Please Note: At MSUCOM, we are constantly working to improve our curriculum and to meet new AOA accreditation guidelines. We need to meet the challenges of modern medicine that force us to innovate. While major changes will generally be instituted at the beginning of the school year, most minor changes may be implemented semester to semester.

Please be mindful of the need to read your syllabi before beginning your rotations.
Introduction and Overview

Welcome to the radiology clerkship. During this two-week clerkship, it is anticipated you will have the opportunity to build on your current knowledge of diagnostic imaging to better equip you both for the remainder of your clinical experiences, as well as in your postgraduate training.

This curriculum is extremely flexible consisting of 17 on-line education modules. The MSU Desire 2 Learn (D2L) RAD 610 site offers additional resources to assist you in obtaining the maximum value from your radiology clerkship. The on-line modules are available from the D2L site and from direct links on the Michigan State University Radiology web site at: http://education.rad.msu.edu/Courses/RAD_Clerkship/index.html

Please familiarize yourself with the content of the syllabus, as it will be your guide to managing this course.

Goals and Objectives

GOALS

Our overall goal of this rotation is to provide our students with a basic level of understanding of the principles and applications of diagnostic imaging. We offer direct exposure to the individuals obtaining (i.e. technologists) and interpreting (i.e. Radiologists) the diagnostic examinations.

OBJECTIVES

- Reinforce the student’s understanding of x-ray, ultrasound, CT, MRI, Nuclear Medicine and PET imaging obtained during the first 2 years of the MSU-COM curriculum.

- Gain additional insight into how diagnostic imaging fits into the multidisciplinary approach to patient care and understand the importance of communication, professionalism, and teamwork between clinicians and radiologists relating to patient management while developing a better understanding of the synergies possible between clinicians and radiologists in the consultative care of patients.

- Encourage correlation of diagnostic images with previously learned normal and pathologic anatomy and pathophysiology to increase the student's understanding and recognition of common processes and pathology available from diagnostic images.

- Understand the basic requirements and restrictions necessary to obtain quality imaging by the various modalities and the impact on that quality by variation in patient condition, size, and mental status while introducing the students to the indications, contra-indications, patient preparation, post-procedure care, and relative radiation exposure and risks for various diagnostic imaging exams.
• Increase the student's knowledge of the various diagnostic imaging modalities offered by a modern radiology department and achieve a better understanding of how to select and sequence the appropriate imaging examinations for specific clinical presentations while considering the relative costs of different diagnostic imaging exams to be better able to plan and sequence patient exams that optimizes outcome and cost-effective patient care.

• Offer the student the opportunity to observe diagnostic imaging exams, instill sensitivity towards the patient's needs and apprehension about particular procedures and discuss the results and interpretation with the radiologist.

• Increase the students understanding of image digitization, how variables in digitization influence resolution and the computer's impact on diagnostic imaging (PACS).

**College Program Objective**

In addition to the above course-specific goals and learning objectives, this clerkship rotation also facilitates student progress in attaining the College Program Objectives. Please refer to the complete list provided on the MSUCOM website.

**References**

Selected texts can be of value during the clerkship and to assist in the understanding of the materials included in the on-line learning modules. Suggested readings will be provided via D2L but are not essential for the successful completion of the clerkship.

1. Felson’s Principles of Chest Roentgenology, A Programmed Text, Third Ed. by Lawrence R. Goodman

Textbooks, current radiology periodicals, and digital teaching series may be available in the onsite Radiology library and may vary somewhat by site.

Full service, extended hour, libraries are present at Michigan State University with onsite medical librarians, web-based searchable medical databases, and standard medical journals in both print and electronic formats. In addition, all MSU students have 24-hour access to the extensive online Michigan State University electronic library, including databases and electronic journals.
**Student Responsibilities**

The student is expected to be available daily in their assigned radiology department for the assigned hours each day (typically 8:00 – 5:00). During the course of the rotation the student is expected to participate in the 17 on-line modules and the associated quizzes. The preparation of a brief PowerPoint presentation on a Radiology related topic of the student’s choice to be presented to the local faculty/house staff is required during the second week of the rotation. Specific dress requirements may be dictated by the location specific faculty dependent on the clinical experiences the student might be scheduled for on a given day. White coats should be worn unless instructed otherwise by the local faculty.

**MSUCOM Student Responsibilities**

**Clinical Responsibilities**

- Students are expected to function collaboratively on health care teams that include health professionals from other disciplines in the provision of quality, patient-centered care.

**Academic Responsibilities**

- Students are expected to identify, access, interpret and apply medical evidence contained in the scientific literature related to patients health problems.
- Students are expected to: assess their personal learning needs specific to this clinical rotation, engage in deliberate, independent learning activities to address their gaps in knowledge, skills or attitudes; and solicit feedback and use it on a daily basis to continuously improve their clinical practice.
Course Requirements

ACADEMIC

1. Quizzes: Completion of quiz assignment on D2L associated with each module. Satisfactory completion of the 17 quizzes with an overall 80% score is necessary for the completion of the course.
2. PowerPoint presentation: Preparation of a PowerPoint on topic of choice in radiology with presentation to local faculty and copy to MSU radiology via course dropbox in D2L. This is due before the end of the 2nd week of this rotation.

CLINICAL

1. Attending Evaluation of Rotation: A satisfactory evaluation of the student by an attending physician. The determination of a satisfactory attending evaluation is governed by the College's Policy for Retention, Promotion, and Graduation. This evaluation is due after the rotation is complete and must be submitted to the hospital's Medical Education office.
2. Student Evaluation of Rotation: To submit this evaluation, access the 'evaluate' link in the Kobiljak schedule. This evaluation is due at the end of the rotation.

Corrective Action Process for Deficient Academic Requirements

If a student does not successfully complete the academic requirements of the course, the student will be permitted to go through a “Corrective Action” process.

The “Corrective Action” process for Radiology 610 is as follows:

1) Module D2L Quizzes – The student will be provided a total of 3 opportunities to satisfactorily complete each module quiz. If a minimum overall combined 80% quiz score is not achieved within those 3 opportunities, the student will receive an “N” grade and will proceed to the remediation process.
2) PowerPoint Presentation – In the case the student does not satisfactorily complete and submit the PowerPoint Presentation, the student will be notified via email and given 24 hours to successfully submit their presentation to the course dropbox.

If a student completes the corrective action successfully, as determined by the Instructor of Record, the student will receive credit for the deficient academic grading requirement(s). If a student does not complete the corrective action successfully, as determined by the Instructor of Record, the student will receive an “N” grade for the course.
**Unsatisfactory Clinical Performance**

A student’s clinical performance will be assessed through the Attending Clinical Clerkship Rotation Evaluation. Unsatisfactory Attending Evaluations are governed by the Policy for Retention, Promotion and Graduation (4.e). An overall “Below Expectations” rating on Section 1 of the Clinical Clerkship Rotation Evaluation will be referred to the Instructor of Record/Department Chairperson for review and grade determination. Students who receive two or more Clinical Clerkship Rotation Evaluations with an overall “Below Expectations” rating will be referred to the COSE Clerkship Performance Subcommittee for review. An overall “Below Expectations” rating on Section 2 of the Clinical Clerkship Rotation Evaluation will be referred to the Associate Dean/Student Services. In consultation with the Instructor of Record/Department Chairperson a determination of action will be reached.

**IMPORTANT NOTE:** The student will maintain an “Extended” (ET) grade until they have successfully completed all academic and clinical requirements for the course.
Base Hospital Requirements
(To be defined and evaluated by individual hospitals)
Radiology Core Competency/Learning Modules

Unit 1 / Module 1: Introduction/Chest Radiography
- Review X-Ray production
- Learn image capture mechanisms
- Identify radiographic attenuation principles
- Review normal chest X-Ray/technical considerations
- Compare normal variations/congenital variation in imaging chest anatomy
- Identify technical artifacts

Unit 1 / Module 2: Chest Radiography - Continued/Inflammatory processes and Lobar disease
- Review chest radiography positioning
- Review chest imaging presentation of inflammatory processes
- Understand differences in presentation of alveolar and interstitial disease
- Understand pleural inflammatory disease

Unit 1 / Module 3: Chest CT/PET imaging Lung neoplasm
- Review Computed Tomography operational principles
- Understand PET imaging operational principles
- Review X-Ray, CT and PET presentation of lung/mediastinum neoplasm

Unit 1 / Module 4: Chest Radiography/Cardiac Evaluation Pulmonary Embolism
- Review cardiac evaluation with diagnostic imaging techniques – application and interpretation
- Review congestive heart failure evaluation with diagnostic imaging
- Identify cardiac ultrasound techniques and appearances
- Review coronary angiography techniques
- Understand CT evaluation of the heart techniques and appearances
- Review MRI evaluation of the heart techniques and appearances
- Understand Radionuclide cardiac imaging – perfusion, blood pool and metabolism techniques and appearances
- Understand principles, techniques, and current status of pulmonary embolism detection

Unit 2 / Module 1: Imaging Evaluation of the Abdomen
- Review abdomen evaluation imaging technologies – their application and interpretation
- Understand renal calculi disease evaluation
- Recognize intestinal obstruction/ileus evaluation utilizing x-ray
- Understand pneumoperitoneum evaluation

Unit 2 / Module 2: Gastrointestinal Imaging
- Understand the utilization of positive and negative contrast agents in the GI tract including both GI studies and CT
- Identify the different varieties of GI tract diverticula
- Understand and identify hiatal hernia
- Understand the variable causes of GI tract obstruction, i.e. foreign goodies, ulcer disease, neoplasm, volvulus & hernia
- Identify inflammatory disease of the GI tract, infection, ulcer disease, regional enteritis, ulcerative colitis, appendicitis & diverticulitis
- Recognize neoplastic disease of the GI tract

Unit 2 / Module 3: Hepatobiliary disease, Pancreatic Disease
- Review and understand the imaging modalities used in hepatobiliary and pancreatic evaluation including x-ray, radioisotope, ultrasound, CT and MRI
- Understand the imaging presentation of gallbladder pathology including cholecystitis and cholelithiasis
- Understand the imaging presentation of focal and diffuse liver diseases including cirrhosis, hepatitis, vascular abnormalities and neoplasm
- Review and understand the appearance of pancreatic disease including pancreatitis and neoplasm

Unit 2 / Module 4: Evaluation of the urinary tract
- Review and understand the imaging modalities utilized in evaluation of the urinary tract including x-ray, ultrasound, nuclear medicine, CT, MRI and PET
- Review the imaging anatomy of the urinary tract
- Understand the nature and imaging appearance of various renal calculi
- Understand the relative benefits and risks of iodinated contrast agents utilized in diagnostic x-ray base imaging
- Understand the imaging appearances of various developmental anomalies of the urinary tract
- Understand the imaging presentation of neoplasms affecting the urinary tract
- Understand the imaging approach to conditions affecting the prostate gland and the scrotum/scrotal contents

Unit 3 / Module 1: Musculoskeletal imaging introduction
- Review and understand the imaging modalities utilized in the evaluation of musculoskeletal structures including x-ray, ultrasound, nuclear medicine, CT, MRI and PET
- Review the normal anatomy of bone and the normal ossification structures
- Review and understand the imaging evaluation and findings associated with skeletal trauma and fracture
- Understand the descriptive terms utilized in the description of fractures and dislocations
- Demonstrate an understanding of the principles related to the development of stress injury to musculoskeletal structures
- Understand the varied appearance of musculoskeletal soft tissue injuries utilizing US and MRI

Unit 3 / Module 2: Bone tumors and tumor like conditions of bone
- Review and understand the imaging techniques utilized in the evaluation of bone tumors and tumor like conditions of bone including x-ray, CT, MRI and Nuclear Medicine
- Review the descriptive terms utilized in the evaluation of bone lesions
- Understand the steps in the evaluation of bone lesions including the modalities and the appropriate sequence of evaluation
- Review and understand the imaging appearance of benign and malignant neoplastic processes involving bone
- Review the imaging appearances of infection involving the skeletal system
- Develop an awareness of other bone abnormalities that may mimic more serious
conditions and their imaging appearance

Unit 3 / Module 3: Imaging presentations of arthritis imaging evaluation of the aging skeletal system
- Review and understand the imaging evaluation of the various sero-negative and sero-positive arthritides
- Understand the imaging approach to evaluation of declining bone mass in the aging adult

Unit 3 / Module 4: Pediatric Fractures & Other unusual bone diseases
- Identify and describe Salter-Harris fractures
- Identify and describe findings and mechanisms of injury of fractures peculiar to the pediatric population
- Understand the mechanisms and appearances of delayed and non-union fractures
- Demonstrate an understanding of the appearance of, significance of, and cause of tendon insertion avulsion injuries
- Demonstrate an awareness of various skeletal manifestations of various defects of osteochondral structures and their appearance by diagnostic imaging
- Demonstrate an awareness of skeletal manifestations of vascular compromise abnormalities and their appearance by diagnostic imaging

Unit 4 / Module 1: Spine evaluation
- Understand the techniques of evaluating the appearance of the spine utilizing imaging techniques including x-ray, CT and MRI
- Recognize and understand developmental anomalies of the spine that may be demonstrated with diagnostic imaging techniques
- Recognize and understand the appearance of spine injury including both fractures and dislocations with the knowledge of the appropriate modality to choose
- Recognize and understand the appearances related to vertebral disk disease using imaging technologies including x-ray, CT and MRI
- Understand the basic principles of myelography and its value in evaluating the thecal sac, cord and roots

Unit 4 / Module 2: Neuroradiology
- Review and understand the imaging modalities utilized in the evaluation of the neural axis
- Review the findings related to head trauma using imaging technologies
- Understand the imaging of pituitary disease
- Understand the imaging of, and diseases affecting the orbits
- Understand the imaging appearances of primary and metastatic benign and malignant brain neoplasms
- Understand the appropriate imaging work-up of headache and the imaging appearances of various underlying etiologies for headache
- Understand the application of imaging modalities in the diagnosis of intracranial vascular abnormalities

Unit 4 / Module 3: Imaging evaluation of facial and neck abnormalities
- Review imaging of pediatric airway disease, techniques and findings
- Review evaluation of swallowing difficulties originating in the neck by imaging
techniques
- Review imaging of congenital cystic structures arising in the neck
- Understand imaging of facial and neck trauma
- Review imaging of infectious processes affecting the facial structures and neck

Unit 4 / Module 4: Pelvic ultrasound
- Review and understand the principles of diagnostic ultrasound and its application to pelvic structure
- Review and understand the application of ultrasound in the evaluation of ovarian disease including cysts, torsion and neoplasm
- Review and understand the application of ultrasound in evaluation of diseases of the uterus including infection and neoplasm
- Review and understand the applications of ultrasound to the evaluation of pregnancy and its complications including ectopic pregnancy and placental abnormalities

Unit 4 / Module 5: Pediatric Imaging
- Review and understand the differences inherent in the imaging of the pediatric patient compared to the adult patient
- Understand the three main types of respiratory distress that may be encountered during the newborn period
- Review and understand the various developmental anomalies that can be evaluated with diagnostic imaging
- Review and understand the application of the various imaging modalities in the pediatric population

**UNSATISFACTORY CLINICAL PERFORMANCE**

A student’s clinical performance will be assessed through the Attending Clinical Clerkship Rotation Evaluation. Unsatisfactory Attending Evaluations are governed by the Policy for Retention, Promotion and Graduation (4.e).

An overall “Below Expectations” rating on Section 1 of the Clinical Clerkship Rotation Evaluation will be referred to the Instructor of Record/Department Chairperson for review and grade determination. Students who receive two or more Clinical Clerkship Rotation Evaluations with an overall “Below Expectations” rating will be referred to the COSE Clerkship Performance Subcommittee for review.

An overall “Below Expectations” rating on Section 2 of the Clinical Clerkship Rotation Evaluation will be referred to the Associate Dean/Student Services. In consultation with the Instructor of Record/Department Chairperson a determination of action will be reached.
The following are the standard MSUCOM policies students must adhere to across rotations.

**ATTENDANCE POLICY**

Clerkship activities are mandatory and timely attendance is expected at all educational events.

In the event a student must be absent from clerkship activities, he/she must, firstly, have prior approval from the Graduate Medical Education office (DME/DIO, Clerkship Director, and/or Student Clerkship Coordinator per the rotation sites process/policy). The clinical preceptor must also approve the absence, and determine an acceptable make-up plan which may include, but is not limited to: additional time on rotation, additional presentation(s), or written assignment(s). In the event of an emergency, the student must contact the Graduate Medical Education office and clinical preceptor as soon as the situation allows. Any exception to this attendance policy for any given rotation will be noted in the course syllabus.

Abuse of this policy, as determined by the GME office or a clinical preceptor, may be documented in a student evaluation(s) and/or reported to the Associate Dean of Student Services at MSUCOM via the Student Incident Report Form: [http://com.msu.edu/Students/Registrar/Policies.htm](http://com.msu.edu/Students/Registrar/Policies.htm) or via phone call to the Associate Dean of Student Services (517-353-8799).

**ROTATION SPECIFIC EXCEPTIONS TO THE ABOVE ATTENDANCE POLICY: NONE**

**Policy for Medical Student Supervision**

**Supervisors of the Medical Students in the Clinical Setting**

The MSUCOM curriculum includes required clinical experiences in a variety of clinical learning environments. The role of the student is to participate in patient care in ways that are appropriate for the student’s level of training and experience and to the clinical situation. The student’s clinical activities will be under the supervision of licensed physicians. This supervising physician may delegate the supervision of the medical student to a resident, fellow, or other qualified healthcare provider, however, the supervising physician retains full responsibility for the supervision of the medical students assigned to the clinical rotation and must ensure his/her designee(s) are prepared for their roles for supervision of medical students.

The physician supervisor and his/her designee(s) must be members in good standing in their facilities and must have a license appropriate to his/her specialty of practice and be supervising the medical student within that scope of practice as delineated by the credentialing body of the facility.

**Level of Supervision/Responsibilities**

Clinical supervision is designed to foster progressive responsibility as a student progresses through the curriculum, with the supervising physicians providing the medical student the opportunity to demonstrate progressive involvement in patient care. MSUCOM students will be expected to follow
clinical policies of the facility regarding medical records and clinical care. Medical student participation in patient history/physical exam, critical data analysis, management, and procedures will include factors, but not limited to:

- The students demonstrated ability
- The students level of education and experience
- The learning objectives of the clinical experience

First and second year medical students will be directly supervised at all times (supervising physician or designee present or immediately available.

Third and fourth year medical students will be supervised at a level appropriate to the clinical situation and student’s level of experience. For some tasks, indirect supervision may be appropriate for some students. Direct supervision would be appropriate for advanced procedures.

Supervising physicians will provide medical students with timely and specific feedback on performance. The supervising physician will complete a mid-rotation evaluative discussion with the medical student. Supervising physicians will complete a summative evaluation and are encouraged to contact the course/clerkship director with any gaps in student performance.

Medical students with any concern regarding clinical, administrative, and educational or safety issues during his/her rotation will be encouraged to contact the supervising physician or clerkship/course director.

STATEMENT OF PROFESSIONALISM

Principles of professionalism are not rules that specify behaviors, but guidelines that provide direction in identifying appropriate conduct. These principles include the safety and welfare of patients, competence in knowledge and skills, responsibility for consequences of actions, professional communication, confidentiality, and lifelong learning for maintenance of professional skills and judgments. Professionalism and professional ethics are terms that signify certain scholastic, interpersonal and behavioral expectations. Among the characteristics included in this context are the knowledge, competence, demeanor, attitude, appearance, mannerisms, integrity and morals displayed by the student to faculty, peers, patients and colleagues in other health care professions. Students are expected to conduct themselves at all times in a professional manner and to exhibit characteristics of a professional student.

STUDENTS RIGHTS AND RESPONSIBILITIES

Each individual student is responsible for their behavior and is expected to maintain standards of academic honesty. Students share the responsibility with faculty for creating an environment that supports academic honesty and principles of professionalism. Proper relationship between faculty and student are fundamental to the college's function and this should be built on mutual respect and understanding together with shared dedication to the education process. It is a fundamental belief that each student is worthy of trust and that each student has the right to live in an academic environment that is free of injustice caused by dishonesty. While students have an obligation to assist their fellow students in meeting the common goals of their education, students have an equal obligation to maintain the highest standards of personal integrity.

FACULTY RESPONSIBILITIES
It is the responsibility of the college faculty to specify the limits of authorized aid (including but not limited to exams, study aids, internet resources and materials from senior students) in their syllabi, and it is the responsibility of students to honor and adhere to those limits. Course instructors shall inform students at the beginning of the semester of any special criteria of academic honesty pertinent to the class or course.

It is the responsibility of the clinical faculty to provide students with ongoing feedback during rotation upon request. Clinical faculty are generally recommended (though not required) to limit student assigned duty hours from 40 to 60 hours weekly (and not exceeding 60 hours). Both faculty and students are to be treated fairly and professionally in order to maintain a proper working relationship between trainer and trainee.

**COURSE GRADES**

- **P-Pass** – means that credit is granted and that the student achieved a level of performance judged to be satisfactory according to didactic and clinical performance by the department.
- **N-No Grade** – means that no credit is granted and that the student did not achieve a level of performance judged to be satisfactory according to didactic and clinical performance by the department.
- **ET-Extended Grade** – means that a final grade (“Pass” or “No Grade”) cannot be determined due to one or more missing course requirements. In Years 3 and 4, the ET grade is used instead of an “Incomplete (I)” grade. Once all course requirements have been completed, received, and processed, the ET grade will be changed to a final grade. An “ET” will NOT remain on a student's transcript.

**“N” Grade Policy**

Any student who receives an N grade in the Clerkship Program will be required to appear before the COSE Clerkship Performance Subcommittee (COSE).

**ROTATION EVALUATIONS**

**Attending/Faculty/Resident Evaluation of Student**

Students are responsible for assuring that his/her clinical supervisor receives the appropriate evaluation form. Forms can be accessed via the “Attending Evaluation” link in the student’s Kobiljak online Clerkship schedule.

Students should assertively seek feedback on his/her performance throughout the course of the clinical rotation. Students should also sit down and discuss the formal evaluation with the clinical supervisor. Note that the clinical supervisor and the DME from the rotation hospital are required to sign the form.

Students should keep a copy of the evaluation and leave the original with the Medical Education Office at the clinical training site where that office will review, sign, and forward the completed form to the Office of Student Services. It is important to know that evaluations will not be accepted by the Office of Student Services if submitted by the student. Any evidence of tampering or modification while in the possession of the student will be considered “unprofessional behavior” resulting in an “N” grade and review by the Committee on Student Evaluation (COSE) and/or the College Heading Committee.
Student Evaluation of Rotation

Students will submit their rotation evaluations electronically at the conclusion of every rotation by accessing their online schedule through Kobiljak.

EXPOSURE INCIDENTS PROTOCOL

A form has been developed by the University to report exposure incidents. These forms will be on file in your DME’s office. You can also access the form at www.com.msu.edu/AP/clerkship_program/clerkship_documents/exposure.pdf. Please make yourself familiar with the procedure and the form.