



# MOLS7052

## Research Topic: Chemical Biology

Session 2, Special circumstances 2021

*Department of Molecular Sciences*

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#### **Session 2 Learning and Teaching Update**

The decision has been made to conduct study online for the remainder of Session 2 for all units WITHOUT mandatory on-campus learning activities. Exams for Session 2 will also be online where possible to do so.

This is due to the extension of the lockdown orders and to provide certainty around arrangements for the remainder of Session 2. We hope to return to campus beyond Session 2 as soon as it is safe and appropriate to do so.

Some classes/teaching activities cannot be moved online and must be taught on campus. You should already know if you are in one of these classes/teaching activities and your unit convenor will provide you with more information via iLearn. If you want to confirm, see the list of [units with mandatory on-campus classes/teaching activities](#).

Visit the [MQ COVID-19 information page](#) for more detail.

## General Information

Unit convenor and teaching staff

Peter Karuso

[peter.karuso@mq.edu.au](mailto:peter.karuso@mq.edu.au)

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://students.mq.edu.au/important-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.

## General Assessment Information

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.

## Assignments 1

Assessment Type <sup>1</sup>: Problem set Indicative Time on Task <sup>2</sup>: 4 hours Due: **Weeks 2, 3, 4, 5**  
Weighting: **30%**

- prebiotic chemistry, reactions of primary metabolism, alkaloids, polyketides

## assignment 2

Assessment Type <sup>1</sup>: Qualitative analysis task Indicative Time on Task <sup>2</sup>: 4 hours Due: **Weeks 6, 7, 8** Weighting: **30%**

shikamate and mevalonate pathways and biosynthesis of heteroaromatics

## assignment 3

Assessment Type <sup>1</sup>: Problem set Indicative Time on Task <sup>2</sup>: 3 hours Due: **Weeks 10, 11**  
Weighting: **20%**

small molecules as probes, drugs and the manipulation of biological systems.

## Oral presentation

Assessment Type <sup>1</sup>: Presentation Indicative Time on Task <sup>2</sup>: 4 hours Due: **Week 8, 12**  
Weighting: **20%**

2 oral presentations

biosynthesis and chemical biology of small molecules

<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 [Learning Skills Unit](#) 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

## Assessment Tasks

Name	Weighting	Hurdle	Due
<a href="#">Assignments 1</a>	30%	No	Weeks 2, 3, 4, 5
<a href="#">assignment 2</a>	30%	No	Weeks 6, 7, 8
<a href="#">assignment 3</a>	20%	No	Weeks 10, 11
<a href="#">Oral presentation</a>	20%	No	Weeks 8, 12

## Assignments 1

Assessment Type <sup>1</sup>: Problem set  
Indicative Time on Task <sup>2</sup>: 4 hours  
Due: **Weeks 2, 3, 4, 5**  
Weighting: **30%**

assignment 1

On successful completion you will be able to:

- write out the mechanism for reactions in primary and secondary metabolism
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- design and propose the synthesis of small molecule affinity probes for use in chemical biology.

## assignment 2

Assessment Type <sup>1</sup>: Qualitative analysis task

Indicative Time on Task <sup>2</sup>: 4 hours

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### assignment 2

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for identifying the cellular target(s) of bioactive compounds

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

## assignment 3

Assessment Type <sup>1</sup>: Problem set

Indicative Time on Task <sup>2</sup>: 3 hours

Due: **Weeks 10, 11**

Weighting: **20%**

assignment 3

On successful completion you will be able to:

- write out the mechanism for reactions in primary and secondary metabolism
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- 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 <sup>1</sup>: Presentation

Indicative Time on Task <sup>2</sup>: 4 hours

Due: **Weeks 8, 12**

Weighting: **20%**

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.

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- the academic teaching staff in your unit for guidance in understanding or completing this type of assessment
- the [Learning Skills Unit](#) 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

lectures, tutorials, small group teaching will be delivered via Zoom

There is no text book set for this unit but the material covered in 3000-level Organic Chemistry is assumed knowledge. The text book for this assumed knowledge is McMurry "[Organic Chemistry](#)". The book by McMurry and Begley "[The Organic Chemistry of Biological Pathways](#)" covers the material presented in week 1-8.

## Unit Schedule

**Wk 1-5 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)

*Wk4: Alkaloids* (Assignment PK3 due)

*Wk 4: Fatty acids/Polyketides* (Assignment PK4 due)

### **Wk 6-9 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: Heteroaromatics; pyrimidines, purine, pteridines, pyrroles & porphyrins* (Assignment AP2 due)

*Wk 8: Student Presentations* (Assignment AP3 due)

### **Wk 10-13 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*

## **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](http://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](http://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 Enquiry Service

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)

## Equity 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.

## 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

inclusion of a new topic: Heteroaromatics; pyrimidines, purine, pteridines, pyrroles & porphyrins

removal of the biomimetic synthesis of natural products section

moving alkaloid biosynthesis to an earlier slot