

General Course Information | Ngā Whakamārama

CHEM 347 Drug Discovery and Development

0.125 EFTS 15 Points
Second Semester 2024

Description | Whakamahuki

This course covers the drug discovery and development process, all the way from lead generation, to structure optimisation, synthetic production, and the protection and development of intellectual property. Topics to be covered include:

- lead generation
- chemical approaches to molecular diversity
- computers in drug discovery and development
- clinical trials and regulatory hurdles
- patenting and intellectual property protection and development
- process chemistry
- the development and use of native flora and fauna as part of the drug discovery process including, ethical, legal and intellectual property issues around indigenous knowledge in such cases will be discussed, both with respect to New Zealand and in a wider global context
- obligations under the Treaty of Waitangi, and associated Treaty Claims
- the un-resolved treaty claim Wai262 will be discussed.

A key aspect of this **Capstone Course** is a mock drug discovery exercise which will require students to apply all of the knowledge and understanding they have acquired in the previous parts of the Medicinal Chemistry program. Therefore, during the second part of the course students will be assigned to a small team, who together will represent a start-up pharmaceutical company. Each student will actively participate in an interactive drug discovery and development process, mimicking all aspects the real-world situation.

Timetable | Wātaka

Lectures and tutorials: Four contact hours per week (weeks 1-2 and 5-6); two contact hours in weeks 3 and 4. Details to be confirmed on 'My Timetable' and the Web.

Computer labs: Two hours in weeks 3 and 4. Details to be confirmed on 'My Timetable' and the Web.

Group sessions: Two hours per week (weeks 7-12). Details to be confirmed on 'My Timetable' and the Web.

Students should note that in the Science Faculty that the average student is responsible for approximately 4.5 hours of additional study for each hour of lecture at the 300-level.

Course Coordinator | Kairuruku Akoranga

Professor Antony Fairbanks, Room West 801 ext 92517, antony.fairbanks@canterbury.ac.nz

Assessment | Aromatawai

Assignments:	60%
Oral presentation:	10%
Exam:	30%

Examination and Formal Tests | Ngā Whakamātautau Ōkawa

End of year Exam: Two hours, with questions from Rudi Marquez, Tim Allison, and Antony Fairbanks

Textbooks | Tuhiंगा

An Introduction to Medicinal Chemistry, Graham L. Patrick, Oxford University Press, Sixth Edition, 2017
Copies are available on reserve in the Engineering and Physical Sciences Library

Prerequisites

P: [CHEM246](#), [CHEM346](#)

R: None

Web-based resources

Various learning resources (lecture material, reference links, quizzes, discussion forums etc.) for this course are available via the University of Canterbury's *Learn (Ako)* web site -- <http://learn.canterbury.ac.nz/>. This site will also be used regularly as a means of communication and information distribution for all of your Canterbury courses. You should familiarise yourself with *Learn (Ako)* as soon as possible.

Goal of the Course

Students who follow this course will develop a complete understanding of the drug discovery and development process. This is a capstone course of the Medicinal Chemistry program, that will require students to use knowledge and understanding that have developed in earlier Medicinal Chemistry courses (CHEM246, CHEM346), and to assimilate this with new information presented here. At the conclusion of the course students should have a complete appreciation of the drug discovery process, all the way from initial molecular lead generation, through molecular optimisation and synthetic production, to clinical approval and therapeutic administration. The course will also introduce students to important ethical, legal and regulatory processes encountered along the drug discovery pathway.

Learning Outcomes

As a student in this course I will develop the ability to:

- appraise how lead compounds may be identified from screening processes
- investigate how modern synthetic chemistry approaches lead to the creation of molecular diversity
- demonstrate the principles and practicalities of solid-supported synthesis
- investigate the use of state-of-the-art computer software for the manipulation of protein crystal structures and molecular docking processes
- critique the different types of intellectual property, and how they may be protected and exploited, both globally and with respect to Mātauranga Māori
- demonstrate obligations under the Treaty of Waitangi
- respect and value Treaty Claims and the Treaty Claims process
- appraise other ethical issues relating to drug development and their commercial exploitation
- critique regulatory hurdles and the clinical trial process
- synthesise all aspects of material covered in the Medicinal Chemistry program to a mock drug development exercise

Transferable Skill Register

As a student in this course I will develop the following skills:

- analytical critical thinking and problem solving
- pattern spotting and logical analysis
- digital literacy
- planning
- creativity
- teamworking and cooperation
- working effectively and professionally with diverse communities
- bicultural competence
- innovation
- entrepreneurship
- written communication
- oral communication, including answering questions posed by a panel of assessors

Summary of the Course Content

The topics covered by this course are:

LEAD GENERATION AND DIVERSITY ORIENTATED SYNTHESIS (8 lectures)

This part of the course will consider how the medicinal chemistry process begins. We will consider how compounds with desired biological activity are first identified. This may be either from screening libraries of synthetic compounds or natural products. The production of synthetic compound libraries for screening will be discussed using diversity orientated synthesis, including an introduction to solid-supported chemical synthesis. Some pitfalls and limitations of the production of simple compound libraries will be discussed, alongside next generation approaches to exploration of diverse of 3D molecular structures.

Lecturer: Professor Rudi Marquez-Mazlin, ext 90162, rudi.marquez-mazlin@canterbury.ac.nz

COMPUTER AIDED DRUG DESIGN (2 lectures plus 2 computer labs)

The use of computer modelling is now considered to be an integral part of the drug discovery process. This part of the course will consider how computers may aid drug design and optimisation in cases where 3-D information is available for the molecular target. This will include hands-on experience of the use and manipulation of protein crystal structures and simple molecular docking software.

Lecturer: Dr Timothy Allison, ext 93034, timothy.allison@canterbury.ac.nz

LEGAL AND REGULATORY PROCESSES: INTELLECTUAL PROPERTY PROTECTION AND DEVELOPMENT AND CLINICAL TRIALS (6 lectures)

This part of the course will provide an overview of the regulatory, legal, clinical and business aspects of the drug development process, and the practicalities of the pharmaceutical business world. It will include a discussion of Intellectual property protection, development, and exploitation, including the PCT process. Progression of a drug through toxicology screening and clinical trials – Phase I, II and III – and the final processes and hurdles encountered before entering the clinic will be discussed. The process of regulatory approval will be discussed, including the requirement to adhere codes of Good Manufacturing Practice and Good Laboratory Practice. Process chemistry will be introduced, highlighting the very different issues that need to be considered when synthesis is scaled up. Finally the business world will be introduced; funding drug development; corporate structure and roles.

Lecturers: Dr Daniel Foley, ext 90479, daniel.foley@canterbury.ac.nz

Dr David Jefferson, ext 90820, david.jefferson@canterbury.ac.nz (legal lecture)

MOCK DRUG DISCOVERY EXCERISE (6 x 2hr weekly interactive sessions, split into groups of 4/5)

This section of the course will be highly interactive, and will comprise group and individual activities as a mock drug development process is undertaken. Students will be split into small groups to work together, and each will be charged with the establishment of a small 'Pharmaceutical Company' the main goal of which will be the development of a new drug against a specific therapeutic target. Each week the teams will be given data on four lead molecular structures what have been tested against a specific drug-target; their group task for the following week will be to suggest four new compounds for testing in order to improve their drug candidates' properties. Each week feedback will be given to the groups on predicted *in vitro* biological activities of their four compounds, together with key toxicological and pharmacokinetic properties of the molecules identified. There will be four iterations of this process altogether, after which each group must identify their lead development compound.

During the drug development process each group member will also be assigned a specific role within the company role. They will be required to perform a specific role-related task during the program, and write a final report on their activities within this role.

This part of the course will be assessed by two written reports from each group member (one on their specific task, and one on their group's drug development program) and oral presentations by each group member to a panel of assessors.

Lecturers: Dr Daniel Foley, ext 90479, daniel.foley@canterbury.ac.nz

Prof. Rudi Marquez-Mazlin, ext 90162, rudi.marquez-mazlin@canterbury.ac.nz

Policy on 'Dishonest Practice' / Ngā Takahitanga me ngā Tinihanga

The University has strict guidelines regarding 'dishonest practice' and 'breach of instructions' in relation to the completion and submission of examinable material. In cases where dishonest practice is involved in tests or other work submitted for credit, a department may choose to not mark such work – see the online guidelines in relation to '[Academic Integrity](#)'.

The School of Physical and Chemical Sciences upholds this policy. It considers plagiarism, collusion, copying and ghost writing – all detailed below – to be unacceptable and dishonest practices:

- **Plagiarism | Tārua Whānako** is the presentation of any material (text, data or figures, on any medium including computer files) from any other source without clear and adequate acknowledgement of the source. Note that the use of **AI generative tools such as ChatGPT** for assessment work is *strictly forbidden*, except where the lecturer concerned has specifically granted approval.
- **Collusion** is the presentation of work performed in whole, or in part, in conjunction with another person or persons, but submitted as if it has been completed by the named author alone. This interpretation is not intended to discourage students from having discussions about how to approach an assigned task and incorporating general ideas that come from those discussions into their own individual submissions, but acknowledgement is necessary.
- **Copying** is the use of material (in any medium, including computer files) produced by another person or persons with or without their knowledge and approval. **This includes copying of the lab reports (raw data may be shared within the group if permitted or required by the experiment) – data analysis and interpretation of obtained results MUST be performed individually.**
- **Ghost writing** is the use of other person(s) (whether with or without payment) to prepare all or part of an item of work submitted for assessment.

Special consideration of assessment | Ngā Pairuri Motuhake

'[Special Consideration](#)' for an item of assessment is for students who have covered the work involved but have been prevented from demonstrating their knowledge or skills at the time of the assessment due to unforeseen circumstances, whether illness, injury, bereavement, car crash or any other extenuating circumstance *beyond one's control*. Special Consideration for a test/exam may be because a student has not sat it or has done so with impaired performance. Applications can be submitted via the above link and must be made **no later than five working days after the assessment due date**. Note that special consideration is **not available for items worth less than 10% of the overall course mark**. In the case of illness or injury, medical consultation should normally have taken place either shortly before or within 24 hours after the due date for the required work or test/examination.

Note that you may be required to sit a special exam or your grade may not be changed if there is insufficient evidence of your performance from other invigilated assessment items in the course. **You have the right to appeal any decision.**

It is important to understand that Special Consideration is only available *where course work has been covered*, and the inability to demonstrate this fully is both *no longer possible* AND is due to *unexpected circumstances beyond one's control*. Thus Special Consideration **is NOT available for:**

- essays, assignments or quizzes where an extension of time is available to complete the assessment item (see below for the process to involved);
- missed lectures during the semester;
- experiencing examination anxiety;
- having several examinations or assessments close together;
- known impairment, such as chronic illness (medical or psychological), injury or disability unless medical evidence confirms that the circumstances were exacerbated, despite appropriate management, at the time of assessment;
- mistaking the date or time of an examination (this is a circumstance one can control!);
- failing to turn up to an examination or test because of sleeping in (a circumstance as above!);
- where applications are repeatedly made for the same or similar reason, then the application may be declined on the grounds that the reason is not unexpected;
- where the application is made at the time of the assessment but the supporting documentation is received significantly after this date or after the date results are released; or
- the application is made following the release of results (unless under exceptional circumstances).

Extensions of deadlines | Tononga Wā Āpiti

Where an extension may be granted for an assessment item, this will be decided by application to the course co-ordinator and/or the lecturer concerned.

Late withdrawal from a course

If you are prevented by extenuating circumstances from completing the course after the final date for withdrawing from the course, you may apply for special consideration for late discontinuation. For details on special consideration, or to make an application, refer to the Examinations Office website <http://www.canterbury.ac.nz/exams/>. Applications must be submitted **within five days** of the end of the main examination period for the semester.

Missing of tests | Te Matangaro i ngā Whakamātautau

In rare cases a student will not be able to sit a test. In such cases, the student should consult with the course co-ordinator to arrange alternative procedures. **This must be done well in advance of the set date for the test.**

Past tests and exams

Past tests can be found on our [Chemistry Undergraduate](#) website. Past exams can be found on the [Library website](#).

Submission of reports and assignments

Reports (including lab reports) and assignments should be handed in on time. Extensions will be granted only in exceptional circumstances (such as illness or bereavement). If an extension is required, as early as possible you should request it from the lecturer concerned.

Note: If you do not submit an assignment for assessment, you will be allotted zero marks, which will affect your final result. You should ensure that you pick up marked assignments and keep them until the end of the course as evidence that the work was completed and marked in the case that either is disputed. To guard against accidental loss, it would be prudent to keep photocopies or electronic copies of anything submitted.

Late Work

Acceptance of late work for assessment will be at the discretion of the course coordinator and/or the lecturer concerned. If your assessment is likely to be late, please contact the relevant of these people **before the assessment is due**. Never assume that an extension will be automatically granted – some courses have the policy of no late work being accepted. A commonly exercised policy is to deduct 10% of the total marks for each day that the work is late, where weekends and public holidays also count as such days.

Marks and Grades | Taumata Ako

The following numbers should be considered as a guide to the expected grades under normal circumstances.

Please note that for all invigilated assessments (tests and exams) worth 33% and above, failure to obtain a mark of at least 40% will result in a final grade no higher than an R at 100 and 200 level; in general this requirement will not be applied at 300 level, but if it is then the course coordinator will inform the class and it will result in a final grade no higher than a C–.

Grade:	A+	A	A–	B+	B	B–	C+	C	C–	D	E
Minimum mark %:	90	85	80	75	70	65	60	55	50	40	0

The School reserves the right to adjust this mark/grade conversion, up or down, to achieve consistency of assessments standards.

Reconsideration of Grades

Students should, in the first instance, speak to the course co-ordinator about their marks. If they cannot reach an agreeable solution, or have questions about their grade in a course, students should then speak to the Director of Undergraduate Studies, [Assoc Prof Greg Russell](#). Students can appeal any decision made on their final grade. You can apply at the Registry for reconsideration of the final grade within four weeks of the date of publication of final results. Be aware that there are time limits for each step of the appeals process.

Student Accessibility Services | Te Whaikaha

Students can speak with someone at [Student Accessibility Service](#), phone: 369 3334 (or ext. 93334), email: sas@canterbury.ac.nz).

Academic Advice

[Assoc Prof Greg Russell](#) is the coordinator of undergraduate chemistry courses. His interest is in the academic performance and well-being of all such students. Anyone experiencing problems with their chemistry courses or requiring guidance about their B.Sc. in Chemistry should get in contact with Greg.

Staff-Class Rep Liaison

[Assoc Prof Greg Russell](#) is in charge of liaison with students in chemistry courses. Your class will appoint a student representative to the liaison committee at the start of the semester. Please feel free to talk to the Academic Liaison or the student rep about any problems or concerns that you might have.

Greg Russell (greg.russell@canterbury.ac.nz, tel. 369 5129)
Director of Undergraduate Studies
School of Physical and Chemical Sciences
2024