Radiological Technologists was established to see that plan through.

b. **Purpose.** The ARRT encourages continuing education among radiologic technologists and seeks to elevate the standards of the profession.

c. **Function.** The ARRT administers comprehensive writen examinations to graduates of educational programs in the fields of radiography, radiation therapy, and nuclear medicine.

## 6-8. THE AMERICAN REGISTRY OF CLINICAL RADIOGRAPHY TECHNOLOGISTS

a. **History.** The American Registry of Clinical Radiography Technologists (ARCRT) was formed in 1955 by a small group of working technologists. Although, this is another certifying organization, its membership is currently at about 2,000, as of this writing, as compared to the 200,000 members of the ARRT. Your choice of certifying organizations will depend upon the state in which you choose to reside and for which local hospital you find employment. Before selecting a certifying organization, check with the hospital where you are employed.

b. **Policies.** The ARCRT policies are determined by *working* technologists. In fact, one of the positive features of this organization is that all of the leadership positions are held by working technologists with a handle on the real world. The organization is composed of, governed by, and for technologists.

c. **Purpose.** The ARCRT promotes high standards of training, public health and safety, and approved continuing education. It conducts educational seminars, and recommends methods of achieving continued competency to membership. The ARCRT discontinued operation in the mid 1980's; however, the members were grandfathered into the ARRT.

## 6-9. THE AMERICAN COLLEGE OF RADIOLOGY

a. **Purpose.** The American College Of Radiology (ACR) is a professional membership organization whose purpose is to represent the interests of physician specialists (radiologists) in the various disciplines of radiology.

b. **Function.** The ACR provides numerous educational programs to its members and participates in many educationally-related activities for radiologic technologists.

**Continue with Exercises**

**EXERCISES, LESSON 6**

**REQUIREMENT.** The following exercises are to be answered by marking the lettered response that best answers the question or best completes the incomplete statemen.

After you have completed all the exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers.

1. Entry-level training in the private (civilian) sector consists of:

   a. A one-year program in radiological technology.

   b. A two-year Associate of Arts program in radiological technology.

   c. Three years of on-the-job training.

   d. A one-year program or completion of a correspondence course.

2. In the private sector it might take an additional _____years to specialize in such areas such as: computed tomography, nuclear medicine, ultrasonography, or radiation therapy.

   a. 1.

   b. 2.

   c. 3.

   d. 4.

3. In the private sector, the earliest point at which a radiological technologist may apply for registry is after completing:

   a. Long-term training.

   b. A Bachelor of Sciences in health care administration.

   c. Specialization training.

   d. The required entry-level training.

4. A civilian radiological technologist who wishes to remain current and enhance his or her chances for promotion should embark on a course of long-term training that may take anywhere from:

   a. 1 to 3 years.

   b. 1.5 to 4 years.

   c. 2.5 to 8 years.

   d. 5 to 10 years.

5. Long-term training for a civilian radiographer generally consists of completion of a _____ followed by additional training in management, education, and computer science.

   a. Bachelor of Sciences in management, education, computer science, or health care administration.

   b. Associate of Arts in radiological technology.

   c. Doctor of Philosophy in radiological imaging.

   d. Bachelor of Arts degree in any liberal arts specialty.

6. The subjects that a civilian radiographer would study while pursuing long-term training would *NOT* include:

   a. Personnel management, decision-making, and planning.

   b. Purchasing, budget preparation, and financial accounting.

   c. X-ray equipment maintenance and repair.

   d. Data processing and legal considerations.

7. There is a high demand for training in _____ for 91Ps because of the increasing use of _____ in this field.

   a. Education; on-the-job training.

   b. Equipment repair; on-site personnel.

   c. Hospice healthcare; life-support systems.

   d. Computer science; computerized imaging.

8. Initial training for the 91P10 consists of the 91P10 course, which is a:

   a. 24-week phase I and a 22-week phase II.

   b. 24-week phase I and a registry exam.

   c. 22-week phase I and a 20-week phase II.

   d. Two-year course of study as in the civilian sector.

9. Following AIT and your first PCS you should take:

   a. PLDC, BNCOC, and correspondence courses.

   b. PLDC, Army correspondences courses, and applies for registry and some civilian education.

   c. PLDC, the airborne course, and the radiology management course.

10. If you make it to the first reenlistment, what further training is it desirable to pursue?

    a. BNCOC, the emergency field medical badge, and an A.A. in radiological technology.

    b. PLDC, BNCOC, and correspondence courses.

    c. An advanced degree in computer sciences.

    d. BNCOC, college courses in radiological technology, and the radiology management course.

11. The equivalent of an AA degree in radiological technology is attained by completing:

    a. AIT, PLDC, correspondence courses, registry, BNCOC, civilian education, the radiology management course, and the rank of sergeant.

    b. AIT, PLDC, correspondence courses, and registry.

    c. Five years of on-the-job experience.

    d. Five years of on-the-job experience plus two years of experience working part-time in the civilian sector.

**SPECIAL INSTRUCTIONS FOR EXERCISES 12 THROUGH 15.** Mat*ch the professional organization listed in the left-hand column with its function in the right-hand column. Enter the appropriate letter in the space provided. (There is an extra lettered choice that will NOT be selected.*

12. American Society of Radiologic Technologists (ASRT). _____

13 American Registry of Radiologic Technologists (ARRT). _____

14. American Registry of Clinical Radiography Technologists (ARCRT). _____

15. American College of Radiology ACR). _____

a. Administers written exams to graduates of educational programs to encourage continuing education and elevate the standards of the profession.

b. Provides educational programs to radiologic technologists; represents the interests of radiologists.

c. Conducts educational seminars and recommends methods of achieving continued competency.

d. Sets essentials and guidelines for accreditation, develops curriculum guides, promotes the socioeconomic status of radiologic technologists, publishes "Radiology Technology" six times per year.

e. Promotes the interests of physicians and publishes the "Journal of the American Medical Association.

16. This professional organization is unique in that it is composed of, is governed by, and was established for radiologic technologists.

    a. ASRT.

    b. ARRT.

    c. ARCRT.

    d. ACR.

17. This professional organization represents the interests of physician specialists, that is, radiologists.

    a. ASRT.

    b. ARRT.

    c. ARCRT.

    d. ACR.

18. The two certifying organizations are the ARRT and the:

    a. ASRT.

    b. AMA.

    c. ARCRT.

    d. ACR.

19. This professional organization was the first to initiate a plan for certifying X-ray equipment operators back in 1923.

    a. ASRT.

    b. ARRT.

    c. ARCRT.

    d. ACR.

20. Select the oldest professional organization for radiologic technologists; it publishes "Radiology Technology," a professional journal, six times a year.

    a. ASRT.

    b. ARRT.

    c. ARCRT.

    d. ACR.

**Check Your Answers on Next Page**

**SOLUTION TO EXERCISES, LESSON 6**

1. b (para 6-2,a)
2 b (para 6-2,b)
3 d (para 6-2,a)
4 a (para 6-3,a)
5 a (para 6-3,a)
6 c (para 6-3)
7 d (para 6-3,d
8 a (para 6-4,b)
9 b (para 6-4,c)
10. d (para 6-4,d)
11. a (para 6-4,e(1))
12 d (para 6-6.a, 6-6.b, 6-6.c)
13 a (para 6-7,a, 6-7,c)
14 c (para 6-8,c)
15 b (para 6-9,a; 6-9,b)
16 c (para 6-8,a)
17 d (para 6-9,a))
18 c (para 6-8,a)
19 b (para 6-7,a)
20 a (para 6-6,a, 6-6,c,(4))

**End of Lesson 6**

# APPENDIX

# GLOSSARY OF TERMS

## A

**accreditation:** confirmation by an outside agency that an institution or program conforms to established standards (para 5-3).

**The American College of Radiology (ACR)**: professional membership organization that represents the interests of physician specialists, and so forth, radiologists; provides educational programs for radiological technologists (para 5-8).

**American Registry of Clinical Radiography Technologists (ARCRT)**: run by working technologists who set policy; promote high standards of training, public health and safety, and continuing education; conduct seminars and recommend methods of continued competency to membership (para 5-10).

**American Registry of Radiology Technologists (ARRT)**: founded, 1920 to certify X-ray equipment operators; encourages study, elevation of standards of the profession; administers exam to graduates of educational programs to certify successful candidates (para 5-9)

**The American Society for Radiologic Technologists (ASRT):** founded by radiologic technologists to promote the welfare and socioeconomic status of technologists, it formulates essentials and guidelines of accredited educational programs, develops curriculum guides, publishes "Radiology Technology" journal and appoints three members to the JRCERT board (para 5-7).

**Army community hospital:** diagnostic, treatment and support services provided at this level of care, for inpatients as well as outpatients (para 3-4).

**audiology:** the study of the hearing impaired (para 2-9).

## B

## C

**cathode ray:** term used by Sir William Crookes to describe electrons, negatively charged particles, emitted from the cathode in an evacuated tube (para 1-8).

**certification:** confirmation by an outside agency that one is qualified to perform within a given occupation; the process of becoming registered (para 5-2).

**Committee on Allied Health Education and Accreditation (CAHEA):** responsible to the US Office of Education for accrediting allied health educational programs; relies on JRCERT recommendations (para 5-5).

**computerized tomography:** diagnosing disease processes through the use of narrow moving beam of x-radiation that scans a thin cross-section of the body (para 2-7).

**Consumer-Patient Radiation Health and Safety Act (1981):** radiographer training programs must be accredited; radiographers must be properly credentialed (certified/registered, and licensed, in states where applicable) (para 5-12).

## D

## E

## F

**full accreditation:** program is *in compliance* or has a *minor infraction* that must be rectified within a year; full reevaluation occurs within 5 years (para 5-5e).

## G

## H

## I

## J

**Joint Review Committee on Education in Radiologic Technology (JRCERT):** provides consultation and guidance to programs on compliance with minimum standards of essentials; accepts applications for development of programs by sponsoring educational institutions; coordinates site visits and makes recommendations on accreditation status to CAHEA (para 5-6).

## K

# L

**limited (restricted) licenses:** allows licensee to radiograph only certain body parts, for example, the chest, extremities, or skull (para 5-11).

**licensure**: the issuing of a permit by a governmental agency attesting to the fact that the individual is competent to practice in a particular field or profession (para 5-4).

# M

**manipulator:** enlisted soldiers trained to assist military surgeons in taking radiographs (para 1-14c).

**medical department activity (MEDDAC):** provides centralized, specialized treatment facilities, inpatient and outpatient care, diagnostic, consultation and medical laboratory support. (para 3-5).

**Medical center (MEDCEN):** the largest type of military treatment facility (para 3-6).

**modalities:** any one of a variety of methodologies used to demonstrate anatomical structures (para 1-15).

# N

**nonaccredited status**: the program suffers from *major deficiencies* that probably cannot be rectified (para 5-5c).

**Nuclear medicine:** treatment modality in which low-level radio pharmaceuticals are introduced into the patient's body by intravenous, intramuscular, subcutaneous, or oral methods (para 2-5).

# O

# P

**probationary status:** a *previously accredited* program that becomes deficient; has up to two years to rectify the deficiency; is reevaluated within 18 months (para 5-5d).

**provisional accreditation**: for *new programs* just after application; indicates probable *future* program compliance when fully operational (para 5-5b).

# Q

# R

**radiation therapy:** treatment modality in which diseased areas are exposed to various types of radiation (para 2-4).

**radiography**: one of the primary methods of diagnosing disease or abnormality (para 2-3).

**resinous object**: charged particle that repels so-called vitreous objects; term coined by Charles Du Fay in 1733 (para 1-4).

**restricted license:** (See *limited license*.)

**roentgenologists:** surgeons who served as the first radiologists in the early days of radiography (para 1-14c).

# S

**state credentialing (licensing):** applicable in over twenty-five states; requires RT to present evidence of certification or take state licensing exam (para 5-11).

**sonography:** also known as *ultrasound*; involves the use of high frequency sound waves to form an image of an organ, a fetus, or a tumor (para 2-6).

# T

**troop medical clinic:** where routine sick call for active duty personnel begins; records for active duty personnel maintained here (para 3-2).

# U

# V

**vitreous objects:** charged particle named by Charles Du Fay; repels so-called resinous objects (para 1-5).

# W

# X

**Y**

**Z**

**End of Appendix**