

**ARMRIT**<sup>®</sup>

*American Registry of Magnetic Resonance Imaging Technologists*

***Magnetic Resonance Imaging Technologist  
(MRI)***

***Examination  
Candidate Handbook***

***B<sub>0</sub><sub>z</sub>***



***“The Gold Standard of MRI Technologist Certification”  
“Because MRI is a Specialty”***

***[www.armrit.org](http://www.armrit.org)***



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**IMPORTANT: READ ENTIRE HANDBOOK!!!**

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## **About the ARMRIT: 'THE MRI REGISTRY of MRI SPECIALISTS'**

*ARMRIT has always stressed the importance of well-trained and highly qualified Technologists for MRI.*

The ARMRIT is the first and only certifying organization to:

- 1) Recognize MRI Technology as a distinct medical imaging specialty utilizing non-ionizing radiation.
- 2) Require MRI clinical experience and competency for eligibility.
- 3) Promote formal MRI education with MRI clinical training.
- 4) Recognize MRI schools that offer full-time educational program leading to a career in MRI.

The ARMRIT Board of Directors and Examination Committee includes MRI professionals such as, MRI Researchers, Physicists, MRI Technologists, Educators, and Legal Advisors.

- **American College of Radiology (ACR)** - MRI Accreditation Committee has recognized ARMRIT as an autonomous certifying body meeting the ACR accreditation requirements for MRI technologists. The Centers for Medicare and Medicaid Services (CMS) has selected the ACR, as a designated accrediting organization.
- **American Council on Education (ACE)**, Washington, DC. The MRI Technologist examination has been recommended for College-Level Credit.
- **Apprenticeship - USDOL**, ARMRIT allows graduates from U.S. Department of Labor (USDOL) Registered Apprenticeship programs to sit for their certification exam. Approved Registered Apprenticeship Program by the U.S. Department of Labor, Office of Apprenticeship, or a State Apprenticeship Agency recognized by the Office of Apprenticeship. Magnetic Resonance Imaging (MRI) Technologist O\*NET Code: **29-2035.00** Rapids Code: **1115**
- **Centers for Medicare and Medicaid Services (CMS)** has established accreditation requirements for providers of advanced medical imaging mandated by the Medicare Improvements for Patients and Providers Act of 2008 (MIPPA). Providers must comply with CMS' requirement that all providers of CT, MRI, PET and nuclear medicine exams be accredited by Jan. 1, 2012, in order to be reimbursed.
- **Institute for Credentialing Excellence (ICE)**, Washington, DC, ARMRIT is a member organization.
- **Intersocietal Accreditation Commission** includes ARMRIT as a recognized certifying body for MRI Technologists.
- **The Joint Commission** includes ARMRIT as a recognized certifying body for MRI Technologists.
- **Los Angeles County, CA, Department of Health Services** includes ARMRIT certification in the selection requirements for MRI Technologist positions in LA County Hospitals.
- **New Hampshire Board of Medical Imaging and Radiation Therapy** includes ARMRIT certification as a requirement to be eligible for a license to practice MRI Technology.
- **New Mexico Medical Imaging & Radiation Therapy Act Committee** includes ARMRIT certification as a requirement to be eligible for a license to practice MRI Technology.
- **North Dakota Medical Imaging & Radiation Therapy Board** includes ARMRIT certification as a requirement to be eligible for a License to practice MRI Technology.
- **Ohio Department of Health** includes ARMRIT as a recognized certifying body for MRI Technologists.
- **O\*NET OnLine** a proud partner of the **americanjobcenter®network** includes ARMRIT Certification. Magnetic Resonance Imaging (MRI) Technologist O\*NET Code: **29-2035.00** Rapids Code: **1115**
- **Oregon Board of Medical Imaging Technology** includes ARMRIT certification as a requirement to be eligible for a Medical Imaging Technologist License to practice MRI Technology.
- **RadSite** includes ARMRIT as a recognized Certifying Organization for MRI Technologists.
- **Veterans Administration** ARMRIT is recognized and approved by the Medical Imaging Department which established the policy of reimbursing the associated application and examination fees of its members.
- **West Virginia Medical Imaging and Radiation Therapy Technology Board of Examiners** includes ARMRIT certification as a requirement to be eligible for a license to practice MRI Technology.

# **The History and Current Practice of Magnetic Resonance Imaging (MRI)**

## **A White Paper presented by the American Registry of Magnetic Resonance Imaging Technologists**

Revised March 2018

*The* American Registry of Magnetic Resonance Imaging Technologists - ARMTRIT, a New York State Not-for-Profit corporation, tax exempt under Internal Revenue Code Section 501(c)(6), is a certifying organization which was founded in 1991 to provide certification to the thousands of MRI Technologists who had been trained on the job since MRI became available in 1983. As an International Certifying Body, ARMTRIT certifies MRI technologists who have met its established criteria, and who work in MRI facilities at Hospitals and private non-hospital facilities. To date it has certified technologists in 46 states, Puerto Rico, Guam, Canada, Britain, and in Asia and the Middle East. ARMTRIT has adopted the slogan - "Because MRI is a Specialty".

**Radiologic** Science, in a strictly technical definition, has to do with the administration of ionizing radiation (X-Ray). MRI Technology has nothing to do with Radiologic Science. MRI Technology employs radio frequency transmission in a main magnetic field. The education and training of an MRI Technologist is distinct from any other medical imaging modality. The patient safety issues, especially, are specific to MRI which involves very strong magnetic fields that can affect medically implanted devices. This high magnetic field can cause ferromagnetic objects to become projectiles. Numerous MRI manufacturers, such as, Fonar Corporation, General Electric Healthcare, Bruker Biospin, Hitachi Medical Systems of America, Philips, Siemens, Varian and Toshiba Medical Systems, etc., produce different types of MRI units with differing designs, magnetic field strengths and imaging capabilities. These MRI scanners allow the patients to be imaged in various positions, for example, lying down on a table supine, sitting-up in a chair or standing, depending on the anatomical area of the body being imaged. The MRI Technologist must have a deep understanding of MR physics which involves electromagnetic fields and deciphering information from the hydrogen atoms in human body tissue. To insure high quality diagnostic images the MRI Technologist must have an extensive knowledge of the numerous and increasingly complex applications, protocols and parameters involved in quality imaging, patient care and safety techniques, the knowledge and ability to inject MRI specific contrast agents and most important, the safety requirements of patient care in the MRI suite.

**MRI** is an exceptionally safe imaging modality. No inherent adverse biological affect has ever been shown in MRI when performed correctly and carefully. MRI is a highly respected modality due to the flexibility and versatility of MRI Technology and modern medical preference to avoid ionizing radiation. MRI is however not without unique safety issues. Ferrous objects can fly into the magnet bore causing severe injury or death, radio-frequency burns could occur on the patient's skin without proper supervision, high-decibel acoustic noise to damage hearing and gadolinium-based IV-contrast agents while much safer than iodine based contrast agents can be harmful in patients with compromised kidney function. The MRI technologist is trained in preventing, and responding to, all possible MRI hazards.

*The* most horrific injuries that have occurred in conjunction with MRI were due to ferrous oxygen tanks and other ferrous items being allowed near the MRI machine which were drawn into the magnet bore with incredible levels of force. There have in fact been a number of MRI related fatalities and other serious injuries all of which occurred when a technologist failed to protect his/her patients. Lack of proper MRI safety training is the cause. No MRI-related patient injury has ever been attributed to an ARMTRIT-certified technologist.

**MRI**, like Ultrasonography uses no 'Ionizing Radiation', hence it does not necessarily fall under generally accepted regulations applicable to Radiography. Accordingly, there are no Federal regulations governing MRI Technologists specifically. The Centers for Medicare and Medicaid Services (CMS) has established accreditation requirements for providers of advanced medical imaging mandated by the Medicare Improvements for Patients and Providers Act of 2008 (MIPPA). Providers have been required to comply with the CMS requirement that all providers of CT, MRI, PET and Nuclear Medicine exams be accredited by a CMS recognized accrediting organization as of January 1, 2012 in order to be reimbursed. CMS has recognized four organizations as acceptable accrediting bodies: the American College of Radiology (ACR), the Inter-societal Accreditation Commission (IAC), The Joint Commission, and RadSite. **ARMTRIT is included in the MRI site accreditation standards of all four CMS recognized accrediting organizations.**

**O\*NET Online:** in the fall of 2009, ARMTRIT was contacted by Traci Davis of RTI International, Raleigh, North Carolina informing announcing that the U.S. Department of Labor was sponsoring research of 400 new careers and that MRI Technology was one of them. Ms. Davis requested a national database of MRI Technologists with at least five (5) years of MRI Clinical experience to participate in the project to collect occupational information on the career of MRI Technologist. In September 2013, Ms. Davis provided the materials to the MRI Technologists explaining the O\*NET Occupational Expert Data Collection Program for review. On September 26, 2013, ARMTRIT agreed to the process.

*In* December 2013, Ms. Davis sent an email for distribution to the MRI Technologists in the database, which included an extensive Occupational Questionnaire. Upon submission of the questionnaires and completion of the Occupational Expert Data Collection Program, Magnetic Resonance Imaging (MRI) Technologist was described as a distinct and separate career by the U.S. Department of Labor with the O\*NET Code: **29-2035.00** Rapids Code: **1115**.

**Apprenticeship-USDOL**, ARMRIT allows graduates from U.S. Department of Labor (USDOL) Registered Apprenticeship programs to sit for their certification exam. Approved Registered Apprenticeship Program by the U.S. Department of Labor, Office of Apprenticeship, or a State Apprenticeship Agency recognized by the Office of Apprenticeship. Magnetic Resonance Imaging (MRI) Technologist O\*NET Code: **29-2035.00** Rapids Code: **1115**

*On* the State level, at this time, currently five States, New Hampshire, New Mexico, North Dakota, Oregon and West Virginia, have licensing requirements for MRI Technologists. ARMRIT certification is a criterion for licensure in all five states. In all other states, certification in the specialty is required or highly recommended however by insurance providers and required by most MRI employers.

**ARMRIT** is the first MRI Registry certifying body that required specific MRI education, in-depth clinical training, and hands-on experience. All applicants for Certification must meet the criteria to be eligible to sit for the ARMRIT certification examination, which are: 1) Graduate of an approved MRI Technologist Program; 2) Cross-Trained from an Allied Health Field with at least one-thousand (1000) hours of documented MRI Clinical experience; 3) Equivalency Clause, which is On-The-Job Training with at least four years of documented full-time clinical experience. Applicants who are qualified as Cross-Trained or the Equivalency Clause must be documented and signed off by a practicing board certified Physician. All eligible applicants must sit and successfully pass the ARMRIT MRI Technologist examination.

*Once* certified, ARMRIT Technologists are required to perform a minimum of 24 Continuing Medical Education credits specifically in the topic of MRI for every three-year renewal period. ARMRIT established an annual meeting and seminar, offering MRI Technologists twelve hours of lecture in MRI subjects by leaders in the MRI field nationally and internationally. For example, in 2010 Raymond Damadian, MD, inventor of the modern MRI scanner was the featured speaker at the ARMRIT Annual Meeting & Seminar.

*The* examination for ARMRIT Certification is administered by PSI Computer Testing. PSI has over 1000 testing sites nationally and internationally. Exams are graded and a hard copy of results is made available immediately to each candidate upon completion of the exam. PSI also provides evaluation of the on-going psychometric data used by the ARMRIT examination committee.

*Moreover*, the genesis of ARMRIT is to offer an alternative venue to qualified MRI Technologists who opted to train specifically in MRI technology without undergoing a Radiology/Radiography oriented background. Parenthetically, there are individuals who have radiation-phobia, whether justified or not, especially among women of child bearing age. That said ARMRIT does not preclude ARRT technologists to take the Registry certification exam, provided the ARMRIT criteria for said candidates are met. In fact a significant number of its current certificants are of ARRT background.

*The* Commission on Accreditation (COA) of the American Registry of Magnetic Resonance Imaging Technologists was created in response to a growing interest in the accreditation of MRI programs and in order to comply with federal and state regulatory requirements and of any national or international body. The voluntary application process assures that any MRI program accredited by the COA is committed to quality education. The sponsoring institution of the MRI program must formally apply to the COA for accreditation. Upon approval of the submitted application a site visit of the institution is scheduled. Accreditation is required for all campuses and at the conclusion of the accreditation period a renewal of accreditation is required.

### **Safety and Imaging Complexity Implications of MRI**

Used properly and with care MRI is extremely safe. **No inherent adverse biological effects from MRI have ever been shown. Moreover, MRI and Ultrasound are the only two imaging modalities deemed safe for imaging a human fetus.** However, the MRI process poses significant dangers. Aside from rare and extreme allergic reactions from IV contrast agents in other modalities, **MRI is the only modality that has resulted in the death of a patient at the time of the exam. MRI is the only imaging modality that can kill instantly.**

*The* complexity of the MRI process is unparalleled in medical imaging. For example, the decision tree for selecting the Imaging Options in Radiography (X-Ray) is 4, Computed Tomography is approximately 6, Ultra-sonography including Echo is approximately 35, Nuclear Medicine including PET is approximately 6. **Contrast these with the number of imaging parameters controlled by an MRI Technologist which is no less than 70.**

*There* is no imaging modality like Magnetic Resonance Imaging. Like Ultrasonography, MRI utilizes a completely different branch of physics. There is no other imaging modality that is at the same time so safe and so **potentially** dangerous. It is understandable that the general public is not aware of the vast differences between MRI and every other imaging modality. What is unfortunate is that so many in the medical imaging field are equally unaware.

## Magnetic Resonance Imaging as Compared to Other Imaging Modalities

Can there be any argument that Radiography and Ultrasonography (U/S) are two completely different imaging modalities? That they are both used in industrial and medical imaging is their only similarity. Nuclear Medicine (NM) and Radiography both share the same unit of energy: ionizing radiation. But again, here the similarities stop. Is it any surprise then that the fields of medical Ultrasonography and Nuclear Medicine have separate registries from medical radiography?

**Computed** Tomography (CT) is often thought to have much in common with Magnetic Resonance Imaging (MRI), yet nothing could be further from the truth. Other than having similar looking machines and consoles they have virtually nothing in common. In fact, CT has far more in common with X-ray Radiography. In the simplest sense, CT is just an X-ray tube that goes around in a circle while energized. MRI, like U/S and NM, is a completely different imaging modality. **A comparison of MRI to other medical imaging modalities (see pages 7-12) is therefore useful.**

### In Conclusion:

- 1) MRI already plays a major role in modern medicine which will continue to grow with expanded clinical and research applications and advanced imaging techniques.
- 2) The patient safety need to reduce exposure to ionizing radiation will lead to the continuing growth of MRI and the reduction of future use of CT Scan.
- 3) At present, **the vast majority of MRI Technologists, as much as 90%, in the United States were trained on the job.** Since its inception, ARMTRIT has advocated for distinct MRI Technologist training verses MRI training as an addendum to Radiologic Science, (X-Ray) School or any other allied health education.
- 4) The essential elements to the growth of MRI are highly trained technologists and maintaining the high level of patient safety that properly trained technologists brings to MRI.
- 5) ARMTRIT continues to be the world leader in the certification of highly trained and certified MRI Technologists.

## A Comparison of MRI to Other Medical Imaging Modalities.

### **RADIOGRAPHY** (X-Ray)

Unit of Energy:	Ionizing X-Radiation.
Principle Contrast Mechanism:	Electron Density.
Approximate Exams/Year:	Over 100 Million.
Main Applications:	Bony detail, lung disease, 1 <sup>st</sup> level screening, breast (mammography).
Short-term potential for patient harm:	<b>Low</b> Typically low radiation dose.
Long-term potential for patient harm:	<b>Medium-High.</b> Cumulative radiation dose linked to increased cancer risk later in life.

### Imaging Options for an X-Ray Tech (RT)

- 1) Peak kilovolts
- 2) Amperage
- 3) Distance
- 4) Time

## A Comparison of MRI to Other Medical Imaging Modalities (continued)

### **COMPUTED TOMOGRAPHY (CT)**

Unit of Energy: Ionizing X-Radiation.

Approximate Exams/Year: 70 Million.

Principle Contrast Mechanism: Electron Density.

Main Applications: Bony detail, lung disease, 2<sup>nd</sup>-3<sup>rd</sup> level screening, brain, angiography, large bowel, 1<sup>st</sup> level coronary screening.

Short-term potential for patient harm: **Medium.** Higher radiation dose than radiography. Misuse of system can lead to over radiating the patient.

Long-term potential for patient harm: **Medium-High.** Cumulative radiation dose shown to increase cancer risk later in life through over-use.

### Imaging Options for an CT Tech (RT)

1) Kvp 2) Milli Amps 3) Time 4) Slice thickness 5) Pitch (table speed) 6) FOV

### **ULTRASONOGRAPHY (U/S)**

Unit of Energy: High Frequency Sound Energy.

Approximate exams/year: 90 Million.

Principle contrast mechanism: Tissue Sound (Reflection and Scattering) Absorption.

Main Applications: Abdomen, Echocardiography, Obstetrics/GYN, Ophthalmic, Musculoskeletal, Neuro-Sonology, Vascular, Color Flow and Tissue Doppler.

Short-term potential for patient harm: **Extremely low.** In extreme circumstances, cavitation and/or tissue heating may occur.

Long-term potential for patient harm: **Extremely low.** None shown to date.

### Imaging Options for an Ultrasonographer

- Application Type Selection
- Transducer Type Selection
- Frequency Selection
- Imaging mode selection:
  - 2D Imaging
  - M-mode
  - Color Flow Doppler
  - PW or CW Doppler
  - Tissue Doppler



## A Comparison of MRI to Other Medical Imaging Modalities (continued)

- Contrast Harmonics
- Strain Imaging
- 3D Imaging
- Imaging Window and Imaging Plane Selection
  - Abdominal (Sagittal, Coronal)
  - Pelvic (Sagittal, Coronal)
  - Cardiac: Parasternal (Long Axis, Short Axis), Apical (4-chamber, 5-chamber, 2-chamber, Long Axis), Subcostal (Long Axis, Short Axis, IVC), Suprasternal (Long Axis, Short Axis), Right Parasternal.
  - Vascular (Long Axis, Cross-section)
  - Ophthalmic, Musculoskeletal, Neurosonology (Sagittal, Coronal)
- Image Optimization Decisions:
  - Depth
  - Gain
  - Pre-processing
  - Post-processing
  - TGC
  - Persistence
  - Dynamic Range
  - Focus
  - PRF
  - Doppler baseline
  - Doppler velocity scale
  - Doppler gain
  - Doppler transmit
- Measurements:
  - Distance, Circumference, Surface Area, Volume, Velocity, VTI, Time Intervals

## **NUCLEAR MEDICINE (NM)**

Unit of Energy: Ionizing Isotope Radiation.

Principle Contrast Mechanism: Tissue Uptake.

Approximate Exams/year: 18 Million.

Main Applications: 2<sup>nd</sup> level cardiac, cancer staging (Includes PET).

Short-term potential for patient harm: **Low.** Rapid Half-Lives pose little if any short term harm.



Long-term potential for patient harm: **Low.** Theoretical risk of increased cancer risk but no link has been shown yet due to the lack of over-use.

## Imaging Options for a Nuclear Medicine Tech

1) Height 2) Weight 3) Dose 4) Collimator 5) Scope (head/body) 6) Dynamic vs. Non-dynamic

## A Comparison of MRI to Other Medical Imaging Modalities (continued)

### **MAGNETIC RESONANCE IMAGING (MRI)**

Unit of Energy:	Radio Frequency Transmission in a Large Main Magnetic field.
Principle Contrast Mechanism:	Tissue Equilibrium Rates.
Approximate Exams/Year:	30 Million.
Main Applications:	Cancer staging, Central Nervous System (Brain/spine), Musculoskeletal, 3 <sup>rd</sup> level breast, 2 <sup>nd</sup> -3 <sup>rd</sup> level cardiac.
Short-term potential for patient harm:	 If improperly employed, RF burns are the most common injury. Instant death can occur due to magnetic or ferrous objects. Several deaths have been documented.
Long-term potential for patient harm:	 No adverse effects from MRI even with multiple and repeated use has ever been shown.

### Imaging Options for an MRI Tech

- Imaging Mode Decisions:
  - 2D acquisition, 3D acquisition, 4D acquisition
- Surface Coil Selection
- Plane: Axial, Sagittal, Coronal, Oblique
- Pulse Sequence Decisions
  - Spin Echo
  - Inversion Recovery
    - STIR
  - Fast (Turbo) Spin Echo
    - FSE-IR, FSE Fast Recovery, Phase-sensitive IR, Single Shot FSE (HASTE)
  - FLAIR: T2 FLAIR, T1 FLAIR
  - Gradient Echo
    - GRE
    - Fast (Turbo) GRE (SPGR)
    - Spoiled GRE
    - Fast (Turbo) Spoiled GRE
    - In/Out of Phase GRE
  - Echo Planar Imaging (EPI)
    - GRE-EPI
    - SE-EPI
    - IR-EPI
    - Multi-shot EPI
    - Single Shot EPI
    - MS-IR-EPI
    - SS-IR-EPI
    - Susceptibility-weighted
    - Diffusion-weighted
    - Diffusion-Tensor: # of directions

## A Comparison of MRI to Other Medical Imaging Modalities (continued)

- Vascular
  - Time-of-Flight
  - Phase Contrast (PC)
  - CINE
  - CINE PC
  - TOF-GRE
  - TOF-SPGR
  - CE MRA
- Acquisition Timing Decisions
  - Time-to-Echo (TE)
    - Min TE, Min Full TE, Number of echoes
  - Repetition Time (TR)
  - Inversion Time (TI)
  - Number of Excitations (NEX) or Number of Single Averages (NSA)
  - < than 1 Fourier Transform steps (0.5, 0.75. etc)
  - Receive Bandwidth
  - Echo-Time Length (ETL)
  - Flip Angle
- Image Resolution Decisions
  - Field of View
  - Slice Thickness
  - Inter-slice skip factor
  - Phase Encoding steps
  - Frequency Encoding Steps
  - Phase/Frequency direction
- General Imaging Options
  - Spatial RF Saturation pulse
    - Default, Placement, Thickness
  - Gradient Moment Nulling
    - Frequency Direction, Slice direction, Both
  - Magnetization Transfer
  - Sequential slice ordering
  - Interleaved slice ordering
  - Parallel Imaging
    - Acceleration factor
  - Anti-Aliasing
  - Respiratory Compensation
    - Resp re-ordering, Resp-triggering
  - Cardiac Gating
    - R-R interval
    - Delay Time
    - Trigger Window
    - ECG gating vs. Peripheral
    - Views per Segment
  - Vascular
    - Contrast Bolus detection
      - Manual timing
      - Computer-assisted
      - Real-time “Fluoro-triggering”
      - Time-Resolved Kinetics (IE:TRICKS)

**A Comparison of MRI to Other Medical Imaging Modalities (continued)**

- Fat Suppression
  - Fat Saturation, Spectral Fat Suppression, 3pt Dixon
- Local Field Shimming
  - Auto, Selection Volume
- Image Prescription Decisions
  - Number of slices
  - Slice/Volume coverage
- Image Reconstruction Options
  - Zero-filling interpolation: In-plane, Through-plane
  - Surface Coil intensity correction
  - Auto-Image subtraction
  - Image Filtration
  - Image Add/Subtract
  - ADC Map
  - FA Map
  - Perfusion Maps
    - rCBV, rCBF, rMTT
  - Auto-Reformation
  - Maximum-Pixel Intensity
  - Minimum-Pixel Intensity

**ARMRIT BOARD OF DIRECTORS**

<u>President &amp; Executive Director:</u>	James F. Coffin, ARMRIT, Bellerose, NY
<u>Director (Examination Committee Chair):</u>	Thomas K. Schrack, BS, ARMRIT, CS, Fairfax, VA
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## **ARMRIT Code of Ethics**

Magnetic Resonance Imaging Technologists, as Certified Technologists of an allied health care profession, must endeavor to always practice their specialty with the highest ethical standards in mind. The American Registry of Magnetic Resonance Imaging Technologists' Board of Directors adopted and enacted the following Guidelines:

- 1) The MRI technologist shall provide quality service and patient care with empathy, respect and concern for the rights, privacy and safety of the patient.
- 2) The MRI technologist shall always be aware of the precautions necessary and available to anyone in the MRI environment in order to safeguard the patient and others.
- 3) The MRI technologist shall respect the confidentiality and never divulge patient information to anyone not directly related to the care of the patient as allowed by law.
- 4) The MRI technologist shall adhere and comply with statutes, laws, regulations or specifications that govern the medical imaging modality of magnetic resonance imaging technology under federal, state and local law.
- 5) The MRI technologist shall perform their assigned duties responsibly, accurately and competently, and professionally.
- 6) The MRI technologist shall always endeavor to enhance and improve their knowledge of the specialty and skills annually through formal and informal continuing education.
- 7) The MRI technologist shall not violate any laws.
- 8) The MRI technologist shall promote community awareness of the importance of quality health care and participate in related activities, whenever possible.

### **Mission Statement**

The mission of the American Registry of Magnetic Resonance Imaging Technologists (ARMRIT) is to recognize individuals qualified as specialists in the use of Magnetic Resonance Imaging (MRI) Technology which employs non-ionizing radiation, to promote high standards of patient care and safety in the diagnostic medical imaging modality of MRI Technology, including interventional MRI, cardiovascular MRI, functional MRI, and MRI breast imaging. The Registry is open to all qualified technologists in all imaging fields who have documented MR clinical experience and/or formal education completed through schools dedicated to MRI Technologists.

### **Mission Objectives**

- Promote high standards of MRI education and clinical training prior to entering the profession;
- Promote high standards of professionalism required by a diagnostic medical imaging specialty;
- Administer competency examinations that measure the theoretical knowledge and clinical skills necessary to competently perform the tasks of a MRI specialist.

## **ARMRIT Certified MRI Technologists Responsibilities**

- 1) Frame and display your certificate proudly at your place of employment demonstrating that you have fulfilled the educational and clinical requirements to be competent in the field of MRI Technology.
- 2) Adhere to the Code of Ethics set forth by the ARMRIT Board of Directors.
- 3) Stay active in the MRI profession.
- 4) Attain the required Continuing Medical Education credits in MRI Technology, currently eight (8) per year, twenty-four (24) per three-year period.
- 5) Keep the Registry informed of any changes of employment, address, contact phone number, MRI equipment experience, and promotions.
- 6) Pay the triennial renewal fee of \$300 on-time for the next three calendar years.
- 7) Your support of the ARMRIT helps protect your right to be employed in MRI and is recognized by all four Centers for Medicare and Medicaid (CMS) designated accrediting organizations, the American College of Radiology, Inter-societal Accreditation, the Joint Commission, and RadSite.

### **Certified Tech's Resume' (CV) - On-Line**

All Registry Active Certified Technologists are encouraged to post their resume (CV) on the ARMRIT Webpage at: [www.armrit.org](http://www.armrit.org)

- 1) Click on **'MRI Tech Resume' (CV)** at the top of the homepage.
- 2) Scroll down to the bottom and click on: **'Click here to post your Resume (CV)'**.
- 3) Enter your Login: use your e-mail address.
- 4) Enter a password.
- 5) Enter all relevant information and click on **Submit**.
- 6) Remember your Login, Password, and Listing Number.
- 7) If you forget your Login, Password, or Listing Number, enter a new listing and the Web Manager will remove the old listing.

# **MRI CME Requirement for Renewal**

**Registry Active Certified MRI Technologists:** All Certified MRI Technologists are required to renew their certification for the next three-year period and must submit evidence of eight (8) CME credits per year for a total of twenty-four (24) CME credits in MRI Technology as awarded by the AHRA, ACCME , AMA, ASRT or other qualified CME granting organization.

**\*CME Topics:** Continuing medical education credits must be derived from topics related to Magnetic Resonance Imaging technology and/or MRI patient care and safety.

**A Certificate and ID card will not be released until the CME Requirement is met!**

**\*IMPORTANT:**      **Subjects other than MRI will not be accepted!!!**  
**If MRI is not in the Title, it will not be accepted!!!**

## **Sources for MRI Continuing Medical Education (CME)**

ARMRIT Recommended CME:

International Center for Postgraduate Medical Education

(ICPME)



International Center for  
Postgraduate Medical Education

To earn CME Credit, visit [www.icpme.us](http://www.icpme.us)

[icpme.us/ARMRIT](http://icpme.us/ARMRIT)

***All ARMRIT Meeting Lectures available at ICPME.US***

# ARMRIT MRI Technologist Examination Overview

**STRUCTURE:** The exam is divided into three (3) sections of eighty (80) questions each for a total of two hundred and forty (240) questions, as follows:

Section 1: MR Physics: Basic, Intermediate and Advanced physics, Tissue Characteristics, Electromagnetism.

Format: Multiple choice and TRUE/FALSE questions.

Section 2: Clinical Applications: Pulse sequences, Image Parameters, Spatial Localization, Image Quality, Enhancement Agents, types of MR magnets, Coils and peripheral equipment.

Format: Multiple choice and TRUE/FALSE questions.

Section 3: Part 1 - Bioeffects, Safety and Patient Care.

Format: Thirty (30) multiple choice and TRUE/FALSE questions.

Part 2 - MR Cross-sectional Anatomy.

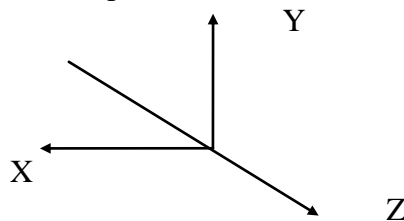
Format: Fifty (50) matching anatomical structures on MRI images.

**TOTAL EXAM TIME:** Four (4) hours. Candidates are advised to use all time allotted to make sure all questions have been answered.

**Passing Score for Each Section:** 70%.

**Multiple Choice Questions:** There is only one right and/or best answer to every question, there are no “multiple, multiple choice” questions (i.e., A and B; C and D).

In many MRI textbooks and manuals, the main static magnetic field will be symbolized  $B_0$ , the radiofrequency (RF)  $B_1$  and the components of the net magnetization vector,  $M_z$  in the longitudinal plane and  $M_{xy}$  in the transverse plane. The orthogonal (mutually perpendicular) axes of the gradient magnetic fields are oriented in the following directions (horizontal for simplification):



The logical (for educational purposes) gradient directions are; Slice Select gradient is  $G_z$ , phase encoding gradient is  $G_y$  and the frequency encoding gradient is  $G_x$  (the “read out” gradient). Understanding how the gradients are physically (actually) employed during a pulse imaging sequence is important to image quality, the management of motion artifact, flow effects and certain artifacts such as aliasing, chemical shift artifact, magnetic susceptibility, respiratory and cardiac activity. Understand the four tissue characteristics; Hydrogen concentration, T1 effects, T2 effects, and velocity (flow) effects, and the various pulse sequences that bring out these properties. The following pulse sequences are covered: Spin-echo, Gradient -echo, Inversion recovery, MRA, FLAIR, etc. Included in this review package is recommended reading material.



***American Registry of Magnetic Resonance Imaging  
Technologists - ARMTRIT  
Offer exams exclusively on computer via  
PSI Exams On-line.***

**February 27, 2003 New York, NY.** The American Registry of Magnetic Resonance Imaging Technologists exams for MRI technologists will be offered only on computer, replacing the standard paper and pencil format, beginning in March of this year.

PSI Exams On-line, a leading computer-based testing company, offers ARMTRIT candidates the availability of over 1,000 test sites nationally. This will allow accessibility to more candidates with the added benefit of scheduling flexibility.

The process begins once a candidate's application is received and reviewed. If approved, a secure email will be sent to PSI authorizing the Candidate to sit for the examination. PSI will contact the Candidate to schedule an appointment online at a conveniently located test site. The applicant must schedule the appointment within one-year of the date of the secure email.

According to James F. Coffin, President of ARMTRIT, "Some of the benefits of PSI Exams On-line are: flexible scheduling, more geographical test site locations, immediate results to the candidate and the basic exam results data will be provided to the ARMTRIT psychometrician regularly"

The CBT process will provide the ARMTRIT examination committee with the necessary data to update and improve the examination on a continuous basis. The goal of the examination committee will be to implement periodic updates and improvements to the examination.

To locate a PSI test site go to: [www.psiexams.com](http://www.psiexams.com)

# Accredited MRI Programs

Commission on Accreditation - COA

of the

American Registry of Magnetic Resonance Imaging Technologists

- ❖ **American Institute of Medical Sciences & Education**, Piscataway, NJ  
Phone: 908-222-0002 24 Month Certificate Program. [www.aimsedu.com](http://www.aimsedu.com)
  
- ❖ **Apprenticeship - USDOL**, Washington, DC  
MRI Technologist O\*NET Code: 29-2035.00 Rapids Code: 1115  
Phone: 866-487-2365 18 Month Certificate Program. [www.dol.gov/apprenticeship](http://www.dol.gov/apprenticeship)
  
- ❖ **Aquarius Institute of Computer Science**, Des Plaines, IL  
Phone: 847-296-8870 One-Year Certificate Program. [www.aquariusinstitute.com](http://www.aquariusinstitute.com)
  
- ❖ **Career Networks Institute**, Orange, CA  
Phone: 714-437-9697 16 Month Diploma Program. [www.cniccollege.edu](http://www.cniccollege.edu)
  
- ❖ **Casa Loma College**, Van Nuys, CA  
Phone: 818-785-2726 Associate Degree Program. [www.casalomacollege.edu](http://www.casalomacollege.edu)
  
- ❖ **Gurnick Academy of Medical Arts**, Modesto, CA  
Phone: 209-521-1821 Associate Degree Program. [www.gurnick.edu](http://www.gurnick.edu)
  
- ❖ **Gurnick Academy of Medical Arts**, Sacramento, CA  
Phone: 916-588-2060 Associate Degree Program [www.gurnick.edu](http://www.gurnick.edu)
  
- ❖ **Gurnick Academy of Medical Arts**, San Mateo, CA  
Phone: 650-685-6616 Associate Degree Program. [www.gurnick.edu](http://www.gurnick.edu)
  
- ❖ **Med Academy**, Hialeah, FL  
Phone: 786-271-0987 18 Month Certificate Program. [www.medacademy.education](http://www.medacademy.education)
  
- ❖ **Midwestern Career College**, Chicago, IL  
Phone: 312-236-9000 Associate Degree Program. [www.mccollege.edu](http://www.mccollege.edu)

## **Accredited MRI Programs (continued)**

Commission on Accreditation - COA

of the

American Registry of Magnetic Resonance Imaging Technologists

- ❖ **Midwestern Career College**, Naperville, IL  
Phone: 630-536-8679 Associate Degree Program. [www.mccollege.edu](http://www.mccollege.edu)
  
- ❖ **MRI School of Minnesota**, Woodbury, IL  
Phone: 651-702-0674 One-Year Certificate Program. [www.mrischoolofmn.com](http://www.mrischoolofmn.com)
  
- ❖ **MRI Institute & Consulting**, West Chicago, IL  
Phone: 630-876-1600 One-Year Certificate Program. [www.mritutors.com](http://www.mritutors.com)
  
- ❖ **National Polytechnic College**, Lakewood, CA  
Phone: 888-243-2493 18 month Certificate Program. [www.npcollege.edu](http://www.npcollege.edu)
  
- ❖ **Southwest University**, El Paso, TX  
Phone: 915-778-4001 Associate Degree Program. [www.southwestuniversity.edu](http://www.southwestuniversity.edu)
  
- ❖ **West Coast Ultrasound Institute**, Beverly Hills, CA  
Phone: 310-289-5123 Associate Degree Program. [www.ultrasoundinstitute.com](http://www.ultrasoundinstitute.com)
  
- ❖ **West Coast Ultrasound Institute**, Ontario, CA  
Phone: 909-483-3808 Associate Degree Program. [www.ultrasoundinstitute.com](http://www.ultrasoundinstitute.com)
  
- ❖ **West Coast Ultrasound Institute**, Phoenix, AZ  
Phone: 602-954-3834 Associate Degree Program. [www.ultrasoundinstitute.com](http://www.ultrasoundinstitute.com)

# **ELIGIBILITY CRITERIA for CANDIDATES of the ARMRIT MRI TECHNOLOGIST EXAMINATION**

- 1) **Graduate of an MRI Program:** (within three (3) years of date of graduation).  
Completion of an ARMRIT approved Certification or Degree program that includes at least 1,000 hours of Documented MRI clinical training (see pages 18 & 19).
  
- 2) **Graduate of an MRI Registered Apprenticeship Program:** (within three (3) years of date of graduation).  
The American Registry of Magnetic Resonance Imaging Technologists (ARMRIT) allows graduates from U.S. Department of Labor (USDOL) Registered Apprenticeship programs to sit for their certification exam. Graduates must document a minimum of 2,000 hours of MRI clinical training from an approved Registered Apprenticeship program. Registration may be by the U.S. Department of Labor, Office of Apprenticeship, or by a State Apprenticeship Agency recognized by the Office of Apprenticeship (see page 18).  
Magnetic Resonance Imaging (MRI) Technologist O\*NET Code: **29-2035.00** Rapids Code: **1115**
  
- 3) **Medical Imaging or Allied Health Field Cross-Trainers:**  
Individuals from another medical imaging modality or allied health field and have at least 1,000 hours of documented MRI clinical experience such as:
  - Cardio Vascular Technologist (CVT).
  - EEG Technologists.
  - Electro-Physiology and Evoked Potential Technologists.
  - Emergency Medical Technician (EMT).
  - Foreign Medical Graduate (see page 24 for U.S. evaluators).
  - Medical Assistants Diploma and/or Certification.
  - Nuclear Medicine Technologists certified by the NMTCB or ARRT.
  - Nurses (RN, LPN, LVN).
  - Physical Therapist (PT).
  - Physical Therapy Technician/Assistant (PT).
  - Physicians (MD, DO, DC, DPM).
  - Physician Assistants (PA).
  - Radiographers certified by the ARRT, LRT, CRT or State license.
  - Surgical Technician with National Certification.
  - Ultrasonographers certified by the ARDMS or CCI.
  
- 4) **Equivalency Clause:**  
On The Job Trained: applicant must prove four (4) years or 6,240 hours of documented full-time MRI clinical experience or possess a Bachelor Degree and one-year (1700 hours) of full-time MRI work experience.

## **All Applications Must Include the Following:**

- 1) Application, Completely fill-out.
- 2) Application fee of **\$300.00, Non-Refundable!**
- 3) Resume/Curriculum Vitae (CV).
- 4) Copy of Drivers License or Non-Drivers Picture ID.

### **Graduate of an ARMRIT Approved MRI Tech Program (see pages 18 & 19) Include:**

- 1) Copy of Certificate or Diploma within three (3) years of graduation.
- 2) Original Letter of recommendation, dated within the last twelve (12) months, from your MRI Clinical Supervisor or Externship Coordinator stating you have 1,000 MRI clinical hours and are competent as an MRI Technologist.
- 3) Copy of Drivers License or Non-Drivers Picture ID.

### **Graduate of an MRI Registered Apprenticeship Program (see page 18) Include:**

- 1) Copy of Certificate or Diploma within three (3) years of graduation.  
Magnetic Resonance Imaging (MRI) Technologist O\*NET Code: **29-2035.00** Rapids Code: **1115**
- 2) Original Letter of recommendation, dated within the last twelve (12) months, from your MRI Clinical Supervisor or Externship Coordinator stating you have 2,000 MRI clinical hours and are competent as an MRI Technologist.
- 3) Copy of Drivers License or Non-Drivers Picture ID.

### **Cross-Trainer from an Allied Health Field (see page 20) Include:**

- 1) Original letter, dated within the last twelve (12) months, from your current Medical Director or Reading Physician stating you have 1,000 MRI clinical hours and are competent as an MRI Technologist.
- 2) Original Letter of recommendation, dated within the last twelve (12) months, from your MRI Clinical Supervisor stating you have 1,000 MRI clinical hours and are competent as an MRI Technologist.
- 3) Copy of Certificate and/or License in the Allied Health Field you cross-trained from (see page 20).
- 4) Evaluation of Foreign education by a U.S. organization for Foreign Graduates (see below).
- 5) Copy of Drivers License or Non-Drivers Picture ID.

### **On The Job Trained – Equivalency Clause (see page 20) Include:**

- 1) Original letter, dated within the last twelve (12) months, from your current Medical Director or Reading Physician stating you have four (4) years or 6,240 hours full-time clinical experience and are competent as an MRI Technologist or possess a Bachelor Degree and one-year (1700 hours) of full-time MRI work experience.
- 2) Original Letter of recommendation, dated within the last twelve (12) months, from your MRI Clinical Supervisor stating you have four (4) years or 6,240 hours full-time clinical experience and are competent as an MRI Technologist or possess a Bachelor Degree and one-year (1700 hours) of full-time MRI work experience.
- 3) Copy of Diploma-Bachelor Degree.
- 4) Copy of Drivers License or Non-Drivers Picture ID.

## **Evaluation of Foreign Academic Credentials**

Eligibility based on a degree from a foreign educational institution, official transcript(s) must be evaluated. Listed below are acceptable agencies:

- **A&M Logos International**-40 Rector ST., Suite 1504, NY, NY 10006  
Ph.: 212-233-7021 Email: [www.amlogos.com](http://www.amlogos.com)
- **Globe Language Service**-319 Broadway, 2<sup>nd</sup> Floor, NY, NY 10007  
Ph.: 212-227-1994 Email: [info@globelanguage.com](mailto:info@globelanguage.com)
- **The Trustforte Corporation**-271 Madison Avenue, Third Floor, NY, NY 10016  
Ph.: 212 481-4870 Email: [info@trustfortecorp.com](mailto:info@trustfortecorp.com)
- **World Education Services**-Bowling Green Station, P.O. Box 5087, NY, NY 10274  
Ph.: 212-966-6311 Email: [www.wes.org](http://www.wes.org)
- **Educational Credential Evaluators** -PO Box 514070, Milwaukee WI 53203  
Ph.: 414-289-3400 Email: [eval@ece.org](mailto:eval@ece.org)

# Recommended Sources for MRI Information.

## Soft cover books:

- Questions and Answers in Magnetic Resonance Imaging, by Allen D. Elster, MD, Mosby-Yearbook
- Magnetic Resonance, Bioeffects, Safety, and Patient Management, by Frank G. Shellock and Emanuel Kanal, Raven Press
- MRI for Technologists, modules 1-6, Bayer, contact your Bayer, Magnevist Sales Representative.
- Pocket Atlas of Cross-Sectional Anatomy, by Torsten B. Moller and Emil Reif, Theime Flexibook
- MRI for Technologists, by Peggy Woodward / Roger Freimarck, McGraw Hill

## Hard cover books:

- Clinical Magnetic Resonance Imaging, 3<sup>rd</sup> Edit., by Robert R. Edelman, MD & John R. Hesselink, MD, W.B. Saunders Company
- Magnetic Resonance Imaging, 2nd Edition, by David D. Stark, MD and William G. Bradley, MD, PhD, Mosby-Yearbook

**On-Line:** [www.MRIsafety.com](http://www.MRIsafety.com)

**Practice Tests:** [www.armrit.org](http://www.armrit.org)

**Study Guide:** “MRI Technologist Quick Reference and Study Guide”—a compilation of the principles of MRI physics, instrumentation, clinical applications, bio-effects-safety and cross-sectional anatomy.

\***Price: \$75.00** (Non-refundable). Purchase of the Study Guide is **not required** for certification.

**Send to:** Name: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip Code: \_\_\_\_\_

**Payment Options:** Check \_\_\_\_\_ Money Order \_\_\_\_\_ Make check or MO payable to: **ARMRIT**

**Mail to:** 2444 NW 8<sup>th</sup> Street or **Fax to: 561-265-5045**  
Delray Beach, FL 33445

Pay by Credit Card: (check one) MasterCard \_\_\_\_ Visa \_\_\_\_ American Express \_\_\_\_ Discover \_\_\_\_

Card Number: \_\_\_\_\_ Expiration Date: \_\_\_\_\_ Verification Code: \_\_\_\_\_  
(On Back of Card)

Print Name on Card: \_\_\_\_\_

Authorized Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Fax Form to: **718-347-8691**

**For Office Use only:** Payment Method: Check#/MO#/CC Approval #: \_\_\_\_\_

Transaction Date: \_\_\_\_\_

Processed by: \_\_\_\_\_

## **Sample MRI Resume:**

**John / Jane Doe, ARMRIT  
111 Main Street, Apt. 1a  
Anywhere, NY 11234**

**Objective:** To obtain a position as a MRI Technologist commensurate with my MRI experience and MRI education.

### **Work Experience:**

- January 2003 – present      **ACME Imaging, PC**, Brooklyn, NY  
MRI Technologist performing MRI studies on 12 patients/day.  
Working with a Hitachi MRP5000 0.2T permanent magnet.
- April 2001 – January 2003    **Parts Production, Inc.**, Queens, NY  
Assistant Manager.
- October 1995 – April 2001    **Smith and Smith, Inc.**, New York, NY  
Sales Representative.

### **Education:**

- May 2002 – May 2003      **Institute of Medical Imaging Professions**, New York, NY  
at **Hospital Medical Center**, Queens, NY  
MRI Technologist Program with Clinical training.
- September 1993 – June 1995    **City Community College**, Brooklyn, NY  
Associates Degree in Applied Sciences.

### **Certification:**

ARMRIT Registry Active # 9999  
BLS, AHA expires May 2010  
IV Insertion Techniques, Hospital Certificate.

*References available upon request.*

## *Application & Examination Process*

**IMPORTANT! Failure to adhere to all time limits and deadlines will lead to revocation  
Of your Registry Candidate status!**

- 1) Fill out all areas of the ARMTRIT MRI Technologist Examination Application **completely**.  
**Incomplete Applications Will Be Returned!!!**
  - 2) Pay the **Non-refundable** Application Fee of \$300 by **check, money order, credit card**, or **pay online at [www.armrit.org](http://www.armrit.org)**. **Note: [Computer Based Testing Company fees are separate](#).**
  - 3) Include all necessary documentation such as; resume (CV), diplomas, certificates, original recommendation letters, copy of Drivers or Non-Drivers Picture ID.
  - 4) Evaluation of foreign education (**if applicable**), see page 21 for acceptable agencies.
  - 5) Send all documentation to: **ARMTRIT.**  
2444 NW 8<sup>th</sup> Street  
**Note: Do Not Send Certified!** Delray Beach, FL 33445
  - 6) Once all documentation is received and reviewed, the Applicant will receive **either** an 'Application Review Letter' will be sent to the Applicant or a 'Secure Email' will be sent to the **Computer Based Testing Company** (PSI) verifying the Candidates Authorization to sit for the exam.  
**Note: [Computer Based Testing Company fees are separate](#).**
  - 7) An 'Application Review Letter' informs the Applicant to provide required documents that were not included in their application package.
  - 8) The Secure Email will provide the Candidate's information to the **Computer Based Testing Company**, and PSI, the **Computer Based Testing Company**, will contact the Candidate by Email with **instructions to schedule their exam online** (the Candidate should check their Spam/Junk Mail for this email).
  - 9) Upon completion of the exam, you will receive a score sheet from the **Computer Based Testing Company**. Immediately alert the Registry by Email: [armrit@msn.com](mailto:armrit@msn.com) or Phone: **561-450-6880**
  - 10) Upon successfully passing the exam, a certificate & ID card will be processed.
  - 11) If the exam is failed, the Candidate must visit 'ARMTRIT Services' on the homepage: [www.armrit.org](http://www.armrit.org) and go to Retake Application to process the application online, **with fee**, within **thirty (30) days** of the date of the score sheet. **Note: [Computer Based Testing Company fees are separate](#).**
  - 12) Maximum attempts to pass the exam are three (3). Failure to pass in three (3) attempts requires the candidate to enroll in a MRI review class or MRI program and start the application process over.
- \* **[A Candidate who fails to sit for the exam within the one \(1\) year period must start the application process again! No Exceptions!](#)**
- \*\* **[A Fee of \\$50 Will Be Charged For A Replacement Letter!](#)**



