Nuclear Medicine: Curriculum Overview and Rotation Goals and Objectives

Part I, Curriculum Overview:

The nuclear medicine curriculum for radiology residents consists of a combination of clinical training/experience (or work experience) in the division of nuclear medicine and didactic classroom and laboratory instruction.

The clinical training and experience consists of four 4-week clinical rotations (16 weeks total) in the division under the direction of the nuclear medicine physician senior staff (faculty), who are authorized users (AU). During these clinical rotations, the resident will observe, participate in, or manage all types of patient imaging, localization, and laboratory studies performed in the division as appropriate to the resident’s level of experience and medical knowledge. Training and experience will also include oral administration of I-131 (for which a written directive is required) for therapy of both benign and malignant thyroid diseases.

Residents may also elect to participate in an additional (fifth) 4-week rotation in the nuclear division primarily dedicated to PET/CT imaging.

The scope of patient imaging, localization, and laboratory studies performed in the division is broad and includes evaluation of:

- Cardiovascular system,
- Respiratory system,
- Gastrointestinal/Hepatobiliary system
- Skeletal system
- Genitourinary system
- Endocrine system
- Cerebrovascular system
- Neoplastic diseases
- Infectious and inflammatory diseases

Therapy of benign and malignant thyroid disease as well as radioimmunotherapy is also performed in the division.

The clinical training is augmented by didactic classroom and laboratory training.

Regularly scheduled classroom sessions cover a broad range of material as it relates to the practice of nuclear medicine including:

- Core clinical curriculum;
- Nuclear medicine physics and radiobiology;
- Chemistry of radioactive by-product materials;
Pharmacological and biologic actions of administered materials;
Safe handling, administration, and quality control of radioactive materials

The nuclear medicine faculty, medical physicists, nuclear pharmacists, or nuclear medicine technologists present these classroom sessions.

Core clinical curriculum lectures are presented yearly or alternating years and titles include:
1. Introduction & History to Nuclear Medicine/Nuclear Cardiology & Molecular Imaging
2. Gastrointestinal Bleeding Assessment with Scintigraphy
3. Hepatobiliary Scintigraphy
4. Radionuclide Brain Death Studies
5. Nuclear Cardiology 1 - Intro, Indications, Radiopharmaceuticals, and Protocols
7. Nuclear Cardiology 3 - PET Cardiac Perfusion Imaging and Viability
8. Introduction/Overview of Nuclear Medicine- (Medical Student Series)
9. Gallium Scintigraphy
10. Functional Brain Imaging – SPECT
11. Renal Scintigraphy
12. The Lung/PLOPED, and Pulmonary Imaging Update
13. Bone Scintigraphy - Intro & Cases
14. Bone Scintigraphy : Ortho Applications
15. Positron Imaging Tomography - Introduction and Cases
16. GI Nuclear Medicine: Functional, Anatomic, and Metabolic Hepatic Imaging
17. Molecular Imaging: PET Updates and More
18. Somatoreceptor Imaging
19. Radioimmunotherapy -Zevalin & Bexxar
20. Pediatric Nuclear Medicine
21. Nuclear Renal Imaging
22. Nuclear Medicine Imaging of Thyroid Disease
23. Cardiac Blood Pool Imaging
24. NRC and ABR Requirements for Nuclear Medicine
25. Nuclear Imaging and Therapy of Thyroid Disease
26. Thyroid Cancer

A yearly formal lecture series presented by the medical physics division covers a broad range of topics related to the physics of medical imaging. The series is based on the textbook: The Essential Physics of Medical Imaging. Burshberg, Siebert, Leidholdt, Boone. Lippincott Williams & Wilkins. 2nd Edition. This lecture series consists of approximately forty-five 1-hour sessions; the topics of many of the sessions (approximately 18 to 20 hours) are either related or specific to nuclear medicine. Chapter titles of particular importance to the nuclear medicine curriculum include:
1. Radioactivity and Nuclear Transformation (Chapter 18)
2. Radionuclide Production and Radiopharmaceuticals (Ch. 19)
3. Radiation Detection and Measurement (Ch. 20)
Lectures presented by the nuclear pharmacists include:
1. TBD

During the first clinical rotation and prior to any handling of radioactive materials, all residents must complete the Scott & White Radiation Protection and Radiopharmaceutical Handling Course. This includes:

- Review of the Scott & White Radiation Protection Policies Manual. This includes topics related to written directives, response to radiation spills and accidents (containment and decontamination procedures), classification of radiation areas and radiation signage, using administrative controls to prevent medical events involving the use of unsealed byproduct material, transport and storage of radioactive materials and waste, occupational and general public exposure limits and monitoring, incident reporting, equipment testing, state and federal regulatory issues.
- Completion of the Radiation Safety written examination,
- Follow-up review of the materials and examination with a medical physicist.

Review of the manual and the written examination are also repeated during the fourth clinical rotation.

During the course of each clinical rotation, scheduled laboratory sessions with the nuclear pharmacists, nuclear technologists, medical physicists, or physician senior staff provide “hands-on” work experience in the areas of:

- Ordering, receiving, and unpacking radioactive material safely, and performing the related radiation surveys;
- Safe elution and quality control (QC) of radionuclide generator systems;
- Calculating, measuring, and safely preparing patient dosages;
- Calibration and QC of survey meters and dose calibrators;
- Safe handling and administration of therapeutic doses of unsealed radionuclide sources (i.e., I-131).

Most of the laboratory sessions will take place in the “hot lab” or the PET “hot lab”. Other sessions take place in the patient areas or camera rooms for “hands-on” experience administering patient doses, operating the gamma cameras for imaging and localization studies, and computer processing of image data in preparation for image interpretation.
Part II, Rotation Goals and Objectives:

Many of the goals and objectives of the nuclear medicine curriculum relate to (or can be categorized under) the general competencies defined by the ACGME: Patient Care (PC); Medical Knowledge (MK); Practice-based Learning and Improvement (PLI); Interpersonal and Communication Skills (ICS); Professionalism (P); and Systems-based Practice (SP).

Although goals and objectives more specific to each of the nuclear medicine rotations are outlined below, there are also many general skills that will be continually developed during the course of all rotations under the direction of the physician senior staff.

General goals and objectives:
1. Recognize personal limitations in clinical experience and medical knowledge while developing skills in the practice of nuclear medicine, making sure to always consult with the senior staff physicians regarding any decisions that are beyond the resident’s level of competence. (PLI, PC, P)
2. The resident will develop a practical working knowledge of the various imaging, localization, and laboratory protocols for all types of studies performed in the division. (MK, PC)
3. Determine/prescribe the appropriate dosages of radiopharmaceuticals and medications used for all adult and pediatric examinations, including those that require a written directive. (MK, PC)
4. Develop safe handling and administration techniques for radiopharmaceuticals and medications used for imaging and localization studies. (PC, MK)
5. Learn proper computer processing of image data for subsequent interpretation. (PC)
6. Develop needed experience and knowledge for interpretation of all types of patient studies and effective reporting and communication of the results to the referring clinician and other appropriate personnel. (PC, MK, ICS)
7. Develop effective communication and interpersonal skills for interaction with patients and their family members that demonstrate appropriate compassion and respect for these individuals, and that demonstrate sensitivity to the diverse population we serve at Scott & White. (ICS, P)
8. Utilize available information technology to confirm the appropriateness of ordered studies and to optimize the exam protocol in order to adequately investigate the clinical question. If appropriate, the resident should communicate directly with ordering physicians regarding any situation where an alternative imaging study may better evaluate the clinical question with consideration given to cost-effectiveness and risk-benefit analysis. (SP, ICS, PLI, PC)
9. Participate in the formal peer review processes that routinely occur in the division, and review results/outcomes related to prior exams that are routinely reviewed (for comparison purposes) during the course of interpreting current studies. (PLI, SP)
10. As must all staff in the department, residents must demonstrate a commitment to carrying out professional responsibilities and an adherence to ethical principles. (P)
Rotation 1 Specific Goals and Objectives:

- Complete the Scott & White Radiation Protection and Radiopharmaceutical Handling Course (further details above). (MK, PC)

- Observe at least one of each of the different scans routinely performed, as well as infrequently ordered studies. (PC)

-Knowledge Based Objectives—at the end of the rotation, the resident should be able to:
  1. Demonstrate a thorough knowledge of the clinical indications, general procedures (including radiopharmaceutical and dose), and scintigraphic findings for: (MK, PC)
     a. pulmonary (emboli) ventilation and perfusion imaging
     b. hepatobiliary imaging and functional studies
     c. gastrointestinal blood loss imaging
     d. bone imaging
  2. Discuss the basic physical principles of nuclear medicine imaging and instrumentation. (MK, PC)
  3. Identify the isotopes (including physical and chemical properties) that are used routinely in the compounding of radiopharmaceuticals for nuclear radiology procedures. (MK, PC)

-Technical Skills—at the end of the rotation, the resident should be able to:
  1. Review and dictate selected cases with physician senior staff. (PC, ICS)

-Decision-making and Value Judgment Skills—at the end of the rotation, the resident should be able to:
  1. Protocol scheduled imaging studies—review pertinent clinical history of patients to be imaged each day in order to determine the relevance of the ordered study to the clinical question, to assess for any contraindications to the study, and to alert nuclear technologists about anticipated non-standard views or specific parameters of the study that require special attention. (PC, MK)
  2. Assist nuclear technologists in the determination of radiopharmaceutical or medication dosages when patient conditions do not fall within the criteria for the standard dose. (PC, MK)
  3. Make a preliminary review of obtained images and advise technologists when additional views or repeat views are needed. (PC, MK)

-Laboratory Sessions:
  1. Schedule at least one session with the nuclear pharmacist; to be scheduled directly with the pharmacist and generally take place in the “hot lab” in the morning before beginning routine duties. (MK, PC)
  2. Schedule at least one session with head nuclear technologist; sessions typically in “hot lab”, patient areas, and camera rooms. (MK, PC)
-Reading and Educational Assignments:
  1. Prepare selected imaging studies performed during the rotation for presentation at the monthly nuclear medicine case-review conference; this conference is presented by the resident under the supervision of the nuclear medicine faculty for the educational benefit of all radiology residents as well as any medical students on rotation in the department. (ICS, PLI)
Goals & Objectives
Nuclear Medicine Rotation 1

Resident: _________________________________________________

Rotation Dates: ____________________________________________

Rotation 1 Specific Goals and Objectives: AU Training Checklist

-Complete the Scott & White Radiation Protection and Radiopharmaceutical Handling Course (further details above).

_________________________________________________________
(Date/Hours/Preceptor)

-Observe at least one of each of the different scans routinely performed, as well as infrequently ordered studies.

-Knowledge Based Objectives—at the end of the rotation, the resident should be able to:
  1. Demonstrate a thorough knowledge of the clinical indications, general procedures (including radiopharmaceutical and dose), and scintigraphic findings for:
     a. pulmonary (emboli) ventilation and perfusion imaging
     b. hepatobiliary imaging and functional studies
     c. gastrointestinal blood loss imaging
     d. bone imaging
  2. Discuss the basic physical principles of nuclear medicine imaging and instrumentation.
  3. Identify the isotopes (including physical and chemical properties) that are used routinely in the compounding of radiopharmaceuticals for nuclear radiology procedures.

-Technical Skills—at the end of the rotation, the resident should be able to:
  1. Review and dictate selected cases with physician senior staff.

-Decision-making and Value Judgment Skills—at the end of the rotation, the resident should be able to:
  1. Protocol scheduled imaging studies—review pertinent clinical history of patients to be imaged each day in order to determine the relevance of the ordered study to the clinical question, to assess for any contraindications to the study, and to alert nuclear technologists about anticipated non-standard views or specific parameters of the study that require special attention.
  2. Assist nuclear technologists in the determination of radiopharmaceutical or medication dosages when patient conditions do not fall within the criteria for the standard dose.
3. Make a preliminary review of obtained images and advise technologists when additional views or repeat views are needed.

-Laboratory Sessions:
1. Schedule at least one session with the nuclear pharmacist; to be scheduled directly with the pharmacist and generally take place in the “hot lab” in the morning before beginning routine duties.

   (Date/Hours/Preceptor)

   (Date/Hours/Preceptor)

2. Schedule at least one session with head nuclear technologist; sessions typically in “hot lab”, patient areas, and camera rooms.

   (Date/Hours/Preceptor)

   (Date/Hours/Preceptor)

-Reading and Educational Assignments:
1. Prepare selected imaging studies performed during the rotation for presentation at the monthly nuclear medicine case-review conference; this conference is presented by the resident under the supervision of the nuclear medicine faculty for the educational benefit of all radiology residents as well as any medical students on rotation in the department.


   (Chapters 1-3: Date/Hours)


   (Chapters 1-3, 14, Appendices D, G, and I: Date/Hours)
Participate in the formal peer review processes that routinely occur in the division, and review results/outcomes related to prior exams that are routinely reviewed (for comparison purposes) during the course of interpreting current studies.
Rotation 2 Specific Goals and Objectives:

-Knowledge Based Objectives—at the end of the rotation, the resident should be able to:
  1. Demonstrate a thorough knowledge of the clinical indications, general procedures (including radiopharmaceutical and dose) and scintigraphic findings in:
     a. renal and urinary tract studies
     b. liver/spleen imaging
     c. gastrointestinal tract imaging and functional studies
     d. thyroid imaging and functional studies
     e. brain imaging and functional studies
     f. tumor and abscess imaging
     g. myocardial perfusion studies
     h. gated cardiac blood pool (MUGA) studies
  2. Identify and discuss indications for isotopes used for therapeutic purposes. (MK, PC)
  3. Describe the protocol for using I-131 in the treatment of hyperthyroidism and thyroid malignancies, including protocol for hospitalization and monitoring of patients who receive over 30 mCi of activity. (MK, PC)
  4. Describe accepted indications for and the role of PET/CT imaging. (MK, PC)

-Technical Skills—at the end of the rotation, the resident should be able to:
  1. Interpret and dictate studies under the guidance of the physician senior staff. (PC, ICS)
  2. Assist with radioactive therapy treatments—clinically assess patients with benign thyroid disease including estimation of gland size, calculate dosages, and be able to verify the quantity of a dose prior to administration, giving particular attention to radiation safety practices during the procedure.(PC, MK)

-Decision-making and Value Judgment Skills—at the end of the rotation, the resident should be able to:
  1. In consideration of the resident’s expanded responsibilities, continually assess and recognize personal limitations in interpretive experience and medical knowledge, always ensure the accuracy of transcribed dictations, and review any physician consultations with the nuclear medicine faculty. (PLI, ICS, P)
  2. Review all scans as they are performed for any significant findings that require prompt attention, and make decisions regarding notification of the referring physician if the nuclear medicine faculty is not immediately available for consultation. (PC, ICS, P)

-Laboratory Sessions:
  1. Schedule at least one session with the nuclear pharmacist; to be scheduled directly with the pharmacist and generally take place in the “hot lab” in the morning before beginning routine duties.(MK, PC)
  2. Schedule at least one session with head nuclear technologist; sessions typically in “hot lab”, patient areas, and camera rooms. (MK, PC)
-Reading and Educational Assignments:
  1. Prepare selected imaging studies performed during the rotation for presentation at the monthly nuclear medicine case-review conference. (ICS, PLI)
Goals & Objectives
Nuclear Medicine Rotation 2

Resident: _________________________________________________

Rotation Dates: ____________________________________________

Rotation 2 Specific Goals and Objectives: AU Training Checklist

-Knowledge Based Objectives—at the end of the rotation, the resident should be able to:
  1. Demonstrate a thorough knowledge of the clinical indications, general procedures (including radiopharmaceutical and dose) and scintigraphic findings in:
     a. renal and urinary tract studies
     b. liver/spleen imaging
     c. gastrointestinal tract imaging and functional studies
     d. thyroid imaging and functional studies
     e. brain imaging and functional studies
     f. tumor and abscess imaging
     g. myocardial perfusion studies
     h. gated cardiac blood pool (MUGA) studies
  2. Identify and discuss indications for isotopes used for therapeutic purposes.
  3. Describe the protocol for using I-131 in the treatment of hyperthyroidism and thyroid malignancies, including protocol for hospitalization and monitoring of patients who receive over 30 mCi of activity.
  4. Describe accepted indications for and the role of PET/CT imaging.

-Technical Skills—at the end of the rotation, the resident should be able to:
  1. Interpret and dictate studies under the guidance of the physician senior staff.
  2. Assist with radioactive therapy treatments—clinically assess patients with benign thyroid disease including estimation of gland size, calculate dosages, and be able to verify the quantity of a dose prior to administration, giving particular attention to radiation safety practices during the procedure. (Record all treatments below)

-Decision-making and Value Judgment Skills—at the end of the rotation, the resident should be able to:
  1. In consideration of the resident’s expanded responsibilities, continually assess and recognize personal limitations in interpretive experience and medical knowledge, always ensure the accuracy of transcribed dictations, and review any physician consultations with the nuclear medicine faculty.
  2. Review all scans as they are performed for any significant findings that require prompt attention, and make decisions regarding notification of the referring physician if the nuclear medicine faculty is not immediately available for consultation.
-Laboratory Sessions:
  1. Schedule at least one session with the nuclear pharmacist; to be scheduled directly
     with the pharmacist and generally take place in the “hot lab” in the morning
     before beginning routine duties.

     (Date/Hours/Preceptor)

     (Date/Hours/Preceptor)

  2. Schedule at least one session with head nuclear technologist; sessions typically in
     “hot lab”, patient areas, and camera rooms.

     (Date/Hours/Preceptor)

     (Date/Hours/Preceptor)

-Reading and Educational Assignments:
  1. Prepare selected imaging studies performed during the rotation for presentation at
     the monthly nuclear medicine case-review conference.
  2. Zeissman HA, O’ Malley JP, Thrall JH. Nuclear Medicine: The Requisites, 3rd
     Chapters 4-6, 8, 10-13. Appendices E-1, E-2, F, H-1, and H-2.

     (Appendices H-1 and H-2: Date/Hours)

-Radioiodine Therapies (Include Preceptor Signature):

     (Details/Preceptor)

     (Details/Preceptor)

     (Details/Preceptor)
-Participate in the formal peer review processes that routinely occur in the division, and review results/outcomes related to prior exams that are routinely reviewed (for comparison purposes) during the course of interpreting current studies.
Rotation 3 Specific Goals and Objectives:

-Knowledge Based Objectives—at the end of the rotation, the resident should be able to:
  1. Identify normal and abnormal findings on all imaging and functional studies, including nuclear cardiology studies, and PET/CT imaging. (PC, MK)
  2. Discuss all aspects of nuclear studies, including indications, pathologies, protocols, correlative studies, radiopharmaceuticals used for each study, and various parameters that might interfere with the results of the procedure. (MK, PC, PLI)

-Technical Skills—at the end of the rotation, the resident should be able to:
  1. Independently make a preliminary interpretation and dictate a report after review with the nuclear medicine faculty for all scans performed, including PET/CT. (PC, ICS)
  2. Independently assess imaging and laboratory studies of patients being considered for therapy of benign thyroid disease with I-131 and determine whether therapy is appropriate. Counsel patients and obtain informed consent regarding any proposed therapy, outlining the possible risks and anticipated benefits. Review all proposed therapy plans with nuclear medicine faculty (AU)—a written directive is required. (PC, ICS, PLI)
  3. Participate in the care and monitoring of any patients requiring admission to the hospital, for radiation safety purposes, after the administration of a radiopharmaceutical. (PC, PLI)
  4. Participate in cardiac stress testing lab as directed by nuclear medicine faculty. (PC)

-Decision-making and Value Judgment Skills—at the end of the rotation, the resident should be able to:
  1. Make preliminary decisions on all matters of film interpretation and consultation, recognizing need for and obtaining assistance in situations that require the expertise of the nuclear medicine faculty. (PC, PLI)
  2. Comment on anatomical findings, scanning technique, and indications for performing the study in order to assist in the training of more junior residents or medical students. (PLI, ICS)

-Laboratory Sessions:
  1. Schedule at least one session with the nuclear pharmacist; to be scheduled directly with the pharmacist and generally take place in the “hot lab” in the morning before beginning routine duties. (MK, PC)
  2. Schedule at least one session with head nuclear technologist; sessions typically in “hot lab”, patient areas, and camera rooms. (MK, PC)

-Reading and Educational Assignments:
  1. Prepare selected imaging studies performed during the rotation for presentation at the monthly nuclear medicine case-review conference. (ICS, PLI)
2. Related textbooks/references, related current journal articles and online resources. (MK, PLI)
Goals & Objectives  
Nuclear Medicine Rotation 3

Resident: _________________________________________________

Rotation Dates: ____________________________________________

**Rotation 3 Specific Goals and Objectives: AU Training Checklist**

- **Knowledge Based Objectives**—at the end of the rotation, the resident should be able to:
  1. Identify normal and abnormal findings on all imaging and functional studies, including nuclear cardiology studies, and PET/CT imaging.
  2. Discuss all aspects of nuclear studies, including indications, pathologies, protocols, correlative studies, radiopharmaceuticals used for each study, and various parameters that might interfere with the results of the procedure.

- **Technical Skills**—at the end of the rotation, the resident should be able to:
  1. Independently make a preliminary interpretation and dictate a report after review with the nuclear medicine faculty for all scans performed, including PET/CT.
  2. Independently assess imaging and laboratory studies of patients being considered for therapy of benign thyroid disease with I-131 and determine whether therapy is appropriate. Counsel patients and obtain informed consent regarding any proposed therapy, outlining the possible risks and anticipated benefits. Review all proposed therapy plans with nuclear medicine faculty (AU)—a written directive is required. (Record all treatments below)
  3. Participate in the care and monitoring of any patients requiring admission to the hospital, for radiation safety purposes, after the administration of a radiopharmaceutical.
  4. Participate in cardiac stress testing lab as directed by nuclear medicine faculty.

- **Decision-making and Value Judgment Skills**—at the end of the rotation, the resident should be able to:
  1. Make preliminary decisions on all matters of film interpretation and consultation, recognizing need for and obtaining assistance in situations that require the expertise of the nuclear medicine faculty.
  2. Comment on anatomical findings, scanning technique, and indications for performing the study in order to assist in the training of more junior residents or medical students.
-Laboratory Sessions:
  1. Schedule at least one session with the nuclear pharmacist; to be scheduled directly with the pharmacist and generally take place in the “hot lab” in the morning before beginning routine duties.

                        (Date/Hours/Preceptor)

                        (Date/Hours/Preceptor)

  2. Schedule at least one session with head nuclear technologist; sessions typically in “hot lab”, patient areas, and camera rooms.

                        (Date/Hours/Preceptor)

                        1. (Date/Hours/Preceptor)

-Reading and Educational Assignments:
  1. Prepare selected imaging studies performed during the rotation for presentation at the monthly nuclear medicine case-review conference.
  2. Related textbooks/references, related current journal articles and online resources.

-Radioiodine Therapies (Include Preceptor Signature):

                        (Details/Preceptor)

                        (Details/Preceptor)

                        (Details/Preceptor)

-Participate in the formal peer review processes that routinely occur in the division, and review results/outcomes related to prior exams that are routinely reviewed (for comparison purposes) during the course of interpreting current studies.
Rotation 4 Specific Goals and Objectives:

-Repeat review of the Scott & White Radiation Protection and Radiopharmaceutical Handling Course (further details above).

-Knowledge Based Objectives—at the end of the rotation, the resident should be able to:

1. Discuss the following information regarding all radiopharmaceuticals used in nuclear radiology studies:
   a. production of isotopes
   b. physical properties of isotopes
   c. generation elution and quality control
   d. compounding of radiopharmaceuticals
   e. radiochemical quality control
   f. biodistribution and mechanisms of localization

2. Calculate patient doses, using information related to decay factors, volume concentration, and patient parameters. (MK, PC)

3. Describe the procedures and rationale for instrument quality control in nuclear medicine. (MK)

4. Discuss rules and regulations that apply to the practice of nuclear medicine. (MK)

5. Describe the types of records that must be maintained in order to comply with federal/state guidelines for radiation safety and radioisotope receipt/use/disposal. (MK)

6. Demonstrate an in-depth understanding of the physics of nuclear medicine. (MK)

7. Demonstrate a basic knowledge of PET physics and imaging. (MK)

8. Demonstrate a thorough knowledge of the clinical indications, general procedures and findings in:
   a. myocardial perfusion studies (rest and stress)
   b. multigated acquisition imaging and function studies
   c. all other studies

9. Describe the radiopharmaceuticals used in cardiac nuclear studies, including the methods of red cell labeling, patient dosages, and physical properties of the isotopes. (MK)

10. Discuss patient conditions and patient monitoring requirements, particularly in relation to exercise and drug stress studies. (MK)

11. Process computer data obtained in each of the different cardiac studies. (MK, PC)

12. Discuss the range of invasive and noninvasive tests, test characteristics, and the prognostic value of tests used to evaluate cardiac disease. (MK, SP)

-Technical Skills—at the end of the rotation, the resident should be able to:

1. Compound radiopharmaceuticals from kits and do appropriate quality control procedures. (MK, PC)

2. Elute a generator and do appropriate quality control procedures. (MK, PC)

3. Calculate and safely prepare patient doses. (MK, PC)

4. Demonstrate appropriate use of a survey meter to monitor radioactivity spills or other sources. (MK)
5. Perform a wipe test. (MK)
6. Perform quality control procedures on cameras, well/uptake probes, and dose calibrators. (MK)
7. Handle radioactive sources according to the established guidelines. (MK)
8. Select tests for evaluation of cardiac disease on the basis of patient condition and clinical symptoms. (MK, PC, SP)
9. Correlate the results from various tests with interpretation of nuclear cardiology exams. (MK, PC, SP)

- Decision-making and Value Judgment Skills—at the end of the rotation, the resident should be able to:
  1. Carry out the practice of nuclear medicine with a level of competence expected for an independently practicing radiologist, with due regard to quality control, quality assurance, and radiation safety for patients and personnel.

- Laboratory Sessions:
  1. Schedule at least one session with the nuclear pharmacist; to be scheduled directly with the pharmacist and generally take place in the “hot lab” in the morning before beginning routine duties. (MK, PC)
  2. Schedule at least one session with head nuclear technologist; sessions typically in “hot lab”, patient areas, and camera rooms. (MK, PC)

- Reading and Educational Assignments:
  1. Prepare selected imaging studies performed during the rotation for presentation at the monthly nuclear medicine case-review conference. (ICS, PLI)
  4. Related textbooks/references, related current journal articles and online resources. (MK, PLI)
Goals & Objectives
Nuclear Medicine Rotation 4

Resident: _________________________________________________

Rotation Dates: ____________________________________________

Rotation 4 Specific Goals and Objectives: AU Training Checklist

- Repeat review of the Scott & White Radiation Protection and Radiopharmaceutical Handling Course (further details above).

(Date/Hours/Preceptor)

Knowledge Based Objectives—at the end of the rotation, the resident should be able to:

1. Discuss the following information regarding all radiopharmaceuticals used in nuclear radiology studies:
   a. production of isotopes
   b. physical properties of isotopes
   c. generation elution and quality control
   d. compounding of radiopharmaceuticals
   e. radiochemical quality control
   f. biodistribution and mechanisms of localization

2. Calculate patient doses, using information related to decay factors, volume concentration, and patient parameters.

3. Describe the procedures and rationale for instrument quality control in nuclear medicine.

4. Discuss rules and regulations that apply to the practice of nuclear medicine.

5. Describe the types of records that must be maintained in order to comply with federal/state guidelines for radiation safety and radioisotope receipt/use/disposal.

6. Demonstrate an in-depth understanding of the physics of nuclear medicine.

7. Demonstrate a basic knowledge of PET physics and imaging.

8. Demonstrate a thorough knowledge of the clinical indications, general procedures and findings in:
   a. myocardial perfusion studies (rest and stress)
   b. multigated acquisition imaging and function studies
   c. all other studies

9. Describe the radiopharmaceuticals used in cardiac nuclear studies, including the methods of red cell labeling, patient dosages, and physical properties of the isotopes.

10. Discuss patient conditions and patient monitoring requirements, particularly in relation to exercise and drug stress studies.

11. Process computer data obtained in each of the different cardiac studies.

12. Discuss the range of invasive and noninvasive tests, test characteristics, and the prognostic value of tests used to evaluate cardiac disease.
-Technical Skills—at the end of the rotation, the resident should be able to:
  1. Compound radiopharmaceuticals from kits and do appropriate quality control procedures.
  2. Elute a generator and do appropriate quality control procedures.
  3. Calculate and safely prepare patient doses.
  4. Demonstrate appropriate use of a survey meter to monitor radioactivity spills or other sources.
  5. Perform a wipe test.
  6. Perform quality control procedures on cameras, well/uptake probes, and dose calibrators.
  7. Handle radioactive sources according to the established guidelines.
  8. Select tests for evaluation of cardiac disease on the basis of patient condition and clinical symptoms.
  9. Correlate the results from various tests with interpretation of nuclear cardiology exams.

-Decision-making and Value Judgment Skills—at the end of the rotation, the resident should be able to:
  1. Carry out the practice of nuclear medicine with a level of competence expected for an independently practicing radiologist, with due regard to quality control, quality assurance, and radiation safety for patients and personnel.

-Laboratory Sessions:
  1. Schedule at least one session with the nuclear pharmacist; to be scheduled directly with the pharmacist and generally take place in the “hot lab” in the morning before beginning routine duties.

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(Date/Hours/Preceptor)

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(Date/Hours/Preceptor)

  2. Schedule at least one session with head nuclear technologist; sessions typically in “hot lab”, patient areas, and camera rooms.

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(Date/Hours/Preceptor)

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(Date/Hours/Preceptor)

-Reading and Educational Assignments:
1. Prepare selected imaging studies performed during the rotation for presentation at the monthly nuclear medicine case-review conference.


(Chapter 1: Date/Hours)


(Chapters 3 and 14, Appendices G, H-1, H-2, and I: Date/Hours)

4. Related textbooks/references, related current journal articles and online resources.

-Radioiodine Therapies (Include Preceptor Signature):

(Details/Preceptor)

(Details/Preceptor)

(Details/Preceptor)

-Participate in the formal peer review processes that routinely occur in the division, and review results/outcomes related to prior exams that are routinely reviewed (for comparison purposes) during the course of interpreting current studies.
PET/CT Elective Specific Goals and Objectives:

-Knowledge Based Objectives—Relative to level of knowledge obtained during the required nuclear medicine rotations, at the end of this elective rotation, the resident should be able to demonstrate a more thorough understanding of:

1. PET/CT radiopharmaceuticals. (MK)
2. Related physics. (MK)
3. Normal variants and image artifacts. (MK)
4. Accepted indications and the role of PET/CT in the evaluation of oncologic, neurologic, and cardiac diseases. (MK, PC, SP)
5. Proper patient preparation protocols and the variations in radiopharmaceutical biodistribution relating to proper versus improper patient preparation. (MK, PC)
6. Limitations of PET/CT imaging. (MK, SP)
7. Proper handling of PET radiopharmaceuticals and safety issues particular to these agents. (MK)

-Technical Skills—at the end of the rotation, the resident should be able to:

1. Independently assess image/diagnostic quality of an exam. (MK, PC)
2. Independently operate the PET/CT workstation for complete image analysis. (MK)
3. Provide an interpretation of clinical images at the level expected of an independently practicing radiologist.

-Decision-making and Value Judgment Skills—at the end of the rotation, the resident should be able to:

1. Consult with referring clinicians regarding the appropriateness and utility of PET/CT imaging for various patients and clinical questions. (PC, SP, ICS)
2. Effectively integrate PET/CT imaging with other imaging modalities with goals of optimized clinical accuracy and cost-efficiency. (PC, SP)

-Laboratory Sessions: At least one session will be scheduled with the nuclear technologists performing the PET/CT exams to gain experience with receiving patient doses from supplier, safe handling of PET agents in the “hot lab”, and safe administration of patient doses. (MK)

-Reading and Educational Assignments:

1. Kipper MS, Tartar M. Clinical Atlas of PET with Imaging Correlation. (MK)
2. Other related textbooks/references, related current journal articles and online resources. (MK, PLI)
PET/CT Elective Rotation Specific Goals and Objectives: AU Training Checklist

-Knowledge Based Objectives—Relative to level of knowledge obtained during the required nuclear medicine rotations, at the end of this elective rotation, the resident should be able to demonstrate a more thorough understanding of:

1. PET/CT radiopharmaceuticals.
2. Related physics.
3. Normal variants and image artifacts.
4. Accepted indications and the role of PET/CT in the evaluation of oncologic, neurologic, and cardiac diseases.
5. Proper patient preparation protocols and the variations in radiopharmaceutical biodistribution relating to proper versus improper patient preparation.
6. Limitations of PET/CT imaging.
7. Proper handling of PET radiopharmaceuticals and safety issues particular to these agents.

-Technical Skills—at the end of the rotation, the resident should be able to:

1. Independently assess image/diagnostic quality of an exam.
2. Independently operate the PET/CT workstation for complete image analysis.
3. Provide an interpretation of clinical images at the level expected of an independently practicing radiologist.

-Decision-making and Value Judgment Skills—at the end of the rotation, the resident should be able to:

1. Consult with referring clinicians regarding the appropriateness and utility of PET/CT imaging for various patients and clinical questions.
2. Effectively integrate PET/CT imaging with other imaging modalities with goals of optimized clinical accuracy and cost-efficiency.

-Laboratory Sessions: At least one session will be scheduled with the nuclear technologists performing the PET/CT exams to gain experience with receiving patient doses from supplier, safe handling of PET agents in the “hot lab”, and safe administration of patient doses.

-(Date/Hours/Preceptor)

-Reading and Educational Assignments:

2. Other related textbooks/references, related current journal articles and online resources.