

Advanced Medical Imaging *Program Proposal*



Presented to the South Dakota
State Board of Education
May 2014
For Implementation
Fall 2014



Mitchell Technical Institute
1800 E. Spruce St. • Mitchell, SD 57301



Mitchell Technical Institute

Program Title:	Advanced Medical Imaging
Length of Program:	Associate of Applied Science (9 months)
	Prerequisite: ARRT Registered in Radiography, Nuclear Medicine Technology, or Radiation Therapy
	Optional Exit Points: Computed Tomography Certificate (16 credits) and Magnetic Resonance Imaging Certificate (16 credits)
Number of Students:	36
Projected Start Date:	Fall 2014

Executive Summary

Mitchell Technical institute is requesting approval to offer an Associate of Applied Science Degree in Advanced Medical Imaging. This degree program will provide students who are already hold a primary pathway registration with the American Registry of Radiologic Technologists the opportunity to obtain specialized skills in magnetic resonance imaging (MRI) and computed tomography (CT) which will increase their employability and wages and fill a growing need in the state's healthcare industry. In addition, certificate options will be available for employed technologists who want to pursue advanced skills in MRI or CT.

Identification and Description of the Program:

Magnetic Resonance Imaging (MRI) technologists operate MRI scanners, which use strong radio frequencies and magnetic fields to create a three-dimensional image of a patient's body tissues, which are then used by a physician to aid in making an accurate diagnosis. Computed tomography (CT) is an advanced form of diagnostic imaging where technologists use x-rays and computers to produce cross-sectional anatomical images of the human body for diagnostic testing, radiation therapy treatment planning, and nuclear medicine PET scanning. Mitchell Technical Institute's Advanced Medical Imaging program is designed to deliver the didactic coursework and clinical experience in magnetic resonance imaging and computed tomography that will prepare students to become certified technologists in these advanced imaging technologies.

The content of the Advanced Medical Imaging program at Mitchell Technical Institute will be based on the Practice Standards of the American Society of Radiologic Technologists and the Content Specifications for the Magnetic Resonance Imaging and Computed Tomography examinations of the American Registry of Radiologic Technologists. All didactic courses will be offered online. Students will also be required to complete clinical activities, with the assistance of MTI or their employers, to demonstrate competence in these advanced imaging procedures. The clinical component is designed to meet clinical competency requirements of the American Registry of Radiologic Technologists (ARRT).

Upon successful completion of the program, the student will be qualified to sit for either the ARRT Advanced Registry in Magnetic Resonance Imaging or the ARRT Advanced Registry in Computed Tomography or both.

Objectives and Purpose of the Program:

The Advanced Medical Imaging program will be dedicated to offering students the experience and overall training to become successful technologists in both MRI and CT technologies. Graduates of the program will be able to:

- Work with patients to prepare them for MRI tests and scans
- Explain technical and procedural portions of the MRI scan to patients
- Operate MRI imaging equipment safely, effectively, and efficiently
- Expose, process, and evaluate MRI images
- Qualify to sit for the ARRT Advanced Registry in Magnetic Resonance Imaging
- Prepare patients for computed tomography diagnostic procedures
- Position patients to correctly capture the CT images requested by a physician
- Operate CT equipment to produce cross-sectional images of patients' bones, organs and tissues
- Qualify to sit for the ARRT Advanced Registry in Computed Tomography.

Methods of Attaining the Objectives of the Program:

Pending approval, MTI will develop marketing materials and recruit students. MTI will hire instructors and, with assistance from an advisory committee, will finalize course syllabi, purchase equipment and supplies, develop schedules, secure resource materials, arrange clinical sites, and interview staff to hire.

MTI provides assurance that it possesses the resources and staff necessary to:

- Develop marketing materials and recruit students
- Recruit and supervise qualified staff
- Assess the abilities of students for good program and course placement
- Provide access to online library materials
- Develop and administer budgets
- Make available textbooks and other instructional resources
- Provide career and personal counseling to students
- Evaluate programs and staff
- Assist students in finding jobs
- Secure input from industry through advisory committees
- Maintain membership in professional organizations and provide time and fiscal resources for professional development
- Provide financial aid
- Assure that clinicals meet the clinical competency requirements of the American Registry of Radiologic Technologists
- Provide services to disabled and nontraditional students

Description of Labor Market Demand

Even during a slow economy, jobs in health care have stabilized or grown. This is especially true of the technical health care arena, which includes MRI and CT technologists and other specialty staff members.

Experts at the U.S. Bureau of Labor Statistics predict that job openings for radiologic technologists will rise 21 percent by 2022, much faster than the average for all occupations. Technologists with advanced skills such as in MRI and CT will be in even greater demand due to an aging population, more

sophisticated diagnostic capabilities, and health legislation that will expand the number of patients who have access to health insurance.

Hospitals will remain the main employer of MRI and CT technologists, but a number of new jobs will be in physicians' offices and in outpatient imaging centers. Employment in these healthcare settings is expected to increase because of the shift toward outpatient care whenever possible, as well as the decline in the cost of equipment (Bureau of Labor Statistics, U.S. Department of Labor, Occupational Outlook Handbook, 2014-15 Edition, Radiologic and MRI Technologists, on the Internet at <http://www.bls.gov/ooh/healthcare/radiologic-technologists.htm> (visited April 08, 2014). Job growth is projected by federal and state government experts as follows:

United States	Employment		Percent Change	Job Openings
	2012	2022		
Magnetic resonance imaging technologists	30,100	37,200	+24%	7,100
Radiologic technologists and technicians*	199,200	240,800	+21%	41,500

Source: Bureau of Labor Statistics, Employment Projections program.

South Dakota	Employment		Percent Change	Annual Demand
	2010	2020		
Radiologic technologists and technicians*	915	1,110	+21.3%	34

Labor Market Information Center Occupational Employment Projections, South Dakota Department of Labor and Regulation, on the Internet at http://dlr.sd.gov/lmic/occupation_projections.aspx (visited April 8, 2014)

*CT is a separate certification for radiographers with specialized training.

Population Served:

The program is available to applicants who are registered with the ARRT (or a candidate for certification) in Radiography, Nuclear Medicine Technology, or Radiation Therapy. MTI does not discriminate in its educational programs on basis of race, color, creed, religion, age, sex, disability, national origin or ancestry. The program will draw its students from South Dakota, but could attract

students from outside the state due to its online delivery. The A.A.S. program will be especially beneficial for recent graduates of radiologic technology programs who want to acquire advanced skills. MTI expects that the certificate options will be especially of interest to working radiologists who want to increase their skills and career opportunities while continuing their employment.

Projected Three-Year Budget:

	2014-2015	2015-2016	2016-2017
Salaries/Benefits	\$60,000	\$61,800	\$63,654
Equipment	\$2,500	\$1,000	\$1,000
Supplies	\$500	\$500	\$500

Program Competencies and Entry and Exit Points:

Entry point will be the beginning of a traditional fall or spring semester. The exit point for the degree will be at the completion of coursework, generally at the end of two semesters (nine months). Graduates will receive an Associate of Applied Science degree in Advanced Medical Imaging.

Two optional exit points will be available. A Certificate in Magnetic Resonance Imaging Technology will be awarded to students who complete the 16 credit hours of didactic coursework covering MRI theory and practice. A Certificate in Computed Tomography Technology will be awarded to students who complete the 16 credit hours of didactic coursework covering CT theory and practice.

In all options, students must maintain an overall GPA of 2.0 to graduate. The curriculum is competency-based and will be reviewed and approved by a program advisory committee. Additionally, MTI will adhere to any future guidelines or requirements by the ARRT.

Statement of Nonduplication:

At the present time, we are not aware of a similar degree offered anywhere in South Dakota.

Curriculum Design and Research:

Applicants to the program must be registered or a candidate for certification by the American Registry of Radiologic Technologists in Radiography, Nuclear Medicine Technology, or Radiation Therapy.

Semester One

Course Title	Credit Hours
Introduction to Magnetic Resonance Imaging	2
Cross-sectional Anatomy and Pathology	3
MR Physics	3
MR Imaging Principles	4
MR Imaging Procedures	4
Total Credits	16

Semester Two

Course Title	Credit Hours
Introduction to CT Imaging	2
CT Physics	3
CT Imaging Principles	4
CT Imaging Procedures	4
Total Credits	13*

Students earning the A.A.S. degree will also be required to meet MTI's general education requirements (16 credit hours in mathematics, social science, behavioral science, English, computer applications and student success). In addition, MTI will accept up to 16 hours of transferred credit upon completion of the student's clinical experience.

Students can earn the MRI Certificate by completing the Fall Semester curriculum (16 credit hours). *Students who choose to earn only the CT Certificate must also complete the CT curriculum as well as one course from the MR curriculum, Cross-sectional Anatomy and Pathology for a total of 16 credit hours. Certificate students will not be required to meet general education requirements.

Course Descriptions

MR 100 – Cross-sectional Anatomy and Pathology - Begins with a review of gross anatomy of the entire body. Detailed study of gross anatomical structures will be conducted systematically for location, relationship to other structures and function. Gross anatomical structures are located and identified in axial (transverse), sagittal, coronal and orthogonal (oblique) planes. Illustrations and anatomy images will be compared with CT and MR images in the same imaging planes and at the same level when applicable. The characteristic appearance of each anatomical structure as it appears on CT, MR and ultrasound images, when applicable, will be stressed. Content also provides thorough coverage of diseases commonly evaluated with cross-sectional imaging.

MR 101 - Introduction to Magnetic Resonance Imaging - Provides an introduction to the science and practice of magnetic resonance imaging to include the history of MRI, organization of an MRI department and responsibilities of the MRI technologist. Additional content is designed to provide the basic concepts of patient information management including medical records management concerns, privacy, ethical and legal issues as well as regulatory issues. This course will offer an overview of imaging sciences in healthcare, including regulation and professional standards. In addition, the course provides information on all aspects of patient care in the MRI environment including patient assessment, pharmacology, and IV contrast screening. Finally students will learn the safety issues and practices unique to the MRI environment.

MR 200 – MR Physics - Provides information on the fundamentals of acquiring an MR signal as well as a comprehensive overview of the system components required to complete the necessary processes for MR image acquisition. Factors affecting image weighting and contrast in generating an MR signal are discussed. Signal encoding, image formation, and optimal image quality are emphasized. Students will learn the basic elements of establishing an MRI Quality Control program.

MR 230 – MR Imaging Principles - The parameters and imaging options used to build pulse sequences for routine and advanced MR imaging applications. Students will cultivate proficiency with interpreting and building pulse sequence

diagrams. The course also provides information on image artifacts, what causes them, and how they are properly managed.

MR 250 – MR Imaging Procedures - Scan procedures related to the all body systems and regions typically evaluated with MRI. Emphasis is placed on patient set-up, scan parameters, methods of data acquisition and contrast administration. Anatomical structures and the plane that best demonstrates anatomy are discussed as well as signal characteristics of normal and abnormal structures. The variations in imaging parameters for specific body regions and the resultant effect on signal characteristics are discussed. Evaluation criteria for determining the quality of images is reviewed. Finally, students will research industry periodicals and other sources to present contemporary ideas and practices from the MRI field.

CT 101 – Introduction to Computed Tomography - An introduction to the science and practice of computed tomography. Topics include the history of CT, the role of the CT technologist, and factors impacting image acquisition and display. Additional content is designed to provide the basic concepts of patient information management including medical records management concerns, privacy, ethical and legal issues as well as regulatory issues. This course will offer an overview of imaging sciences in healthcare, including regulation and professional standards. In addition, the course provides information on all aspects of patient care in the CT environment including patient assessment, pharmacology, and IV contrast screening. Finally students will learn the safety issues regarding the interaction of radiation and living systems.

CT 200 – CT Physics – Physical principles involved in computed tomography, image acquisition and image display and manipulation. The historical development and evolution of computed tomography is reviewed. Physics topics covered include x-radiation in forming the CT image, CT beam attenuation, linear attenuation coefficients, tissue characteristics and Hounsfield numbers application. Data acquisition and manipulation techniques, and image reconstruction algorithms will be explained. CT components and operations will be explored with full coverage of radiographic tube configuration, collimator design and function, detector types, characteristics and functions and the CT computer and array processor. The differences in serial scanning, single-row detector helical scanning, and multi-row detector helical scanning will be studied. Image display will be discussed from ADC in the Data Acquisition System, including explanation of binary conversion, through the image reconstruction process resulting in a 2D image display and discussions on DFOV, SFOV, matrix, pixels, voxels, and window level and width.

CT 230 – CT Imaging Principles - Designed to develop a strong understanding of the imaging parameters which influence image noise and SNR and the 3 elements of image quality: spatial resolution, contrast resolution, and temporal resolution. A comprehensive study of post processing techniques and their

common applications will be reviewed. Content identifies common CT image artifacts including their cause and explanations on improving or eliminating them. Explanations of imaging topics include exam protocols, image display, improving image quality, recognition of artifact characteristics and minimizing artifacts. Finally, quality control testing and quality assurance programs are discussed as recommended by the American College of Radiology and other regulatory agencies.

CT 250 – CT Imaging Procedures - Detailed coverage of routine procedures for CT imaging of body systems in adults and pediatric patients. Topics include, but are not limited to, indications for the procedure, patient education, preparation, orientation and positioning, patient history and assessment, contrast media usage, scout image, selectable scan parameters and archiving of the images. CT procedures will be taught for differentiation of specific structures, patient symptomology and pathology. CT images studied will be reviewed for quality, anatomy and pathology. CT procedures vary from facility to facility and normally are dependent on the preferences of the radiologists.

Wage Factor:

The American Society of Radiologic Technologists performs a national comprehensive survey of its members' compensation every three years. In the 2013 survey, MRI technologists reported a \$68,384 average annual salary, which was a 5.0% percent increase over the average annual salary in 2010. Wages for MRI technologists were 27% higher than those reported by radiographers in the same survey. Computed tomography technologists reported a \$63,454 average annual survey, which was a 4.9 percent increase over the \$60,586 average annual salary in 2010. Wages for CT technologists were 18% higher than that reported by radiographers in the same survey.

The ASRT survey also reported mean salaries by state. MRI technologists in South Dakota reported a 10% higher wage (\$57,168) than that reported by radiographers in the state (\$51,805).

As shown in the following table, the U.S. Bureau of Labor Statistics reports the nationwide median annual wage for MRI technologists was \$66,050 in May 2013. The U.S. BLS does not report wages for CT technologists. CT is a separate certification for radiographers with specialized training.

Location	Pay Period	10%	25%	Median	75%	90%
United States	Hourly	\$22.03	\$26.37	\$31.75	\$36.70	\$43.35
	Yearly	\$45,820	\$54,860	\$66,050	\$76,330	\$90,160
South Dakota	Hourly	\$17.45	\$20.54	\$25.10	\$31.18	\$35.81
	Yearly	\$36,296	\$42,723	\$52,208	\$64,854	\$74,485

National Data Source: Bureau of Labor Statistics, Occupational Employment Statistics Survey (May 2013)
 State Data Source: South Dakota Occupational Worker and Wage Estimates (May 2012)

CIP Code: 51.0920 Magnetic Resonance Imaging (MRI) Technology/
 Technician

Appendix A

From: Tom Beaudry <tom.beaudry@prairielakes.com>
Date: April 11, 2014 at 1:15:18 PM CDT
To: "'Kristi.Rayman@mitchelltech.edu'" <Kristi.Rayman@mitchelltech.edu>
Cc: Tom Beaudry <tom.beaudry@prairielakes.com>
Subject: MTI MRI/CT



Hi Kristi,

I appreciate the opportunity to weigh in on the on-line MRI/CT training pathways. From our own historical perspective, at times our department struggles with not having the appropriate number of MRI and CT staff to conduct day to day operations and after hour call for CT. To shore up resignations and or maternity leaves we have hired technologists with these skill sets and have cross trained technologists for years to have a deep enough bench, especially for call. When an unexpected resignation arises, we have had to bring in expensive locum CT technologists to bridge us over until we can land a candidate with the appropriate MRI/CT skill set and/or while we cross train one of our employed technologists.

With that being said it is a cost and challenge to cross-train our technologists. During the duration of time to cross train you have to replace that technologist's position with another technologist.

Prairie Lakes Hospital is no stranger in managing a collaborative effort in educating Radiology students. Our department has learned how to handle the challenges of becoming a classroom and a still be a health-care provider. Our department has a very positive atmosphere, the Radiology staff understand their roles of being mentors to students who have a desire to learn imaging.

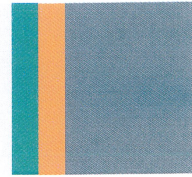
I want to close by stating Prairie Lakes Hospital is interested in supporting a clinical partnership, consulting, or even enrolling PLH Radiology staff as candidates for the training as long as we have the numbers clinically to get these students all the CT or MRI exams they need in that short time to qualify for their registry. When Mary and Jenna were filling out their MRI papers in order to write their MRI Boards they went back over 18 months on some procedures.

Thank you,

Thomas Beaudry RTR RDCS
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Jerrilyn McNary

917 North Washington Avenue
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April 10, 2014

Vicki Weise
Office of Academic Affairs
1800 East Spruce Street
Mitchell SD 57301

Dear Vicki Weise,

As a Director of a smaller facility, of which we have technologists responsible for multi modalities. I am very excited to have the opportunity to provide my staff with an opportunity to acquire education without travel expense nor staff replacement costs.

I am a strong believer in not having button pushing technologists, but the cost of sending staff off site to acquire this type of training is expensive and very limiting in experience. Having this type of educational opportunity available at one's own time management pace and still be available for their work schedule is so beneficial for my size of facility.

Our intent would be to enroll one of my technologists in the MR program once this is up and going. Our facility would also consider being a clinical site for others enrolled in the program. Madison Community Hospital Radiology Department is presently a clinical site for the radiology program at Minnesota West so we are very familiar with this type of training.

Warm regards,

Jerrilyn McNary



Office of Academic Affairs
1800 E. Spruce St
Mitchell, SD 57301

Tom Davis B.S., RT(R)(CT)
Sanford Chamberlain Radiology
Chamberlain, SD 57325

4/16/14

To the Office of Academic Affairs,

This letter is being sent in regards to support for the proposed on-line MR/CT training pathways that is being proposed at MTI.

As a Director of radiology in this area for over 12 years, and being actively involved in advancement of the radiologic services and the continued training, advancement, and competency of technologists, I firmly believe that a program like this would be an incredible enhancement to the quality of training that can be provided which ultimately benefits the quality of care being given to our patients.

Because of distance and work commitment, an on-line program would be the opportunity of choice for many technologists. I would see many rural hospitals such as mine taking advantage of this type of advanced training if it were available and to be offered by an educational institution that already has a proven track record and reputation in the field of radiologic sciences only adds to the potential of this program's success.

I would encourage MTI to pursue this pathways program for the benefit of the radiology field, the patients we serve, and for the betterment of your institution in providing leading edge venues for advancement in healthcare education

Sincerely;

A handwritten signature in black ink, appearing to read "Tom Davis B.S., RT(R)(CT)".

Tom Davis B.S., RT(R)(CT)
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