



MOLS8003

Application of Nuclear Science to Medicine

Session 1, Weekday attendance, North Ryde 2020

Department of Molecular Sciences

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General Information

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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

Assessment Tasks

Coronavirus (COVID-19) Update

Assessment details are no longer provided here as a result of changes due to the Coronavirus (COVID-19) pandemic.

Students should consult [iLearn](#) for revised unit information.

[Find out more about the Coronavirus \(COVID-19\) and potential impacts on staff and students](#)

General Assessment Information

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

Final exam: The final exam will be 3 hours in length with 10 minutes reading time. It is designed to address specific understanding of all the topics presented within the course and to show that the knowledge obtained can be applied to new problems.

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 examination timetable will be available in Draft form approximately eight weeks before the commencement of the examinations and in final form approximately four weeks before the commencement of the examinations. You are expected to present yourself for examination at the time and place designated by the University in the Examination Timetable. This could be any day after the final week of semester and up until the final day of the official examination period. 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. **NOTE: If you apply for a supplementary examination, you must make yourself available for 2 weeks after the formal examination period. If you are not available at that time, there is no guarantee an additional examination time will be offered. Specific examination dates and times will be determined at a later date.**

The only exception to sitting an examination at the designated time is because of documented illness or unavoidable disruption. Absence from the final exam will result in a grade of F except in the case of a genuine medical emergency or misadventure as defined by the University (see below). In these circumstances you should apply for a supplementary exam at ask.mq.edu.au.

Delivery and Resources

Coronavirus (COVID-19) Update

Any references to on-campus delivery below may no longer be relevant due to COVID-19.

Please check here for updated delivery information: https://ask.mq.edu.au/account/pub/display/unit_status

MOLS8003 delivers the knowledge and some of the skills required to work as a clinical Radiopharmaceutical Scientist (RPSS). The role of the RPSS is to prepare radiopharmaceuticals (RPs) for the clinic. This can include radionuclide production, labelling of the biologically active molecule, performing all of the quality control processes and maintaining the documentation required. Additionally the RPSS can be involved in the research and development of new RPs and clinical trials. In this Unit the student will learn about the processes and techniques involved in the preparation and quality control of RPs as well as how a new RP may be introduced into the clinic, its evaluation and biological and clinical assessment. A significant outcome is how this improves clinical management.

An important aspect of this Unit is that it is mapped to the Training, Education and Assessment Program (TEAP), which leads to Certification as a RPSS through the Australasian College of Physical Scientists and Engineers in Medicine (ACPSEM).

The Unit demonstrates the multidisciplinary nature of radiopharmaceutical science. The student will gain knowledge and skills that enable the application of pharmaceutical and medicinal chemistry, nuclear science, pharmacology, biology and radiation safety to the production of radiolabelled drugs and biological macromolecules for use in non-invasive imaging, and in

therapy. The Unit demonstrates the application of drug design.

The student will also gain knowledge and skills relevant to laboratory management, in particular the quality assurance and regulatory affairs requirements that govern both the use of ionising radiation and the manufacture of radiopharmaceuticals.

The student will also gain access to a number of institutions and departments, such as public hospitals, ANSTO, and some private entities to see the application of the knowledge and skills gained from the Unit.

The Curriculum will be delivered so as to encourage directed self-learning, a skill essential to functioning as a proactive scientist in the workplace. The three hour weekly sessions on-campus will be run as a combination of lectures and workshops (lectorials). Additionally, specific topics will be nominated for self-study. The student is expected to come to the weekly classes prepared to participate in robust discussion on these topics.

The site visits are aimed to provide students with exposure to practical experience of working with radioactivity, and exposure to its use, clinically and pre-clinically. To best facilitate this process, visits to various institutions that employ radiopharmaceutical scientists have been organised, thus also offering the students insight into potential career options available. Times for these will be determined in consultation with all students in the unit.

Unit Schedule

Coronavirus (COVID-19) Update

The unit schedule/topics and any references to on-campus delivery below may no longer be relevant due to COVID-19. Please consult [iLearn](#) for latest details, and check here for updated delivery information: https://ask.mq.edu.au/account/pub/display/unit_status

Weekly Topics (note may be subject to variation)

Week 1	An introduction to radiopharmaceutical science
Week 2	The nature of radioactivity Radiation detection methods Radiation safety Radiobiology
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
Week 12	Radiopharmaceutical R&D
Week 13	Revision

Site visits (dates to be confirmed)

Site visits to suitable institutions such as ANSTO and the cyclotron facility at Camperdown will be arranged if suitable numbers can attend on the days made available for these visits.

Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central](https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central) (<https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central>). 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](#) (**Note:** *The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.*)

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

If you would like to see all the policies relevant to Learning and Teaching visit [Policy Central](https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central) (<https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central>).

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of

Conduct: <https://students.mq.edu.au/study/getting-started/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 or if you are a Global MBA student contact 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) 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

If you are a Global MBA student contact 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/.

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

Classes each week will have a much greater workshop/lectorial component to aid engagement and understanding of the unit content.