



MOLS7052

Research Topic: Chemical Biology

Session 2, Weekday attendance, North Ryde 2020

Department of Molecular Sciences

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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 learning activities on campus for the second half-year, while keeping an online version available for those students unable to return or those who choose to continue their studies online.

To check the availability of face-to-face and online 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

Lecturer in Charge

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Credit points

10

Prerequisites

Admission to MRes

Corequisites

Co-badged status

Unit description

This unit comprises study of an advanced topic in chemistry and biomolecular sciences. The area studied each year is tailored to the current student cohort. Emphasis is put on both the understanding of advanced concepts as well as their application in problem-solving and/or research environments. Chemical biology is the science of small molecules in the context of living systems. This course focuses on current topics in chemical biology, particularly experiments in which small molecules are used to probe or control biological systems in novel ways or manipulate and understand biological systems. As the goal of the course is to familiarise students with innovative recent experimental approaches and to stimulate them to explore the boundaries of chemistry and biology, the unit will be taught extensively through the primary literature. Topics may include but are not limited to: In vitro display technologies, chemical proteomics, primary and secondary metabolism, chemical tools in mammalian systems, natural products and drug discovery.

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: write out the mechanism for reactions in primary and secondary metabolism

ULO2: apply chemical rationale for the design, synthesis, and application of small molecules for the manipulation of biological systems

ULO3: apply chemical rationale for the design, synthesis, and application of small molecules for the manipulation of biological systems

ULO4: able to propose a set of experiments to elucidate the mode of action of a bioactive small molecule in the development of our understanding of cellular pathways and in drug design.

ULO5: articulate the principles underpinning forward and reverse chemical proteomics and in vitro display techniques and describe the advantages and limitations of each technique for identifying the cellular target(s) of bioactive compounds

ULO6: design and propose the synthesis of small molecule affinity probes for use in chemical biology.

Assessment Tasks

Name	Weighting	Hurdle	Due
Final Exam	50%	No	Week 15

Name	Weighting	Hurdle	Due
<u>Oral presentation</u>	10%	No	Weeks 8 & 12
<u>Assignments</u>	40%	No	Weeks 2, 3, 4, 6, 7, 8, 10 & 11

Final Exam

Assessment Type ¹: Examination

Indicative Time on Task ²: 3 hours

Due: **Week 15**

Weighting: **50%**

Formal written final examination

On successful completion you will be able to:

- write out the mechanism for reactions in primary and secondary metabolism
- apply chemical rationale for the design, synthesis, and application of small molecules for the manipulation of biological systems
- apply chemical rationale for the design, synthesis, and application of small molecules for the manipulation of biological systems
- able to propose a set of experiments to elucidate the mode of action of a bioactive small molecule in the development of our understanding of cellular pathways and in drug design.
- articulate the principles underpinning forward and reverse chemical proteomics and in vitro display techniques and describe the advantages and limitations of each technique for identifying the cellular target(s) of bioactive compounds
- design and propose the synthesis of small molecule affinity probes for use in chemical biology.

Oral presentation

Assessment Type ¹: Presentation

Indicative Time on Task ²: 4 hours

Due: **Weeks 8 & 12**

Weighting: **10%**

2 oral presentations

On successful completion you will be able to:

- apply chemical rationale for the design, synthesis, and application of small molecules for the manipulation of biological systems
- able to propose a set of experiments to elucidate the mode of action of a bioactive small molecule in the development of our understanding of cellular pathways and in drug design.
- articulate the principles underpinning forward and reverse chemical proteomics and in vitro display techniques and describe the advantages and limitations of each technique for identifying the cellular target(s) of bioactive compounds
- design and propose the synthesis of small molecule affinity probes for use in chemical biology.

Assignments

Assessment Type ¹: Problem set

Indicative Time on Task ²: 8 hours

Due: **Weeks 2, 3, 4, 6, 7, 8, 10 & 11**

Weighting: **40%**

8 written assignments

On successful completion you will be able to:

- write out the mechanism for reactions in primary and secondary metabolism
- apply chemical rationale for the design, synthesis, and application of small molecules for the manipulation of biological systems
- apply chemical rationale for the design, synthesis, and application of small molecules for the manipulation of biological systems
- able to propose a set of experiments to elucidate the mode of action of a bioactive small molecule in the development of our understanding of cellular pathways and in drug design.
- articulate the principles underpinning forward and reverse chemical proteomics and in vitro display techniques and describe the advantages and limitations of each technique for identifying the cellular target(s) of bioactive compounds
- design and propose the synthesis of small molecule affinity probes for use in chemical

biology.

¹ 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.

² 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

lectures

tutorials

small group teaching

Unit Schedule

Lecture 4-7PM Tuesdays from week 1-13 in 4WW 325 (ignore the university timetable)

Wk 1-4 Professor Peter Karuso (Primary and Secondary Metabolism)

The first four-week section will introduce you to the **chemistry of biological systems**, from primary metabolism and energy production to secondary metabolism. We will dissect mechanisms behind how and why nature has chosen specific pathways to synthesise new molecules and convert one molecule into another.

Wk 1: The Origin of Life, the Universe and well everything...

Wk 2: Reactions in Primary and Secondary Metabolism (Assignment PK1 due)

Wk 3: Bizarre Chemistry of Primary Metabolism (Assignment PK2 due)

Wk 4: Fatty acids/Polyketides (Assignment PK3 due)

Wk 5-8 Dr Andrew Piggott (Natural Product Biosynthesis)

This section will build on the groundwork laid in Weeks 1-4 and highlight other important biosynthetic pathways used by Nature to construct specific types of natural products

Wk 5: The shikimate pathway

Wk 6: The mevalonic acid pathway(s) and terpenoids (Assignment AP1 due)

Wk 7: Amino acids to the alkaloids (Assignment AP2 due)

Wk 8: Student Presentations (Assignment AP3 due)

Wk 9-12 Dr Fei Liu (Small Molecules in Chemical Biology)

Small molecules are frequently used as chemical tools for probing biological systems or engineering new bio-networks with new function. This section will cover current topics in the use of chemical tools in mammalian systems that have led to new approaches in drug discovery and elucidation of new cellular mechanisms.

Wk 9: Introduction to the uses of small molecules in chemical biology

Wk 10: Probing protein pathways with small molecules (Assignment FL1 due)

Wk 11: Targeted molecular therapeutics (Assignment FL2 due)

Wk 12: Student presentations

Wk 13 Professor Peter Karuso (Biomimetic synthesis)

The final section will cover aspects of biologically inspired total synthesis of natural products

Wk 13: Biomimetic synthesis of natural products

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.