



## UNSW Course Outline

# CHEM3051 Medicinal Organic Chemistry - 2024

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## General Course Information

**Course Code :** CHEM3051

**Year :** 2024

**Term :** Term 3

**Teaching Period :** T3

**Is a multi-term course? :** No

**Faculty :** Faculty of Science

**Academic Unit :** School of Chemistry

**Delivery Mode :** In Person

**Delivery Format :** Standard

**Delivery Location :** Kensington

**Campus :** Sydney

**Study Level :** Undergraduate

**Units of Credit :** 6

### Useful Links

[Handbook Class Timetable](#)

## Course Details & Outcomes

### Course Description

This course is focused on the principles of medicinal chemistry and highlights its importance in the world. It will provide an insight into how new drugs are developed, from the design stage to eventual introduction into the clinic, using case studies of successful drugs. It will emphasise the

processes required to optimise chemicals to ensure that they have appropriate drug properties. Synthesis of new organic molecules is a core skill that lies at the heart of medicinal chemistry and as such, advanced synthetic methodologies and strategies will be introduced.

Topics to be covered in this course include computational organic chemistry and biochemistry, synthesis and optimization of heterocyclic drugs, and drug delivery.

The course is based on a series of face-to-face lectures, tutorials, workshops and laboratory classes delivered by academic staff from the School of Chemistry.

This course builds on the fundamental medicinal chemistry knowledge taught in CHEM1151 and organic synthetic strategies taught in CHEM3021. By the end of this course the students would have gained a sound knowledge of modern medicinal chemistry.

## Course Aims

The aim of this course is to build on CHEM1511 and CHEM3021 to provide Bachelor of Medicinal Chemistry (program 3992 and 4755) students with a deeper understanding on the drug development process, particularly the design and synthesis of bioactive organic molecules. This course also aims to introduce techniques of optimizing lead molecules to improve their drug properties. The research-style laboratory component in this course aims to provide students an opportunity to develop their professional research skills such as literature search, record keeping, multi-step syntheses and structural characterization skills. Overall, this course provides students the advanced techniques required for medicinal chemistry research projects in Honours year.

## Relationship to Other Courses

This course builds on the fundamental medicinal chemistry knowledge taught in CHEM1151 and organic synthetic strategies taught in CHEM3021. This course provides students the advanced techniques required for medicinal chemistry research projects in Honours year.

# Course Learning Outcomes

Course Learning Outcomes
CLO1 : Outline the most commonly utilised methods for identifying drug leads and modern strategies for their development into drug candidates.
CLO2 : Design multistep organic syntheses towards target drug molecules and predict the outcomes of multistep processes.
CLO3 : Design and synthesise a nanoparticle system for the delivery of curcumin similar to those used in cancer therapy.
CLO4 : Describe safety precautions and assess risks related to working in the lab environment.
CLO5 : Keep records of experiments and discuss the results in reference to relevant literature.
CLO6 : Manipulate chemicals, glassware and apparatus to synthesise, purify and characterise organic molecules.

Course Learning Outcomes	Assessment Item
CLO1 : Outline the most commonly utilised methods for identifying drug leads and modern strategies for their development into drug candidates.	<ul style="list-style-type: none"><li>Assignment</li><li>Mid-term test</li><li>Final Exam</li></ul>
CLO2 : Design multistep organic syntheses towards target drug molecules and predict the outcomes of multistep processes.	<ul style="list-style-type: none"><li>Lab Work</li><li>Assignment</li><li>Mid-term test</li><li>Final Exam</li></ul>
CLO3 : Design and synthesise a nanoparticle system for the delivery of curcumin similar to those used in cancer therapy.	<ul style="list-style-type: none"><li>Assignment</li><li>Final Exam</li></ul>
CLO4 : Describe safety precautions and assess risks related to working in the lab environment.	<ul style="list-style-type: none"><li>Lab Work</li></ul>
CLO5 : Keep records of experiments and discuss the results in reference to relevant literature.	<ul style="list-style-type: none"><li>Lab Work</li></ul>
CLO6 : Manipulate chemicals, glassware and apparatus to synthesise, purify and characterise organic molecules.	<ul style="list-style-type: none"><li>Lab Work</li></ul>

## Learning and Teaching Technologies

Moodle - Learning Management System

## Learning and Teaching in this course

The course will engage students in learning, at an advanced level, the language of medicinal organic chemistry in the lectures and workshops. This will be achieved by expanding on topics

focused on the development of small molecules as potential therapeutics. Furthermore, they will be trained in modern synthetic methodologies and their application in industry in the laboratory classes. They will be introduced to the key concepts of hit-to-lead, lead optimisation and pharmacokinetics, as well as have their repertoire of chemical scaffolds and chemical reactivity expanded. Application of these concepts will be illustrated using a series of case studies. The course will provide a range of individual practical experience in the execution of multistep synthetic sequences, while at the same time expose students to laboratory techniques, including record keeping, and methods of physicochemical characterisation and spectroscopic analysis. Students in the practical classes work at their own pace but are restricted in their hours of work so that they develop skills in time management.

At this stage in their development, students have an understanding of medicinal organic chemistry as a field in which small molecules can be optimised to be used as treatments for medical conditions. They have some experience in the techniques used to characterise molecules or their reactions. However, they have limited knowledge of the diverse arsenal of reactions and reagents that are available, and practical experience of these processes. The purpose of this course is to widen the knowledge and experience of the students (Engaging, Designing and Contextualising), to introduce the concepts of modern synthetic strategies, reactive intermediates and retrosynthesis, and to engage the students in learning through practical experience (Engaging and Contextualising), both on paper and in the laboratory.

## Assessments

### Assessment Structure

Assessment Item	Weight	Relevant Dates
Assignment Assessment Format: Individual	10%	
Mid-term test Assessment Format: Individual	20%	
Lab Work Assessment Format: Individual	30%	
Final Exam Assessment Format: Individual	40%	

# **Assessment Details**

## **Assignment**

### Assessment Overview

These are three written assignments; one per section of the course. These assignments involve answering short questions and/or analysing literature – details will be confirmed during the course. You will be expected to use lecture concepts in problem solving and analytical thinking. You will be awarded marks for problem solving according to a rubric.

Each assignment is worth equal marks and the average of the three assignments contributes to 10% of the course total.

The assignments are due in weeks 4, 8 and 10, and will be returned within 2 weeks of the due date, with feedback based on marks and written advice.

### Course Learning Outcomes

- CLO1 : Outline the most commonly utilised methods for identifying drug leads and modern strategies for their development into drug candidates.
- CLO2 : Design multistep organic syntheses towards target drug molecules and predict the outcomes of multistep processes.
- CLO3 : Design and synthesise a nanoparticle system for the delivery of curcumin similar to those used in cancer therapy.

### Generative AI Permission Level

#### **No Assistance**

This assessment is designed for you to complete without the use of any generative AI. You are not permitted to use any generative AI tools, software or service to search for or generate information or answers.

For more information on Generative AI and permitted use please see [here](#).

## **Mid-term test**

### Assessment Overview

You will complete a 45 min midterm test, designed as a summative assessment of your progress towards the learning outcomes associated with the “Computational organic chemistry and biochemistry” topic.

Learning materials being assessed include lectures, workshops and lab materials. The midterm

test will typically be scheduled in week 5 as a single attempt. The test consists of multiple-choice questions and structured questions - details will be confirmed during the course. Feedback will be provided within two weeks of the test through the gradebook and via a generalised class feedback discussion on Moodle.

### **Course Learning Outcomes**

- CLO1 : Outline the most commonly utilised methods for identifying drug leads and modern strategies for their development into drug candidates.
- CLO2 : Design multistep organic syntheses towards target drug molecules and predict the outcomes of multistep processes.

### **Detailed Assessment Description**

The mid-term test will cover Dr Ho's lecture material. The precise format of the test will be communicated via Moodle, closer to the time.

### **Hurdle rules**

A combined mark (in the mid-term test and final exam) of at least 35% is required to pass this course.

### **Generative AI Permission Level**

#### **No Assistance**

This assessment is designed for you to complete without the use of any generative AI. You are not permitted to use any generative AI tools, software or service to search for or generate information or answers.

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### **Lab Work**

#### **Assessment Overview**

Lab work is assessed in a variety of ways. You will be marked for quality of the synthesised product, yield, experimental reports, and discussion / answers to questions where required.

Your laboratory notebook will also be assessed to ensure data are recorded in a manner appropriate for protecting intellectual property. Your ability to use practical laboratory knowledge and skills in preparing target substances will be assessed.

Lab classes are scheduled in all weeks in the term except flexibility week. You will be required to complete a full risk assessment for each reaction before you can start your experiment, and it will be assessed to ensure that you are aware of all risks associated with the experiment.

You will be required to complete your lab book during your lab class and your lab book will be marked at the end of weeks 8 and 10. In addition, you are required to submit four post-lab reports which are due in weeks 3, 4, 9 and 10.

The two lab book submissions and four reports each contribute 5% towards the course total.

Verbal feedback on your lab books is provided weekly, while the lab reports will be returned within one week and feedback will be a combination of marks, and written and verbal advice.

Hurdle requirement: must attend at least 8 out of 9 of scheduled lab classes and achieve 50% to receive a passing grade in the course.

#### Course Learning Outcomes

- CLO2 : Design multistep organic syntheses towards target drug molecules and predict the outcomes of multistep processes.
- CLO4 : Describe safety precautions and assess risks related to working in the lab environment.
- CLO5 : Keep records of experiments and discuss the results in reference to relevant literature.
- CLO6 : Manipulate chemicals, glassware and apparatus to synthesise, purify and characterise organic molecules.

#### Detailed Assessment Description

Details of the laboratory reports for each experiment are available on Moodle in the lab manual. Resources to assist you with scientific writing and the analysis and presentation of results are available on Moodle. Reports will be submitted to the markers via Moodle for marking.

#### Hurdle rules

Students must attend at least 8 out of 9 of scheduled lab classes and achieve 50% to receive a passing grade in the course.

#### Generative AI Permission Level

##### **No Assistance**

This assessment is designed for you to complete without the use of any generative AI. You are not permitted to use any generative AI tools, software or service to search for or generate information or answers.

For more information on Generative AI and permitted use please see [here](#).

# Final Exam

## Assessment Overview

The final exam will assess the lectures, workshops and lab materials covered in the “Drug delivery” and “Synthesis and optimization of heterocyclic drugs” topics. You will be assessed on the overall level of attainment of knowledge and problem-solving skills in these topics.

The exam is typically 2 hours long and consists of short answer responses - details will be confirmed during the course. The examination will occur during the official university examination period. Feedback is available through inquiry with the course convenor.

**Hurdle requirement:** A combined mark (in the mid-term test and final exam) of at least 35% is required to pass this course.

## Course Learning Outcomes

- CLO1 : Outline the most commonly utilised methods for identifying drug leads and modern strategies for their development into drug candidates.
- CLO2 : Design multistep organic syntheses towards target drug molecules and predict the outcomes of multistep processes.
- CLO3 : Design and synthesise a nanoparticle system for the delivery of curcumin similar to those used in cancer therapy.

## Detailed Assessment Description

The final exam will be two hours closed book hand-written exam (+ 10 min reading time) on Prof. Stenzel's and Dr. Yu's sections only.

## Hurdle rules

A combined mark (in the mid-term test and final exam) of at least 35% is required to pass this course.

## Generative AI Permission Level

### No Assistance

This assessment is designed for you to complete without the use of any generative AI. You are not permitted to use any generative AI tools, software or service to search for or generate information or answers.

For more information on Generative AI and permitted use please see [here](#).

# General Assessment Information

## Grading Basis

Standard

### Requirements to pass course

In order to pass this course, you must satisfy four requirements:

1. A mark of at least 50/100 (50%) overall;
2. A mark of at least 15/30 (50%) for the laboratory component;
3. A mark of at least 21/60 (35%) across the mid-term test and final exam;
4. Attend at least 8 out of 9 of scheduled lab classes.

### **Further information:**

UNSW grading system: <https://student.unsw.edu.au/grades>

UNSW assessment policy: <https://student.unsw.edu.au/assessment>

# Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 9 September - 15 September	Lecture	Computational organic chemistry and biochemistry Face-to-face attendance
	Workshop	Face-to-face attendance
	Laboratory	Lab Induction
Week 2 : 16 September - 22 September	Lecture	Computational organic chemistry and biochemistry Face-to-face attendance
	Workshop	Face-to-face attendance
	Laboratory	Computational IR Spectroscopy Lab
Week 3 : 23 September - 29 September	Lecture	Computational organic chemistry and biochemistry Face-to-face attendance
	Workshop	Face-to-face attendance
	Laboratory	NMR Spectroscopy Lab
Week 4 : 30 September - 6 October	Lecture	Synthesis and optimization of heterocyclic drugs Face-to-face attendance
	Workshop	Face-to-face attendance
	Laboratory	Synthesis of Kinase Inhibitors Project
Week 5 : 7 October - 13 October	Lecture	Synthesis and optimization of heterocyclic drugs Face-to-face attendance
	Workshop	Face-to-face attendance
	Laboratory	Synthesis of Kinase Inhibitors Project
Week 6 : 14 October - 20 October	Other	No classes (flexibility week)
Week 7 : 21 October - 27 October	Lecture	Synthesis and optimization of heterocyclic drugs Face-to-face attendance
	Workshop	Face-to-face attendance
	Laboratory	Synthesis of Kinase Inhibitors Project Synthesis of Peptide Mimics Project
Week 8 : 28 October - 3 November	Lecture	Drug delivery Face-to-face attendance
	Workshop	Face-to-face attendance
	Laboratory	Synthesis of Peptide Mimics Project
Week 9 : 4 November - 10 November	Lecture	Drug delivery Face-to-face attendance
	Workshop	Face-to-face attendance
	Laboratory	Synthesis of Peptide Mimics Project
Week 10 : 11 November - 17 November	Lecture	Drug delivery Face-to-face attendance
	Workshop	Face-to-face attendance
	Laboratory	Synthesis of Peptide Mimics Project

## Attendance Requirements

Students must attend at least 8 out of 9 of scheduled lab classes in order to pass this course. In addition, students are strongly encouraged to attend all other classes and review lecture recordings.

## General Schedule Information

This course will be a combination of face-to-face lectures and face-to-face workshops and

laboratory classes. It consists of 18 hours (2 hours/week) of face-to-face lectures and 18 hours of face-to-face workshops (2 hours/week), plus a face-to-face laboratory component (see laboratory manual, available on Moodle, for details).

# Course Resources

## Prescribed Resources

### Textbooks:

- G. L. Patrick, An Introduction to Medicinal Chemistry 5th Edition
- J. Clayden, N. Greeves, and S. Warren, Organic Chemistry, Oxford University Press, 2nd ed
- C. G. Wermuth, ed., The Practice of Medicinal Chemistry, 3rd ed.

### Purchasing options (print):

<https://www.bookshop.unsw.edu.au/details.cgi?ITEMNO=9780198749691>

<https://www.bookshop.unsw.edu.au/details.cgi?ITEMNO=9780199270293>

<https://www.bookshop.unsw.edu.au/details.cgi?ITEMNO=9780124172050>

### Purchasing options (digital):

<https://unswbookshop.vitalsource.com/products/-v9780192522894>

<https://unswbookshop.vitalsource.com/products/k-v9780192518545>

# Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Tsz Tin Yu		Room 113, Dalton Building	+61 2 9348 1738	By appointment	Yes	Yes
Lecturer	Junming Ho				By appointment	No	No
	Martina Stenzel		SEB 735	+612938546 56	By appointment	No	No
Lab staff	Aditi Taunk					No	No

# Other Useful Information

## Academic Information

Upon your enrolment at UNSW, you share responsibility with us for maintaining a safe, harmonious and tolerant University environment.

You are required to:

- Comply with the University's conditions of enrolment.
- Act responsibly, ethically, safely and with integrity.
- Observe standards of equity and respect in dealing with every member of the UNSW community.
- Engage in lawful behaviour.
- Use and care for University resources in a responsible and appropriate manner.
- Maintain the University's reputation and good standing.

For more information, visit the [UNSW Student Code of Conduct Website](#).

## Academic Honesty and Plagiarism

**Referencing** is a way of acknowledging the sources of information that you use to research your assignments. You need to provide a reference whenever you draw on someone else's words, ideas or research. Not referencing other people's work can constitute plagiarism.

Further information about referencing styles can be located at <https://student.unsw.edu.au/referencing>

**Academic integrity** is fundamental to success at university. Academic integrity can be defined as a commitment to six fundamental values in academic pursuits: honesty, trust, fairness, respect, responsibility and courage. At UNSW, this means that your work must be your own, and others' ideas should be appropriately acknowledged. If you don't follow these rules, plagiarism may be detected in your work.

Further information about academic integrity, plagiarism and the use of AI in assessments can be located at:

- The [Current Students site](#),
- The [ELISE training site](#), and
- The [Use of AI for assessments](#) site.

The Student Conduct and Integrity Unit provides further resources to assist you to understand your conduct obligations as a student: <https://student.unsw.edu.au/conduct>

## Submission of Assessment Tasks

### Penalty for Late Submissions

UNSW has a standard late submission penalty of:

- 5% per day,

- for all assessments where a penalty applies,
- capped at five days (120 hours) from the assessment deadline, after which a student cannot submit an assessment, and
- no permitted variation.

***Any variations to the above will be explicitly stated in the Course Outline for a given course or assessment task.***

Students are expected to manage their time to meet deadlines and to request extensions as early as possible before the deadline.

### **Special Consideration**

If circumstances prevent you from attending/completing an assessment task, you must officially apply for special consideration, usually within 3 days of the sitting date/due date. You can apply by logging onto myUNSW and following the link in the My Student Profile Tab. Medical documentation or other documentation explaining your absence must be submitted with your application. Once your application has been assessed, you will be contacted via your student email address to be advised of the official outcome and any actions that need to be taken from there. For more information about special consideration, please visit: <https://student.unsw.edu.au/special-consideration>

**Important note:** UNSW has a “fit to sit/submit” rule, which means that if you sit an exam or submit a piece of assessment, you are declaring yourself fit to do so and cannot later apply for Special Consideration. This is to ensure that if you feel unwell or are faced with significant circumstances beyond your control that affect your ability to study, you do not sit an examination or submit an assessment that does not reflect your best performance. Instead, you should apply for Special Consideration as soon as you realise you are not well enough or are otherwise unable to sit or submit an assessment.

### **Faculty-specific Information**

#### **Additional support for students**

- [The Current Students Gateway](#)
- [Student Support](#)
- [Academic Skills and Support](#)
- [Student Wellbeing, Health and Safety](#)
- [Equitable Learning Services](#)
- [UNSW IT Service Centre](#)
- Science EDI Student [Initiatives](#), [Offerings](#) and [Guidelines](#)

## School-specific Information

### UNSW Changes to Special Consideration: Short Extension

The School of Chemistry has carefully reviewed all of its assessments to determine whether they are suitable for automatic short extensions as set out by the UNSW Short Extension Policy. The current deadline structures for all assessment tasks in the School of Chemistry already accommodate the possibility of unexpected circumstances that may lead students to require additional time for submission. **The School of Chemistry has opted out of the UNSW Short Extension provision for all its courses**, and we have already integrated flexibility into our assessment deadlines. This decision is subject to revision in response to the introduction of new course offerings. All students may still apply for Special Consideration for any assessment via the usual procedures.

### School Contact Information

Level 1, Dalton Building (F12)

W: [www.chemistry.unsw.edu.au](http://www.chemistry.unsw.edu.au)

Also see: **Contacts and Support** section of the course Moodle page (where applicable)