Mammography Curriculum

Sponsored by the American Society of Radiologic Technologists, 15000 Central Ave. SE, Albuquerque, NM 87123-3917.

Foundations

Computers in Radiologic Sciences
Content is designed to introduce knowledge in computing and information processing. Computer applications in the radiologic sciences related to image capture, display, storage and distribution are presented.

Human Structure and Function
Content is designed to establish a knowledge base in anatomy and physiology. Components of the cells, tissues, organs and systems will be described and discussed.

Patient Care in Radiologic Science
Content is designed to provide the basic concepts of patient care, including consideration for the physical and psychological needs of the patient and family. Routine and emergency patient care procedures will be described, as well as infection control procedures utilizing standard precautions. The role of the radiographer in patient education will be identified.

Patient Assessment, Management and Education
Content introduces a model for clinical thinking to aid in patient assessment. Content includes a focus on the application of normal anatomy and physiological phenomena to ill and injured individuals. Interviewing skills and assessment techniques with clinical focus will be discussed. An emphasis on the analysis and interpretation of physiological data to assist in patient assessment and management will be introduced.

Patient Information Management
Content is designed to provide the basic concepts of patient information management. Medical records management including privacy and regulatory issues will be examined. The role of the technologist in managing patient information will be identified and discussed.

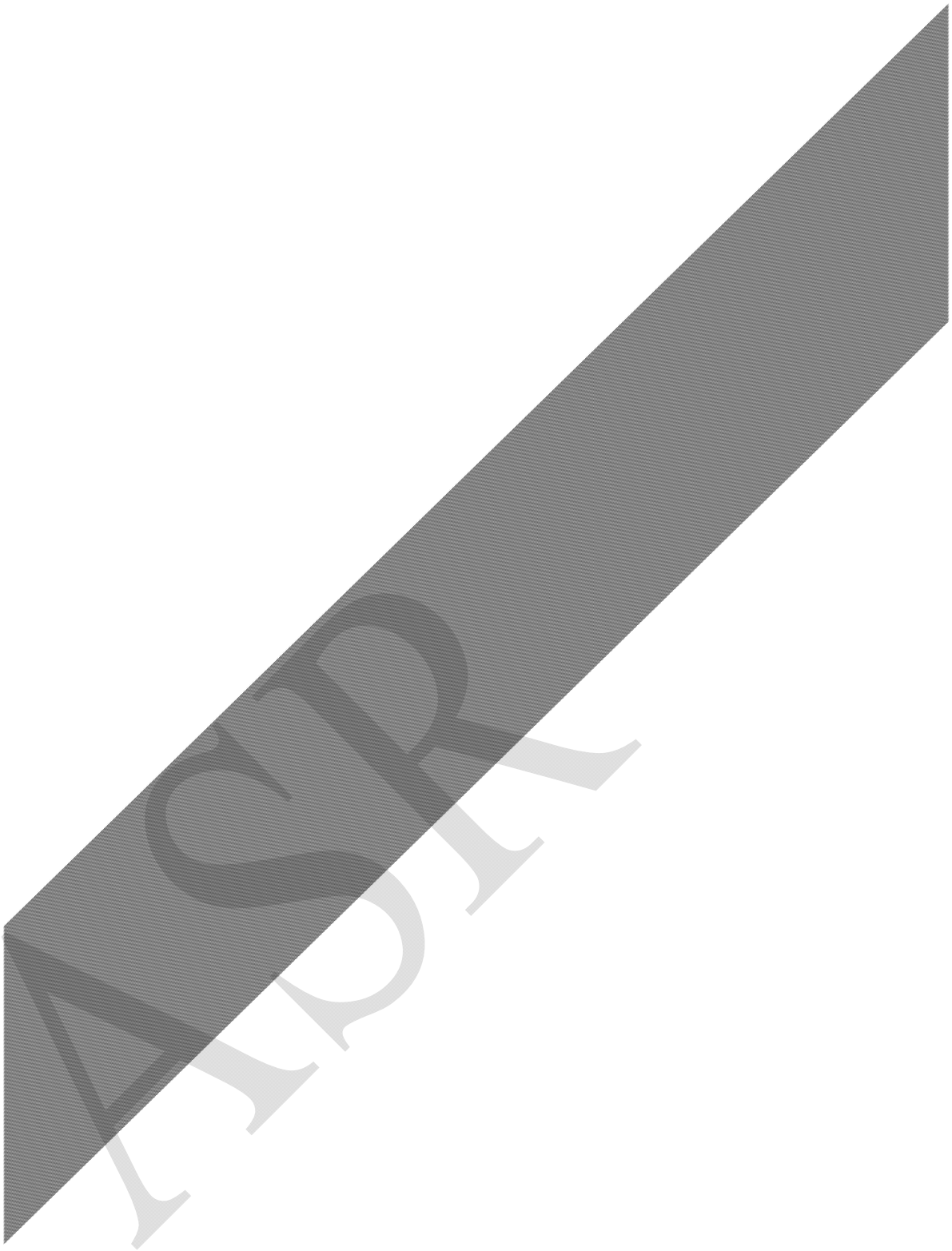
Pharmacology
Content is designed to broaden the technologist's knowledge of pharmacology. Topics include consumer safety and drug regulation, sources and bodily effects of drugs and safe dose preparation. Types of drug preparations, principles of responsible drug administration including routes and techniques are included. An introduction to clinical drug trials and a classification of drugs related to body systems are included as topics for presentation.

Quality Management
Content is designed to impart an understanding of the tasks and protocols making up the quality management activities of a typical radiology department. The roles and responsibilities of all parties contributing to the quality management effort will be presented. Tools, procedures and evaluation criteria used in the performance assessment of imaging modalities and image processing will be discussed. The role of the B.S.R.S. technologist will be identified and discussed. Special attention is given to American College of Radiology (ACR) and Mammography Quality Standards Act (MQSA) guidelines for mammography.

b. Granular (clustered)
c. Irregular
d. Casting

C. Nodules
1. Characteristics
a. Shape
b. Fluid or cystic
c. Solid or indistinct

D. Other indicators of pathology
1. Asymmetry
2. Contour changes
3. Prominent ductal pattern
4. Prominent venous or arterial pattern
5. Skin changes
6. Other


ASR

Ductal ectasia 1. Etiology 2. Mammographic appearance 3. Diagnosis 4. Treatment H. Breast infection

XII. Benign Breast Pathology A. Cyst 1. Etiology 2. Mammo

3. Diagnosis
4. Treatment

I. Abscess
   1. Etiology
   2. Mammographic appearance
   3. Diagnosis
   4. Treatment

J. Hematoma
   1. Etiology
   2. Mammographic appearance
   3. Diagnosis
   4. Treatment

K. Fat necrosis
   1. Etiology
   2. Mammographic appearance
   3. Diagnosis
   4. Treatment

L. Inflammation vs. inflammatory cancer
   1. Etiology
   2. Mammographic appearance
   3. Diagnosis
   4. Treatment

M. Radial scarring
   1. Etiology
   2. Mammographic appearance
   3. Diagnosis
   4. Treatment

3.

7. Establishment of a National Mammography Quality Assurance Advisory Committee
8. Establishment of standards governing record keeping for patient files and requirements concerning mammography reporting and patient notification by physicians

Equipment

Description
Content gives the student a foundation of the concepts of mammography equipment. The types

c. Visual indication of gantry angle

3.

Content

I. Clinical Data of Patient

A. History

1. Gender
2. Age
3. Age at onset of menses
4. Parity
   a. Nulliparity
   b. Multiparity
   c. Age at primiparity
5. Menstrual status
   a. Last menstrual cycle
   b. Age at menopause
   c. Hysterectomy
   d. Oophorectomy
6. Medications
   a. Estrogen
   b. Progesterone
   c. Prolactin
   d. Steroids – males
   e. Estrogen inhibitors
7. Previous breast biopsies
   a. Surgical biopsy and pathologic results
   b. Core biopsy and pathologic results
   c. Cyst aspirations
8. Previous breast surgery
   a. Augmentation
   b. Reduction
   c. Other
9. Family history of breast cancer
10. Other
    a. Previous chest surgery (open heart, etc.)
    b. Port-a-caths
    c. Moles
    d. Accessory nipple
    e. Unusual landmarks

II. Screening Mammography

A. Craniocaudal (CC) projection

1. Purpose
2. Anatomical structures dmoual ateTf1xTJ-1.65 -1.15 TD0 Tc0 Tw(b.)T3/TT10 1 Tf.75 0 TD( )Tj/T
   Progent

2. Anatomical structures demonstrated
3. Part position (x-ray tube assembly and image receptor)
4. Patient position
5. Other

E. Axillary tail (AT) projection
1. Purpose
2. Anatomical structures demonstrated
3. Part position (x-ray tube assembly and image receptor)
4. Patient position
5. Other

F. Rolled (RL and RM) projections
1. Purpose
2. Anatomical structures demonstrated
3. Part position (x-ray tube assembly and image receptor)
4. Patient position
5. Other

G. Superolateral to inferomedial oblique (SIO) projection
1. Purpose
2. Anatomical structures demonstrated
3. Part position (x-ray tube assembly and image receptor)
4. Patient position
5. Other

H. Caudocranial (FB) projection
1. Purpose
2. Anatomical structures demonstrated
3. Part position (x-ray tube assembly and image receptor)
4. Patient position
5. Other

I. Implant displaced (ID) projection
1. Purpose
2. Anatomical structures demonstrated
3. Part position (x-ray tube assembly and image receptor)
4. Patient position
5. Other

J. Magnification (M) projection
1. Purpose
2. Anatomical structures demonstrated
3. Part position (x-ray tube assembly and image receptor)
4. Patient position
5. Other

Technical Applications

Description
Content establishes a knowledge base in factors that govern and influence the production and recording of mammographic images.

Objectives
1. Perceive the purpose for automatic exposure control (AEC) and relate it with an automatic kVp system.
2. Describe how kVp, mA, time and compression affect the mammographic image.
3. Identify the maximum permissible dose per mammography exam, according to MQSA standards.
4. Identify the average dose per mammographic exposure.
5. Describe how kVp, mA, time and compression affect the radiation dose to the patient.
6. Select the correct technical variable based on variations in breast anatomy.
7. Identify imaging artifacts on the mammography film.
8. Understand different film-screen combinations, their functions within the imaging system and their effect on the mammographic image.
9. Describe different types of processing and their importance in the mammographic imaging chain.
10. Identify processing artifacts on the mammography film.

I. Collimation
   1. Purpose and importance
   2. Film size
   3. MQSA requirements

II. Screen and Film Variables

A. Screens
   1. Intensifying differences
      a. Slow
      b. Medium
      c. Fast
      d. Rare earth
   2. Single screens
      a. Advantages
      b. Disadvantages
   3. Double screens
      a. Advantages
      b. Disadvantages
   4. Cassettes
   5. Care and maintenance of screens
   6.

MQeifa.b15]TJ/TT2 1 Tf-.015 -1.14 TD-.0022 Tc01 Tc0 Tw1J-1.44194(b.)272.5715]TJ/TT2 1 Tf-.015

3.

5. Guideshoes
6. Airflow

D. Artifacts

Human Structure and Function

Description
Content is designed to establish a knowledge base in anatomy and physiology. Components of the cells, tissues, organs and systems will be described and discussed.

Objectives
1. Identify the location of structures using directional and orientation terms.
2. Indicate where various planes lie in relation to the body.
3. Identify the structural limits, functions and contents of each of the body cavities.
4. Explain the terms atom, ion, atomic number and atomic weight.
5. Describe the nature of chemical bonds and compare the different types of chemical bonds.
6. Apply the pH scale to differentiate between acid and base substances.
7. Differentiate between polar and nonpolar compounds, and relate these to water solubility.
8. List different types of carbohydrates and give examples of each type.
9. Differentiate between the different types of lipids and determine common characteristics.
10. Describe the structure and functions of proteins.
11. Describe the structure of deoxyribonucleic acid (DNA) and the law of complementary base pairing.
12. Describe the structure of ribonucleic acid (RNA) and name the different types of RNA.
13. Characterize the structure of the cell membrane and the cytoskeleton.
14. Compare endocytosis and exocytosis.
15. Identify the structure and function of cilia and flagella.
16. Diagram the replication of DNA.
17. Diagram the phases of the cell cycle.
18. Describe genetic transcription and the post-transcriptional modifications that change pre-mRNA into mRNA.
19. List the functions of mRNA, tRNA and rRNA.
20. List the functions of the rough endoplasmic reticulum and Golgi apparatus in post-transitional modifications of secretory proteins.
21. Outline the sequence of events that occur in the synthesis packaging and exocytosis of secretory proteins.
22. Differentiate between the stages of meiosis and mitosis and identify the stages of each reproductive process.
23. Define the following: anabolism, catabolism and metabolism.
24. Characterize the role of enzymes in metabolism.
25. Describe carbohydrate metabolism.
26. Describe lipid metabolism.
27. Describe the Krebs cycle in general terms and its functional significance.
28. Express the significance of ketone.
29. List the factors that affect the basal metabolic rate.
30. Diagram the germinal layers of the embryo.
31. Classify tissue types, describe the functional characteristics of each and give examples of their location within the human body.
32. Identify and locate the bones of the human skeleton.

Quality Management

Description
Content is designed to impart an understanding of the tasks and protocols making up the quality management activities of a typical radiology department. The roles and responsibilities of all parties contributing to the quality management effort will be presented. Tools, procedures and evaluation criteria used in the performance assessment of imaging modalities and image processing will be discussed.

Objectives
1. Discuss practical considerations in setting standards for acceptable image quality.
2. Employ a quality control program for intensifying screens.
3. Describe the effects of storage on image quality.
4. Analyze the effects of processing on image quality.
5. Identify the purpose of a daily quality control program for processors.
6. Differentiate between quality improvement/management, quality assurance and quality control.
7. List the benefits of a quality management program to the patient and to the department.
8. List elements of a quality management program and discuss how each is related to the quality management program.
9. Identify common equipment malfunctions that affect image quality.
10. Apply the principles of total quality management.
11. Ensure that performance reflects professional competence in the selection of technical factors to produce quality diagnostic images with lowest radiation exposure possible.
12. Critique images for appropriate clinical information, image quality and patient documentation.

Radiation Protection

Description
Content is designed to present an overview of the principles of radiation protection including the responsibilities of the radiographer for patients, personnel and the public. Radiation health and safety requirements of federal and state regulatory agencies, accreditation agencies and health care organizations are incorporated.

Objectives
1. Identify and justify the need to minimize unproductive radiation exposure of humans.
2. Distinguish between somatic and genetic radiation effects.
3. Differentiate between the stochastic and nonstochastic (deterministic) effects of radiation exposure.
4. Explain the objectives of a radiation protection program.
5. Define radiation and radioactivity units of measurement.
6. Identify dose equivalent limits (DEL) for occupational and nonoccupational radiation exposure.
7. Describe the as low as reasonably achievable (ALARA) concept.
8. Identify the basis for occupational exposure limits.
9. Distinguish between perceived risk and comparable risk.
10. Describe the concept of negligible individual risk level (NIRL).
11. Identify ionizing radiation sources from natural and man-made sources.
12. Comply with legal and ethical radiation protection responsibilities of radiation workers.
13. Calculate dose equivalent limits (DEL) with reference to the latest National Council on Radiation Protection and Measurements (NCRP) reports.
14. Describe the theory and operation of radiation detection devices.
15. Identify appropriate applications and limitations for each radiation detection device.
16. Describe how isoexposure curves are used for radiation protection.
17. Identify performance standards for beam-directing, -defining and -limiting devices.
18. Describe procedures used to verify performance standards for equipment and indicate potential consequences of performance standards failure.
19. Describe the operation of various interlocking systems for equipment and indicate potential consequences of interlock system failure.
20. Identify conditions and locations evaluated in an area survey for radiation protection.
21. Distinguish between controlled and noncontrolled areas and list acceptable exposure levels.
22. Describe “Radiation Area” signs and identify appropriate placement sites.
23. Describe the function of federal, state and local regulations governing radiation protection practices.
24. Describe the requirements for and responsibilities of a radiation safety officer.
25. Express the need and importance of personnel monitoring for radiation workers.
26. Describe personnel monitoring devices, including applications, advantages and limitations for each device.
27. Interpret personnel monitoring reports.
28. Compare values for dose equivalent limits for occupational radiation exposures (annual and lifetime).

29. Identify anatomical structures that are considered critical for potential late effects of whole body irradiation exposure.
30. Identify dose equivalent limits for the embryo and fetus in occupationally exposed women.
31. Distinguish between primary and secondary radiation barriers.
32. Demonstrate how the operation of various x-ray and ancillary equipment influences radiation safety and describe the potential consequences of equipment failure.
33. Perform calculations of exposure with varying time, distance and shielding.
34. Discuss the relationship between HVL and shielding design.
35. Identify emergency procedures to be followed during failures of x-ray equipment.
36. Demonstrate how time, distance and shielding can be manipulated to keep radiation exposures to a minimum.
37. Explain the relationship of beam-limiting devices to patient radiation protection.
38. Discuss added and inherent filtration in terms of the effect on patient dosage.
39. Explain the purpose and importance of patient shielding.
40. Ur8atieu pproh001 Tw5hode of shieldi

Clinical Experience Requirements

The ARRT Clinical Experience Requirements is reprinted by the permission of the ARRT. The ARRT Clinical Experience Requirements and all parts thereof are copyrighted by the ARRT.

C. EXPERIENCE REQUIREMENT FOR QUALITY CONTROL

The applicant must participate[1] in the performance, evaluation and recording of the following QC tests. QC tests are described in the Mammography Quality Control Manual (1999) published by the American College of Radiology.

Darkroom cleanliness (at least 25 times)
Processor QC (at least 25 times)
Screen cleanliness (at least 4 times)
Phantom images (at least 4 times)
Darkroom fog (at least 2 times)
Screen-film contact (on at least 8 cassettes)
Compression (at least 2 times)
Repeat analysis (at least 2 times)
Viewboxes and viewing conditions (at least 4 times)
Analysis of fixer retention in film (at least 2 times)
Visual checklist (at least 2 times)
Review medical physicist's annual survey report (1 time)

D. EXPERIENCE REQUIREMENT FOR INTERVENTIONAL / SPECIAL EXAMINATIONS

The applicant must observe, assist with, or participate[1] in at least four of the following procedures:

Needle localization
Breast MRI
Breast ultrasound: imaging, biopsy, or fine needle aspiration
Stereotactic procedure
Breast implant imaging
Ductography
Diagnostic work-up (for example, magnification, XCCL, LM, implant imaging)

E. EXPERIENCE REQUIREMENT FOR RADIOGRAPHIC CRITIQUE / INTERPRETATION

The applicant must review at least 20 mammographic examinations with a radiologist to evaluate radiographic technique, breast anatomy, and pathology.

[1] "Participate" means being actively involved in the performance of the procedure even though the applicant may not have primary responsibility for performing the procedure.

MAMMOGRAPHY CLINICAL EXPERIENCE DOCUMENTATION FORM

Name: ____________________________________

A. MAMMOGRAPHY TRAINING / EDUCATION REQUIREMENT

The applicant must complete and document 40 hours of training / education specific to mammography under the supervision of a qualified instructor within the 24 months immediately before application for examination. The hours of documented training shall include, but not necessarily be limited to:

1. Training in breast anatomy and physiology, positioning and compression, quality assurance/quality control techniques, imaging of patients with breast implants;
2. The performance of a minimum of 25 examinations under the direct supervision of an ARRT registered technologist or radiologist (12.5 hours maximum);
3. At least 8 hours of training in each mammography modality to be used by the technologist in performing mammography exams.

Number of training hours completed	Dates performed	Initials of qualified instructor, supervisor, or radiologist

25 Examinations under direct supervision

Date Performed	Time of Day	Facility Name	Verified By (Initials)

D. EXPERIENCE REQUIREMENT FOR INTERVENTIONAL / SPECIAL EXAMINATIONS

Applicant must observe or participate in at least four of the following:

INTERVENTIONAL / SPECIAL EXAMINATIONS

	Date	Time of	Verified By

Publishers