NMED-2600: MOLECULAR AND FUSION IMAGING

Cuyahoga Community College

Viewing: NMED-2600 : Molecular and Fusion Imaging

Board of Trustees:
2014-06-19

Academic Term:
2014-08-23

Subject Code
NMED - Nuclear Medicine Technology

Course Number:
2600

Title:
Molecular and Fusion Imaging

Catalog Description:
Examines the methodology of advanced molecular imaging and fusion imaging in the field of nuclear medicine and analyze current trends and advances in the field. Focus is made on patient preparation, imaging protocols, radiation safety, and special considerations for fusing nuclear medicine studies with computed tomography and magnetic resonance imaging.

Credit Hour(s):
2

Lecture Hour(s):
2

Requisites

Prerequisite and Corequisite
NMED-1501 Radiation Physics and NMED-1701 Nuclear Medicine Instrumentation.

I. ACADEMIC CREDIT

Academic Credit According to the Ohio Department of Higher Education, one (1) semester hour of college credit will be awarded for each lecture hour. Students will be expected to work on out-of-class assignments on a regular basis which, over the length of the course, would normally average two hours of out-of-class study for each hour of formal class activity. For laboratory hours, one (1) credit shall be awarded for a minimum of three laboratory hours in a standard week for which little or no out-of-class study is required since three hours will be in the lab (i.e. Laboratory 03 hours). Whereas, one (1) credit shall be awarded for a minimum of two laboratory hours in a standard week, if supplemented by out-of-class assignments which would normally average one hour of out-of-class study preparing for or following up the laboratory experience (i.e. Laboratory 02 hours). Credit is also awarded for other hours such as directed practice, practicum, cooperative work experience, and field experience. The number of hours required to receive credit is listed under Other Hours on the syllabus. The number of credit hours for lecture, lab and other hours are listed at the beginning of the syllabus. Make sure you can prioritize your time accordingly. Proper planning, prioritization and dedication will enhance your success in this course.

The standard expectation for an online course is that you will spend 3 hours per week for each credit hour.

II. ACCESSIBILITY STATEMENT

If you need any special course adaptations or accommodations because of a documented disability, please notify your instructor within a reasonable length of time, preferably the first week of the term with formal notice of that need (i.e. an official letter from the Student Accessibility Services (SAS) office). Accommodations will not be made retroactively.

For specific information pertaining to ADA accommodation, please contact your campus SAS office or visit online at http://www.tri-c.edu/accessprograms. Blackboard accessibility information is available at http://access.blackboard.com.

Eastern (216) 987-2052 - Voice
Metropolitan (216) 987-4344 – Voice. (216) 987-4048 – TTY.
Western (216) 987-5079 – Voice. (216) 987-5117 – TTY.
III. ATTENDANCE TRACKING

Regular class attendance is expected. Tri-C is required by law to verify the enrollment of students who participate in federal Title IV student aid programs and/or who receive educational benefits through other funding sources. Eligibility for federal student financial aid is based in part on enrollment status.

Students who do not attend classes for the entire term are required to withdraw from the course(s). Additionally, students who withdraw from a course or stop attending class without officially withdrawing may be required to return all or a portion of their financial aid based on the date of last attendance. Students who do not attend the full session are responsible for withdrawing from the course(s).

Tri-C is responsible for identifying students who have not attended a course before financial aid funds can be applied to students’ accounts.

Therefore, attendance is recorded in the following ways:

• For in-person and blended-learning courses, students are required to attend the course by the 15th day of the semester (or equivalent for terms shorter than five weeks) to be considered attending. Students who have not met all attendance requirements for in-person and blended courses, as described herein, within the first two weeks or equivalent, will be considered not attending.

• For online courses, students are required to login at least two times per week and submit one assignment per week for the first two weeks of the semester, or equivalent to the 15th day of the term. Students who have not met all attendance requirements for online courses, as described herein, within the first two weeks or equivalent, will be considered not attending.

At the conclusion of the first two weeks of a semester or equivalent, instructors report any registered students who have “Never Attended” a course. Those students will be administratively withdrawn from that course. However, after the time period in the previous paragraphs, if a student stops attending a class or wants or needs to withdraw, for any reason, it is the student’s responsibility to take action to withdraw from the course. Students must complete and submit the appropriate Tri-C form by the established withdrawal deadline.

Tri-C is required to ensure that students receive financial aid only for courses that they attend and complete. Students reported for not attending at least one of their registered courses will have all financial aid funds held until confirmation of attendance in registered courses has been verified. Students who fail to complete at least one course may be required to repay all or a portion of their federal financial aid funds and may be ineligible to receive future federal financial aid awards. Students who withdraw from classes prior to completing more than 60 percent of their enrolled class time may be subject to the required federal refund policy.

If illness or emergency should necessitate a brief absence from class, students should confer with instructors upon their return. Students having problems with coursework due to a prolonged absence should confer with the instructor or a counselor.

IV. LEARNING OUTCOMES ASSESSMENT

Occasionally, in addition to submitting assignments to their instructors for evaluation and a grade, students will also be asked to submit completed assignments, called ‘artifacts,’ for assessment of course and program outcomes and the College’s Essential Learning Outcomes (ELOs). The artifacts will be submitted in Blackboard or a similar technology. The level of mastery of the outcome demonstrated by the artifact DOES NOT affect the student’s grade or academic record in any way. However, some instructors require that students submit their artifact before receiving their final grade. Some artifacts will be randomly selected for assessment, which will help determine improvements and support needed to further student success. If you have any questions, please feel free to speak with your instructor or contact the Learning Outcomes Assessment office.

V. CONCEALED CARRY STATEMENT

College policy prohibits the possession of weapons on college property by students, faculty and staff, unless specifically approved in advance as a job-related requirement (i.e., Tri-C campus police officers) or, in accordance with Ohio law, secured in a parked vehicle in a designated parking area only by an individual in possession of a valid conceal carry permit.

As a Tri-C student, your behavior on campus must comply with the student code of conduct which is available on page 29 within the Tri-C student handbook, available athttp://www.tri-c.edu/student-resources/documents/studenthandbook.pdfYou must also comply with the College's Zero Tolerance for Violence on College Property available athttp://www.tri-c.edu/policies-and-procedures/documents/3354-1-20-10-zero-tolerance-for-violence-policy.pdf

Outcomes

Course Outcome(s):
Differentiate between varying types of advanced molecular imaging and fusion imaging.

Objective(s):
1. Explain the historical background of advanced molecular imaging.
2. Define advanced molecular imaging.
3. Explain fusion imaging.
4. Discuss advantages and disadvantages to various types of fusion imaging.
Course Outcome(s):
Explain the methodology of various types and techniques of fusion imaging.

Essential Learning Outcome Mapping:
Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):
1. Describe and discuss various imaging protocols for SPECT/CT, PET/CT, SPECT/MR, and PET/MR.
2. Describe quality control for fusion imaging equipment and instrumentation.
3. Examine special considerations for combining other imaging modalities with nuclear medicine.

Course Outcome(s):
Discuss current topics and advances in the fields of advanced molecular imaging and fusion imaging.

Essential Learning Outcome Mapping:
Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):
1. Discuss current research as it relates to molecular imaging and fusion imaging.
2. Examine current trends in molecular imaging.
3. Examine new and emerging fusion imaging instrumentation and techniques.

Methods of Evaluation:
1. quizzes
2. exams
3. worksheets
4. writing assignments
5. case studies
6. presentations

Course Content Outline:
1. Advanced Molecular and Fusion Imaging
   a. Defining molecular imaging
   b. Historical background
2. SPECT/CT system
   a. System characteristics
      i. Quality control
   b. SPECT components
   c. CT components
   d. Spatial resolution
   e. Sensitivity
   f. Imaging protocols
      i. Neurologic
      ii. Cardiac
         1. CT angiography
         2. Imaging plaque
      iii. Cancer imaging: diagnose and staging
   d. Processing data
   e. Creating an image set
      i. Filter selection and tomographic reconstruction
      ii. Attenuation correction
   f. Analyzing the results
      i. Normal versus abnormal results
      ii. Case study review
   g. Special considerations
3. Positron Emission Tomography/Computed Tomography (PET/CT)
   a. PET/CT system characteristics
      i. Quality control
      ii. PET components
      iii. CT components
      iv. Spatial resolution
      v. Sensitivity
   b. Imaging protocols
      i. Neurologic
         1. Dementia and neurologic disorders
         2. Stroke and perfusion imaging
         3. Seizure disorders
         4. Psychological and behavioral
      ii. Cardiac
         1. Myocardial perfusion
         2. Viability studies
         3. Molecular
      iii. Cancer imaging: diagnose and staging
      iv. Miscellaneous uses
   c. Processing data
   d. Creating an image set
      i. Filter selection and tomographic reconstruction
      ii. Attenuation correction
   e. Analyzing the results
      i. Normal versus abnormal results
      ii. Case study review
   f. Special considerations
      i. Patient preparation
      ii. Administering radioactive sugar and patient monitoring
      iii. Creating the ambiance for brain imaging injections
      iv. Contraindications and adverse reactions
      v. Radiation safety considerations
      vi. Advantages and disadvantages
      vii. Uses in molecular imaging
      viii. New advances

4. Single Photon Emission Tomography/Magnetic Resonance (SPECT/MR)
   a. Physics Review
      i. MR physics
   b. SPECT/MR system
   c. System characteristics
      i. Quality control
      ii. SPECT components
      iii. MR components
      iv. Spatial resolution
      v. Sensitivity
   d. Imaging protocols
      i. Neurologic
         1. Dementia and neurologic disorders
         2. Stroke and perfusion imaging
         3. Seizure disorders
         4. Psychological and behavioral
      ii. Cardiac
e. Cancer imaging: diagnose and staging
f. Infection and abscess imaging
g. Miscellaneous
h. Processing data
   i. Creating an image set
      i. Filter selection and tomographic reconstruction
      ii. Attenuation correction
      iii. Image processing techniques for MR
j. Analyzing the results
   i. Normal versus abnormal results
   ii. Case study review
k. Special considerations
   i. MR safety and patient screening
   ii. Patient preparation
   iii. Contraindications and adverse reactions
   iv. Radiation safety considerations
   v. Advantages and disadvantages
   vi. Regulations for nuclear medicine technologists regarding hybrid MR
   vii. Functional MR
   viii. MR spectroscopy
   ix. Uses in molecular imaging
   x. New advances

5. Positron Emission Tomography/Magnetic Resonance (PET/MR)
   a. PET/MR system characteristics
      i. Quality control
      ii. PET components
      iii. MR components
      iv. Spatial resolution
      v. Sensitivity
   b. Imaging protocols
      i. Neurologic
         1. Dementia and neurologic disorders
         2. Stroke and perfusion imaging
         3. Seizure disorders
         4. Psychological and behavioral
      ii. Cardiac
         1. Myocardial perfusion
         2. Viability studies
         3. Molecular
      iii. Cancer imaging: diagnose and staging
      iv. Infection and abscess imaging
      v. Miscellaneous
   c. Processing data
   d. Creating an image set
      i. Filter selection and tomographic reconstruction
      ii. Attenuation correction
   e. Analyzing the results
      i. Normal versus abnormal results
      ii. Case study review
   f. Special considerations
      i. MR safety and patient pre-screening
      ii. Patient preparation
      iii. Administering radioactive sugar and patient monitoring
      iv. Creating the ambiance for brain imaging injections
      v. Contraindications and adverse reactions
      vi. Radiation safety considerations
      vii. Advantages and disadvantages
viii. Uses in molecular imaging
ix. New advances
6. Current Trends
   a. Advanced molecular imaging
   b. Hybrid/fusion imaging techniques
   c. Emerging technologies
   d. Newly approved drugs
   e. Current research

Resources

Bernier, Christian Langan. "Nuclear Medicine Technology and Techniques"

Early, Paul J. and Sodee, D. Bruce. "Principles and Practices of Nuclear Medicine"

Maisey, Britton Gilday. "Clinical Nuclear Medicine"

Mettler Guiberteau. "Essentials of Nuclear Medicine Imaging"

Saha, G. "Fundamentals of Nuclear Pharmacy"

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