



# MOLS8003

## Application of Nuclear Science to Medicine

Session 1, Fully online/virtual 2021

*Archive (Pre-2022) - Department of Molecular Sciences*

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#### Disclaimer

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#### Notice

As part of [Phase 3 of our return to campus plan](#), most units will now run tutorials, seminars and other small group activities on campus, and most will keep an online version available to those students unable to return or those who choose to continue their studies online.

To check the availability of face-to-face activities for your unit, please go to [timetable viewer](#). To check detailed information on unit assessments visit your unit's iLearn space or consult your unit convenor.

## General Information

Unit convenor and teaching staff

Unit Convenor

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Credit points

10

Prerequisites

(Admission to MRadiopharmSc or MSc or MScInnovationChemBiomolecularSc) and permission by special approval

Corequisites

Co-badged status

Unit description

This unit focuses on the preparation/radiolabelling of radiopharmaceuticals used in medical applications including molecular imaging (positron emission tomography (PET), single photon emission computer tomography (SPECT)), and targeted radionuclide therapy. It encompasses pharmaceutical and medicinal chemistry, nuclear science, pharmacology, biology and radiation safety. It is particularly relevant to drug design and the radiolabelling of drugs and biological macromolecules for use in non-invasive imaging. The unit also contains a component of laboratory management, quality assurance and regulatory affairs associated with both pharmaceutical production, and radiation safety. With access to the Australian Nuclear Science and Technology Organisation, the National Medical Cyclotron, and departments of nuclear medicine in hospitals, it will provide highly relevant contemporary and hands-on training for students.

## Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at <https://www.mq.edu.au/study/calendar-of-dates>

## Learning Outcomes

On successful completion of this unit, you will be able to:

**ULO1:** Identify the different types of radiation, and describe terms applicable to radiochemistry, nuclear physics and radiobiology

**ULO2:** Compare and contrast the physical and chemical properties and the methods of production of key radionuclides suitable for diagnostic purposes and therapy

**ULO3:** Present calculations and analysis of experimental results applicable to the practice of radiopharmaceutical science

**ULO4:** Describe the types of chemical reactions and radiochemical processes associated with the incorporation of Carbon-11, the radiohalogens and various radiometals to produce biologically and clinically useful radiopharmaceuticals

**ULO5:** Research the literature on a relevant topic, and present a point of view in written and oral format

**ULO6:** Explain nuclear science concepts in workshops and in written format in a report and exam

## General Assessment Information

Assessment will be a mixture of progressive assessment in the form of quizzes (20%), an assignment (20%), a mark assigned for quality of participation iLearn (10%), and a final exam (50%).

**Quizzes** allow identification of any deficiency in knowledge and understanding and encourage continuous learning of the topics without the stress of a significant assessment component.

The **assignment** will include a written component that will provide the opportunity for a detailed understanding of a clinically used radiopharmaceutical and an oral presentation, and will provide discipline specific skills as well as research in studying the literature and written and oral communication skills.

The **participation** will be designed to consolidate knowledge through active engagement in in-class sessions (via zoom) and through contributing to regular discussions on the iLearn discussion board.

**Final exam:** The final exam is designed to address specific understanding of all the topics presented within the unit and to show that the knowledge obtained can be applied to new problems.

If you are unable to complete an assessment item due to illness or misadventure, you must

submit a request for Special Consideration. Late assessment items will not be accepted without Special Consideration being approved. Further details on applying for Special Consideration can be found here: [students.mq.edu.au/study/my-study-program/special-consideration](https://students.mq.edu.au/study/my-study-program/special-consideration)

Your marks (assignment, quizzes, final exam and mark for participation) will be placed on the MOLS8003 ilearn site. The **minimum requirement** to achieve a passing grade for MOLS8003 is an **aggregate mark for all the assessment tasks of 50% or greater**.

**Final Examination Details:** The format of the exam and how it will be conducted will be provided and discussed with plenty of notice to make sure you are prepared for the logistics of conducting an exam remotely. It is Macquarie University policy to **not set early examinations** for individuals or groups of students. All students are expected to ensure that they are available until the end of the teaching semester, that is, the final day of the official examination period. The only exception to conducting an examination at the designated time is because of documented illness or unavoidable disruption - see Policy and Procedure section. In these circumstances you should apply for a supplementary exam at [ask.mq.edu.au](https://ask.mq.edu.au).

## Assessment Tasks

Name	Weighting	Hurdle	Due
<a href="#">Assignment</a>	20%	No	Week 11 written assignment, Week 12 oral
<a href="#">Workshops</a>	10%	No	Weekly, completion Week 12
<a href="#">Final exam</a>	50%	No	Formal exam period
<a href="#">Quizzes</a>	20%	No	Week 2- Week 11

## Assignment

Assessment Type <sup>1</sup>: Literature review

Indicative Time on Task <sup>2</sup>: 25 hours

Due: **Week 11 written assignment, Week 12 oral**

Weighting: **20%**

The assignment requires a literature search, and findings are to be presented in both written form, and as an oral presentation. The purpose of the assignment is to develop research skills, and scientific communication - both written and oral.

On successful completion you will be able to:

- Identify the different types of radiation, and describe terms applicable to radiochemistry, nuclear physics and radiobiology

- Compare and contrast the physical and chemical properties and the methods of production of key radionuclides suitable for diagnostic purposes and therapy
- Present calculations and analysis of experimental results applicable to the practice of radiopharmaceutical science
- Explain nuclear science concepts in workshops and in written format in a report and exam

## Workshops

Assessment Type <sup>1</sup>: Participatory task

Indicative Time on Task <sup>2</sup>: 30 hours

Due: **Weekly, completion Week 12**

Weighting: **10%**

Participation and discussions during classes (conducted online) will be marked; with the objective being to encourage active participation in learning activities and discussions.

On successful completion you will be able to:

- Identify the different types of radiation, and describe terms applicable to radiochemistry, nuclear physics and radiobiology
- Compare and contrast the physical and chemical properties and the methods of production of key radionuclides suitable for diagnostic purposes and therapy
- Present calculations and analysis of experimental results applicable to the practice of radiopharmaceutical science
- Describe the types of chemical reactions and radiochemical processes associated with the incorporation of Carbon-11, the radiohalogens and various radiometals to produce biologically and clinically useful radiopharmaceuticals
- Explain nuclear science concepts in workshops and in written format in a report and exam

## Final exam

Assessment Type <sup>1</sup>: Examination

Indicative Time on Task <sup>2</sup>: 30 hours

Due: **Formal exam period**

Weighting: **50%**

Final exam

On successful completion you will be able to:

- Identify the different types of radiation, and describe terms applicable to radiochemistry, nuclear physics and radiobiology
- Compare and contrast the physical and chemical properties and the methods of production of key radionuclides suitable for diagnostic purposes and therapy
- Present calculations and analysis of experimental results applicable to the practice of radiopharmaceutical science
- Describe the types of chemical reactions and radiochemical processes associated with the incorporation of Carbon-11, the radiohalogens and various radiometals to produce biologically and clinically useful radiopharmaceuticals
- Research the literature on a relevant topic, and present a point of view in written and oral format
- Explain nuclear science concepts in workshops and in written format in a report and exam

## Quizzes

Assessment Type <sup>1</sup>: Quiz/Test

Indicative Time on Task <sup>2</sup>: 26 hours

Due: **Week 2- Week 11**

Weighting: **20%**

Quizzes will assist in revising the course material as the course progresses.

On successful completion you will be able to:

- Identify the different types of radiation, and describe terms applicable to radiochemistry, nuclear physics and radiobiology
- Compare and contrast the physical and chemical properties and the methods of production of key radionuclides suitable for diagnostic purposes and therapy
- Describe the types of chemical reactions and radiochemical processes associated with the incorporation of Carbon-11, the radiohalogens and various radiometals to produce biologically and clinically useful radiopharmaceuticals

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<sup>1</sup> If you need help with your assignment, please contact:

- the academic teaching staff in your unit for guidance in understanding or completing this type of assessment
- the [Writing Centre](#) for academic skills support.

<sup>2</sup> Indicative time-on-task is an estimate of the time required for completion of the assessment task and is subject to individual variation

## Delivery and Resources

This unit is run **fully online** and you need to ensure you have access to adequate resources for zoom meetings where we can see and hear you and vice-versa. There will be weekly evening live zoom sessions that everyone is expected to attend (see [timetables.mq.edu.au](https://timetables.mq.edu.au)) and contribute to discussions. Week 1 will be an introductory session that will require no preparation prior to the evening class, **but all other weeks will require preparation PRIOR to the live zoom class sessions** that will include listening to specified recordings and contributing to the iLearn discussion board.

Reading materials and resources on all topics will be provided to facilitate the weekly sessions and self-directed learning. There is no prescribed textbook.

## Unit Schedule

Week 1	An introduction to radiopharmaceutical science
Week 2	Radiation safety
Week 3	Radionuclide production
Week 4	An Introduction to imaging modalities and choice of radiopharmaceuticals
Week 5	Carbon-11: Radiopharmaceutical chemistry and radiolabelling methods
Week 6	Fluorine-18: Radiopharmaceutical chemistry and radiolabelling methods
Week 7	Radiolabelling with other halides
Week 8	Chemistry of the radiometals (Tc-99m and Ga-68)
Week 9	Radiolabelling with other metals (In-111, Tl-201, Cu-64, Zr-89, Lu-177, Y-90)
Week 10	Radiochemical measurement, instrumentation and analytical chemistry methods
Week 11	Quality management and the regulatory environment and Radiopharmaceutical R&D
Week 12	Oral presentations
Week 13	Revision

## Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central \(https://policies.mq.edu.au\)](https://policies.mq.edu.au). Students should be aware of the following policies in particular with regard to

## Learning and Teaching:

- [Academic Appeals Policy](#)
- [Academic Integrity Policy](#)
- [Academic Progression Policy](#)
- [Assessment Policy](#)
- [Fitness to Practice Procedure](#)
- [Grade Appeal Policy](#)
- [Complaint Management Procedure for Students and Members of the Public](#)
- [Special Consideration Policy](#)

Students seeking more policy resources can visit [Student Policies](https://students.mq.edu.au/support/study/policies) (<https://students.mq.edu.au/support/study/policies>). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

To find other policies relating to Teaching and Learning, visit [Policy Central](https://policies.mq.edu.au) (<https://policies.mq.edu.au>) and use the [search tool](#).

## Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: <https://students.mq.edu.au/admin/other-resources/student-conduct>

## Results

Results published on platform other than [eStudent](#), (eg. iLearn, Coursera etc.) or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in [eStudent](#). For more information visit [ask.mq.edu.au](https://ask.mq.edu.au) or if you are a Global MBA student contact [globalmba.support@mq.edu.au](mailto:globalmba.support@mq.edu.au)

## Student Support

Macquarie University provides a range of support services for students. For details, visit <http://students.mq.edu.au/support/>

## Learning Skills

Learning Skills ([mq.edu.au/learningskills](https://mq.edu.au/learningskills)) provides academic writing resources and study strategies to help you improve your marks and take control of your study.

- [Getting help with your assignment](#)
- [Workshops](#)
- [StudyWise](#)
- [Academic Integrity Module](#)

The Library provides online and face to face support to help you find and use relevant information resources.



- [Subject and Research Guides](#)
- [Ask a Librarian](#)

## Student Services and Support

Students with a disability are encouraged to contact the [Disability Service](#) who can provide appropriate help with any issues that arise during their studies.

## Student Enquiries

For all student enquiries, visit Student Connect at [ask.mq.edu.au](http://ask.mq.edu.au)

If you are a Global MBA student contact [globalmba.support@mq.edu.au](mailto:globalmba.support@mq.edu.au)

## IT Help

For help with University computer systems and technology, visit [http://www.mq.edu.au/about\\_us/offices\\_and\\_units/information\\_technology/help/](http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/).

When using the University's IT, you must adhere to the [Acceptable Use of IT Resources Policy](#). The policy applies to all who connect to the MQ network including students.

## Changes from Previous Offering

This unit is now being run in fully online mode.