

McGILL UNIVERSITY

MDPH 615 - PHYSICS OF NUCLEAR MEDICINE

Fall 2022

- Instructors:** **Shirin Abbasinejad Enger, Ph.D. (yellow boxes on course outline)**
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- Ives Levesque, Ph.D. (orange boxes on course outline)**
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Email. ives.levesque@mcgill.ca
- Student hours:** Prof. Enger: TBD
 Prof. Levesque, by appointment, virtually or in-person at the Glen
- Time:** Tuesday 9:00 – 11:00 (except Tuesday Oct 11th replaced by Friday Oct 14th)
- Place:** DS1.1427, Royal Victoria Hospital, MUHC Glen Site, 1001 Decarie, Montreal
- Textbooks:** S. Cherry, J. Sorenson, M. Phelps:
 Physics in Nuclear Medicine
 Elsevier (4th Edition, 2012)
- E. B. Podgorsak:
 Radiation Physics for Medical Physicists
 Springer (2006)
- Glen F. Knoll
 Radiation detection and measurement
- Plus lecture notes from the instructors**

Exam 1 (mid-term): **Date and time to be determined.**

Exam 2 (end-of-term): **December 12, 9 am to noon. Non-cumulative.**

Class outline:

Medical Physics: The physics of radioactivity and the applications of radioisotopes and radiopharmaceuticals in medical diagnosis. Topics covered include radiation spectrometry, the scintillation camera, image analysis and data processing in nuclear medicine, single photon emission tomography, and positron emission tomography.

Delivery and course materials:

The class will be delivered using a mix of lectures and question-and-answer sessions held in person. There will also be readings, and pre-recorded videos. Course materials will be posted on MyCourses. If the public health situation deteriorates, we may have to revert to remote delivery.

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Learning Outcomes: By the end of this course, the student should be able to:

1. Be familiar with radionuclides used in nuclear imaging and therapy, production of these radionuclides and their dosimetry and be able to describe the radioactive decay.
 2. Describe the mechanism of action of organic and inorganic scintillators and the analog components of a scintillating counting system.
 3. Describe and understand the principles of the major imaging modalities in nuclear medicine, along with their advantages and limitations.
 4. Understand how image reconstruction approaches are applied to nuclear medicine imaging data.
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Assessment: There will be five assignments (consisting of problem sets, writing, programming, and/or readings), regular graded quizzes, and two exams.

Quizzes (10%) (average of all quiz grades)

Assignments (25%) (5% per assignment x 5 assignments)

Exam 1 (40%)

Exam 2 (non-cumulative, 25%)

McGill Policies:

1) *McGill University values academic integrity. Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures (see www.mcgill.ca/students/srr/honest/) for more information).*

2) *In accord with McGill University's Charter of Students' Rights, students in this course have the right to submit in English or in French any written work that is to be graded.*

Health and Wellness Resources at McGill:

Student well-being is a priority for the University. All of our health and wellness resources have been integrated into a single Student Wellness Hub, your one-stop shop for everything related to your physical and mental health. If you need to access services or get more information, visit the Virtual Hub at mcgill.ca/wellness-hub or drop by the Brown Student Services Building (downtown) or Centennial Centre (Macdonald Campus). Within your faculty, you can also connect with your Local Wellness Advisor (to make an appointment, visit mcgill.ca/lwa).

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Fall 2021

Course Outline

Session	Date	Lecture Title	Reading
1	2021/09/06	Introduction to Nuclear Medicine	Cherry, chap. 1 Dr. Enger's notes
2	2021/09/13	Modes of Radioactive Decay	Cherry, chap. 2 and 3 Dr. Enger's notes
3	2021/09/20	Decay of Radioactivity – Bateman Equation	Cherry, chap. 4 Dr. Enger's notes
4	2021/09/27	Radionuclide production	Cherry, chap. 5 Dr. Enger's notes
5	2021/10/04	Nuclear Radiation Measurements – Scintillation Counting Systems	Knoll, chap. 8 Cherry, chap. 7 & 8
6	2021/10/14 (note: Friday)	Nuclear Radiation Measurements – Pulse-Height Spectrometry	Cherry, chap. 10
7	2021/10/18	Internal radiation Dosimetry	Cherry, chap. 10 Dr. Enger's notes
8	2021/10/25	Radiopharmaceuticals for Radiotherapy	Dr. Enger's notes
	Date TBD	Exam 1	
9	2021/11/01	Gamma camera – Basic Properties	Cherry, ch. 13
10	2021/11/08	Gamma camera – Performance Characteristics	Cherry, ch. 14 & 15
11	2021/11/15	Single Positron Emission Tomography (SPECT)	Cherry, ch. 17, 19
12	2021/11/22	Positron Emission Tomography (PET)	Cherry, ch. 18, 19
13	2021/11/29	Image reconstruction in Nuclear Medicine	Cherry, ch. 16
	2021/12/13	Exam 2 (Tuesday AM, 9 am – noon)	

NOTE: Under appropriate circumstances, the contents of this document can be modified by the instructors to allow for adjustments in the course.